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POLYGAMIC SYSTEM OF THE GREAT WHITE PELICAN (*Pelecanus onocrotalus* L.) IN THE POZNAŃ ZOOLOGICAL GARDEN

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ABSTRACT. Due to high disproportion of sexes (two males, eight females) in the pelican colony at the Poznań Zoo (Poland), polygynic groups were formed. Male with two, and later with three females formed a permanent bond. The females accepted each other, as expressed by mutual greetings. The females built separate nests, and did not show any homosexual behaviour to each other.

This paper describes the history of this harem from its first appearance in 1995 to spontaneous dissolution in 1999. The decomposition took place as a result of balancing the sex ratio and the death of one of the females.

KEY WORDS: Great white pelican, *Pelecanus onocrotalus*, polygynia, breeding behaviour, agonistic behaviour, greetings, zoological garden

INTRODUCTION

The Great white pelican *Pelecanus onocrotalus* usually lays two eggs, however, clutches of three or four (KAZAKOV et AL. 1994), and, in extreme cases, even five eggs (BROWN and URBAN 1969) had been noted. It is also known that a number (in some colonies a significant percentage) of eggs are destroyed by breeding pairs.

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So far, it has not been explicitly determined whether these multi-clutches come from more than one female (a homosexual pair or polygynic group).

Studies carried out in natural environment on many species of colonial birds often indicate the existence of polygynic groups. Although there is no evidence of examples of such groups among pelicans, such a formation is highly probable. Hence, we believe that the presentation of the history of a pelican harem from the moment of its appearance to dissolution will enable to understand how such groups are formed and what causes their breaking up.

MATERIAL AND METHODS

The subject of observation was a group of 17 Great white pelicans (*Pelecanus onocrotalus*) kept in Poznań Zoological Garden since 1985. The birds were kept together with a group of 22 Dalmatian pelicans (*Pelecanus crispus*) in the same exhibit and they utilised the same island for breeding, thus forming a mixed colony. Additionally, there were five Pink-backed pelicans (*Pelecanus rufescens*) which did not breed. At first, there was a highly skewed sex ratio among the Great white pelicans. This had been gradually corrected with the progress of breeding. In subsequent years, the proportion of mature pelican males to females was as follows: 1993 (2:8); 1994 (2:8); 1995 (2:8); 1996 (2:8); 1997 (2:10); 1998 (4:8); 1999 (6:9); 2000 (6:6).

The pelicans were kept on a 4.39 ha pond with an average depth of 1 m. There are two islands on the pond, however, the pelicans occupied only one of them with an area of 870 m^2. The birds were observed in 1993 and from 1995 till 2000. The birds were moved to winter quarters every year. However, only in 1993 they were allowed to breed in winter quarters (with poor results). In the remaining years, the pelicans bred on the pond. The observations were carried out ad libitum at various times of the day and year (over 1000 observation hours).

Male A and females B, C, D and E were wild-caught.

RESULTS

Among the observed pelicans, apart from monogamous pairs, female-female homosexual pairs were formed.

Great white pelicans paired with the Dalmatian pelicans as well. This happened three times, and it was always the same Great white pelican female which coupled with three different Dalmatian males. Additionally, an inter-species homosexual pair of females was noted.

In 1993, male A paired monogamously with female B.

In the same year, females C and D formed a homosexual pair. The females most probably did not lay eggs though their artempted copulations were observed.

Unfortunately, it is not known if or with which female the male A bred in 1994 since no observations were carried out then. However, during that time no polygynic group was formed, hence, most probably, the male remained in the monogamous pair. It is also not known with which individuals the females C and D were coupled, though it is supposed that they did not form a homosexual pair.

In 1995, male A started mating behaviour towards two females at the same time (C and D) (Fig. 1). The behaviour consisted in following the chosen female, greeting her with his head up and emitting a hoarse sound, usually together with the accepting female, and supporting her during agonistic behaviour.

Male A first mated with female C, she laid the first egg and remained his favourite. Only she was relieved on the nest by him.

The females' nests neighboured to each other. The male participated in the construction of both nests. He usually dropped the material brought in his pouch between the females, although sometimes he brought it separately for each one.

Besides the favourite (C), the male also mated the other female (D), no matter whether he was incubating the favourite's eggs at the moment or not. At the same time, the other female (D) was greeted much more frequently than the favourite.

At first, the females behaved aggressively to each other. In 1995, for 19 agonistic behaviours only one greeting was observed between the females and it is worthwhile stressing that it happened after aggression.

During agonistic behaviour between the females, the male supported only his favourite C. Later on, female D showed only limited aggression – she attacked only the opponent's bill and not the head as in the case of typical aggression. The blows were frequent but very weak. Moreover, once a sedative behaviour was observed consisting in movements of slightly lowered bill in the direction of the male.

Female D was uncapable to sit on nest and abandoned it after 9, 6, 0 and 2 days respectively.

In 1996, the group of the studied pelicans was joined by a new, wild caught female (E) brought from Katowice ZOO (Poland). For the first few days of adaptation, she did not make contact with other pelicans. Seven days after joining the flock (from 22nd to 28th May, 1996), she started to chase off one of the females. The aim of this behaviour was not ascertained since the attacked female was not coupled with any other bird.

From 31st May, 1996, female E started showing mating behaviour towards male A (in the way described earlier), and, at the same time, she started to chase off female D. Five days after the start of this behaviour, the male accepted female E. Then, the situation changed because it was female D who started to isolate female E from the male trying to stand between them.

The breakthrough in the behaviour between females C and D took place on 10th June, 1996, when due to simultaneous responses to the male's greetings the females started to treat these greetings as taking place between themselves. This led to the formation of a triangle consisting of male A and females C and D accepting each other. Although female E was at that time accepted by the male, the other females did not tolerate her.

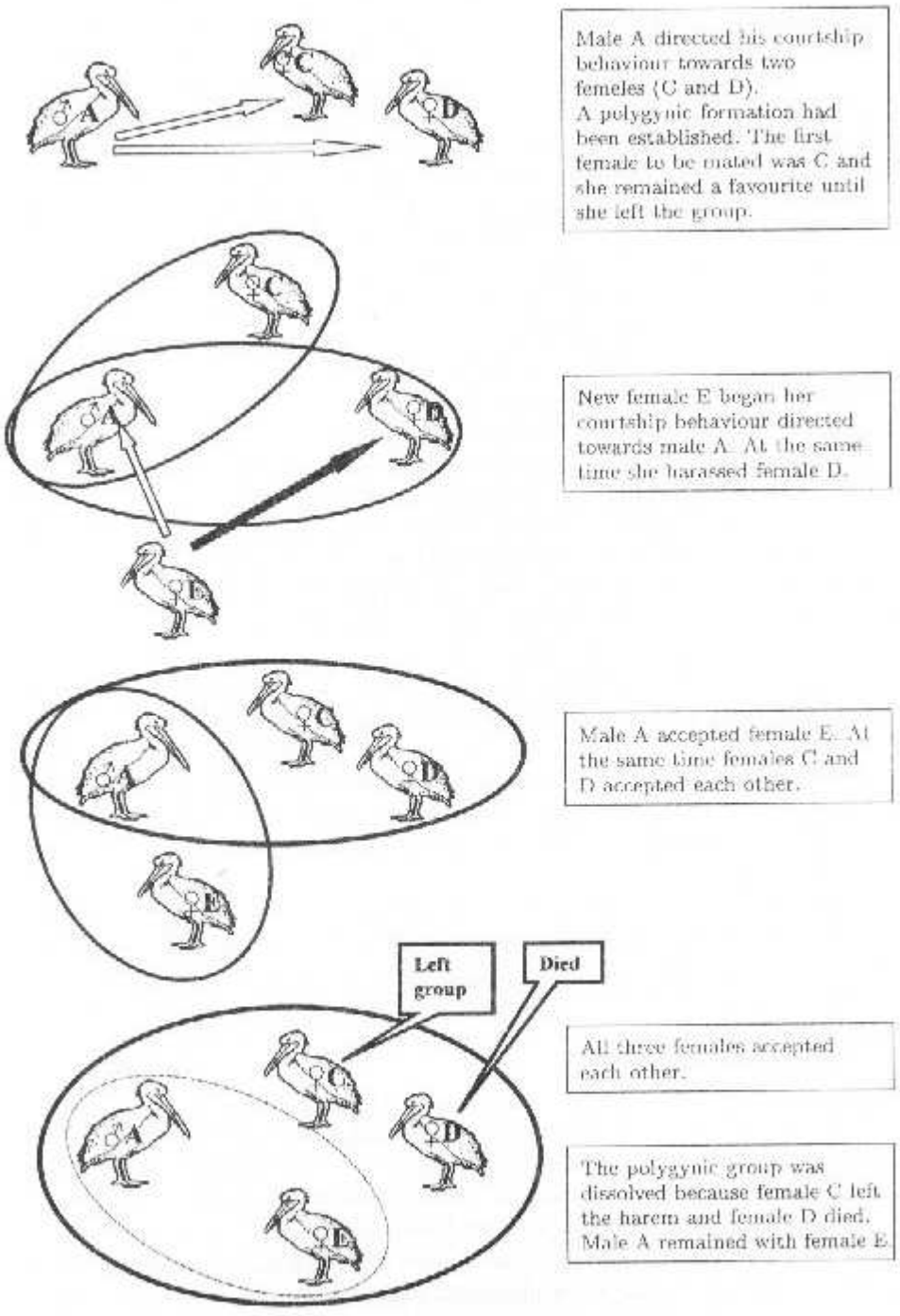

Fig. 1. Scheme of initial polygynic pair and its decomposition

A week later, on 17th June, 1996, in a similar way, female E joined the triangle (male A and females C and D) creating a harem.

On 20th June, 1996, another Great white pelican female tried to join the harem. Because her attempts proved ineffective, on 27th June, 1996, she created an inter-species homosexual pair with a Dalmatian female.

Since that moment, the females in the harem drastically changed their behaviour. Agonistic behaviour practically disappeared. All females usually followed the male while, if one of them ovulated, she usually went first followed by the male and the two remaining birds. When the male was incubating eggs, the females spent time together either close to the nest or at some distance from the colony. Then, they greeted each other many times. During agonistic behaviour directed at other pelicans, the harem females supported each other.

During aggressive behaviour between the females D and E (non favourites) the male did not interfere.

Among the remaining pairs of the studied pelicans, no hierarchical structure was found, however, in the harem, a clear hierarchy was found with the dominating male, the favourite C second in rank followed by two equally placed females D and E.

The birds kept close together also beyond the breeding season.

Already in 1998, two males reared in the colony matured in their third year of life. However, the harem kept together until 10th April, 1999. Its dissolution started before the first breeding in the colony. At first female E separated herself from the harem and started to attract one of the newly matured males. The female failed to create a pair and remained alone. The first mating of the male A was with the favourite C, while female D built her nest in the neighbourhood. Both the male and the female stopped greeting her and often attacked her. Numerous copulations of male A and female D were typical promiscuous copulations. Besides the copulations, the male did not show any interest in the female.

After collecting the first clutch for artificial incubation on 19th April, 1999, the male became disinterested in his favourite (C) for a few days, starting breeding with female D and this time, he relieved her on the nest. On 21st April, 1999, a just matured male started mating with female C. The birds coupled. On 1st and 2nd May, 1999, male A tried to get the female back but with no success. The female did not respond to his greetings, and, during fights between the males she did not support her new partner. The young male got some help during antagonistic behaviour from the other unpaired male with whom he grew up.

Male A remained in pair with female D. On 30th May, 1999, many copulations between male A and female D were observed as well as numerous greetings of female E, whereas the females stopped greeting each other.

On 18th June, 1999, male A left female D, at the same time starting breeding with female E. However, three days later (on the day when female E laid eggs) he left her and returned to female D. Again he started breeding with female D. Also this pair was not stable. He left her on 13th July, 1999, after a week of egg incubation. He paired again with female E. In that year, the pair did not start breeding.

By the end of 1999, female D died and in 2000, the male remained in permanent pair with female E.

DISCUSSION

Up to now, we do not know of any publications which would confirm the existence of polygynic groups among the Great white pelicans. Some information about the possibility of the formation of such a group can be found in the work by KAZAKOV et AL. (1994) who observed two Great white pelican females which built their nests so close that they actually laid eggs into one common nest. Agonistic behaviour should prevent such a phenomenon or lead to abandoning the clutch by non-aggressive birds (ĆWIERTNIA and BERESZYŃSKI unpublished data). Incubation of eggs by two females in one nest without conflict suggests the formation of a polygynic group, similar to that observed in gulls (*Laridae*) by KOVACS and RYDER (1983) and LAGRENADE and MOUSSEAU (1983), and consisting of one male and two females laying eggs into a common nest.

Polygynic nesting of pelicans results in a higher proportion of eggs lost in the incubation. Among pelicans, egg destruction is a common phenomenon and it can be considered typical of birds that incubate eggs with their feet (SCHREIBER 1979).

The most probable cause of the formation of a poligynic group seems to be the lack of suitable males in a colony. Many authors believe that sex ratio favouring females in a population results in forming homosexual female-female pairs (SHUGART 1980, CONOVER 1983, KOVACS and RYDER 1983, LAGRENADE and MOUSSEAU 1983, LOREK and TRYJANOWSKI 1993). This hypothesis was tested by CONOVER (1984) indicating that experimental removal of males increased the number of female-female pairs. SHUGART (1980) found that in the colonies with a growing number of female-female pairs, the number of polygynic groups increased as well. We believe that formation of the observed polygynic group was due to the same factor. This assumption seems to be confirmed by a spontaneous dissolution of this group after the sex ratio in the colony was balanced.

The formation of a polygynic group casts new light on the role of greetings in contacts among the Great white pelicans. This behaviour described for African population by BROWN and URBAN (1969) was considered to be directed towards a female. Another aim of this was, according to the author, to frighten off other males. However, in our studies we did not observe such a dual function of this behaviour. Besides its basic function, which is maintaining contacts between partners during breeding, it should be also treated as an expression of a positive relationship between closely related individuals which could be understood as friendship. At the same time, it should be stated that BROWN and URBAN (1969) could have drawn their conclusions in result of incorrect recognition of sexes caused by difficulties under field conditions.

An increased number of greetings of male A aimed at female D in 1996 and female E in 1997 seem to confirm the "mate attraction hypothesis". Similar phenomenon had been observed among shorebirds where related males showed reduced aggression towards each other (LANCTOT et AL. 2000 after MILLER 1979 and WHITFIELD and BRADE 1991). Our own observations are interesting since they concern one male at the same time related to two females. He showed stronger breeding behaviour towards the female he was attracting than towards that with which he was actually breeding. Unfortunately, due to a very short time in which the harem was under close observation, this hypothesis could not be tested statistically.

In 1997, female D was in the worst position. She had already been in the harem, so the male did not show any breeding behaviour towards her and she was not his favourite. Other birds attacked her most often.

Within the harem, a hierarchy was clearly observed. SHANON (2000) studying flamingos in a zoo also found that in polygynic groups of Caribbean flamingos (*Phoenicopterus ruber ruber*) domination also occurs. Differently than BROWN and URBAN (1969), who describe hierarchy among the Great white pelicans, we did not find domination, apart from birds actually remaining in the harem.

Although the male mated three females there were no statistically important differences between the number of fertile and infertile eggs in comparison to birds living in monogamous pairs.

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