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THE BEHAVIOR AND ECOLOGY OF THE SOUTH AFRICAN OSTRICH

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Photographs by the authors in 1964

Since the Lower Pliocene Epoch at least nine species of ostriches of the genus *Struthio* roamed the Ethiopian, Palearctic, and Oriental Regions. Their fossil relics are spread from western Asia, to Europe, to southern Africa, and eastward to China and Mongolia, reaching as far north as 50° N Lat. Further, *Eleutherornis*, representing a Middle Eocene genus from Switzerland, is described as another member of this order. *Psammornis* from North Africa and Arabia and *Eremopezus* from the famous Fayum formation of Egypt, too, may eventually become classified with the ostriches and no longer with the elephant birds, the Aepyornithidae.

Only one species of ostrich, *Struthio camelus*, the last of the whole order Struthioniformes, survived to the present day with several subspecies on the African continent. This modern bird appears in the fossil record as a neospecies in the Pleistocene. Its Syrian subspecies, *S. c. syriacus*, became extinct as recently as 1941 (Meinertzhagen, 1954), and on the African continent, which is changing so rapidly at present, wild Ostriches have disappeared in vast areas where they thrived only a short time ago.

In contrast to the wild bird, the Ostrich as a domesticated farm bird and zoo specimen is closely approaching the status of a cosmopolitan species, though split into a great number of rigorously isolated populations from large to extremely small. Man has relied heavily on this fenced-in creature to describe the general biological features and functions of this the largest of all living birds. Until a short time ago he has neglected any scientific study of the flightless Ostrich in its wild state.

Beguiled by a glimpse of its secret family life in the wilderness of South West Africa, we (F. Sauer and E. Sauer, 1959) began a systematic study of the life of the wild South African Ostrich (*S. c. australis*) in the arid South West African veld. In 1964, the National Science Foundation supported our research through grant GB-2167, and we were again happily assured of the friendship and help from our many South West African friends and government officials.

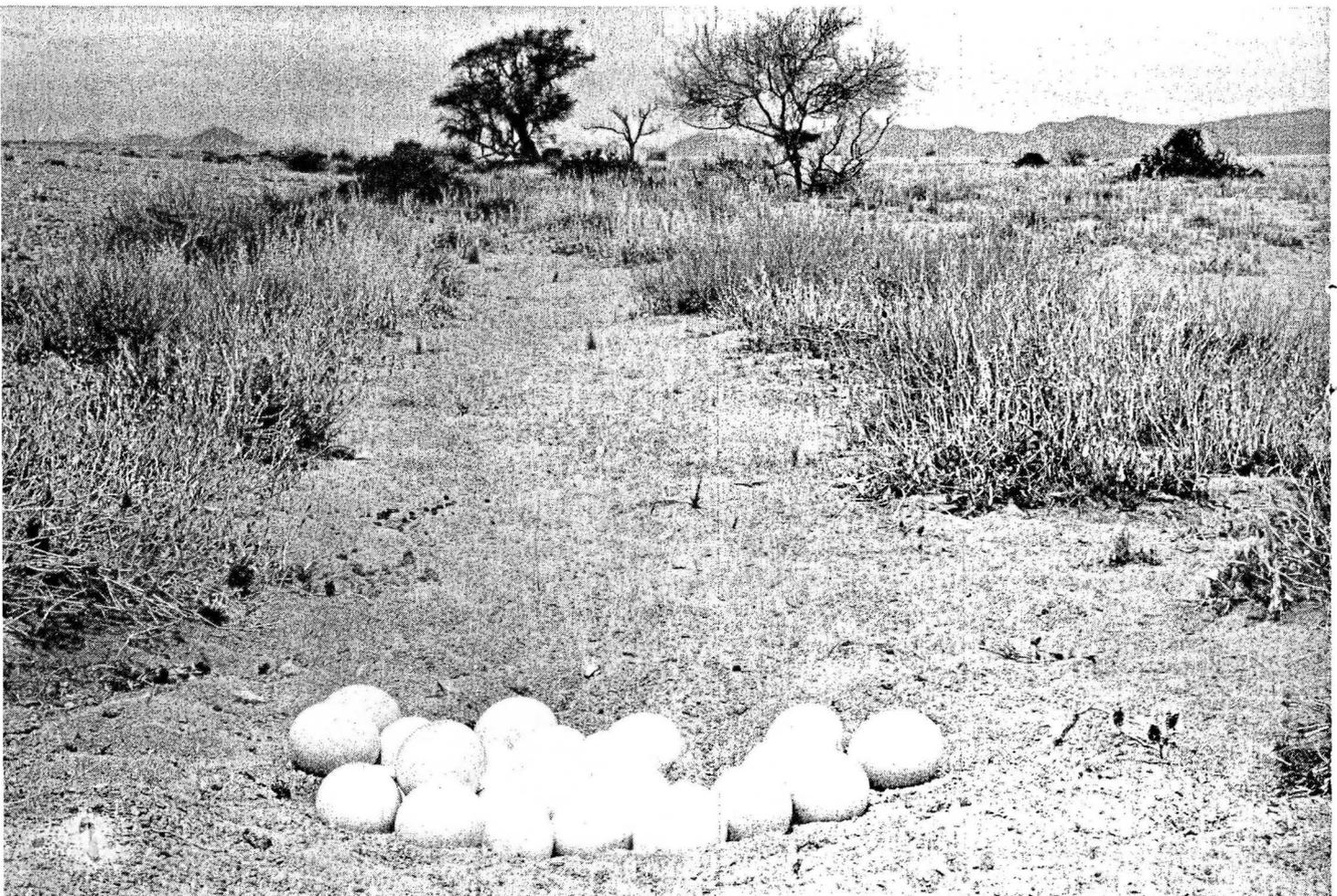
While we are preparing a monograph on the behavior and ecology of the wild Ostrich, we have nevertheless accepted with great pleasure the request by O. S. Pettingill, Jr. to publish this short report of our study for the readers of *The Living Bird*.





Figure 21 (*above*). Mrs. Sauer records the egg, sand, and air temperatures in an Ostrich nest (Tinkas Nest 2). The "scatter" egg outside the nest wall was laid where it rests and was never incubated. Tinkas Flats in Game Reserve 3, 27 November.

Figure 22 (*below*). Hotsas Nest 1 with a clutch of 23 eggs, in a dry river bed. Hotsas, 29 November.



observation revealed that one of the pair might even be a step-parent from the very moment the group left the nest-site while the real parent was engaged in courtship activities with another mate.

Parents with fledglings are very shy and very carefully avoid encounters with local predators whose habits and territories they usually know quite well. But when they notice or encounter danger, they quietly steal away or, if this is impossible, they perform an elaborate distraction display (Figures 33 and 34). Spreading and holding the wings low, beating them rapidly, and repeatedly calling *boo*, a male in company of his mate zigzags toward and away from the enemy, presents him with a lateral display and runs to the side, and every once in a while drops to the ground whirling the dust with his wings for a short time before running off again. He is constantly eager to get the attention of the enemy, to separate him from the group, and to lead him away from the well camouflaged chicks. The chicks scatter first and then crouch and remain motionless during the maneuvers of the male. While a displaying male lures an enemy in one direction, the female may suddenly stop her distraction display, call the chicks, and quickly decoy them. In their excitement the chicks frequently give both distress and contact notes.

We observed in the Ostrich's distraction display a number of modifications, depending on the sex of the displaying bird, the presence of one or both parents, individual modes, whether an enemy was in the air or on the ground, or the particular habitat in which the disturbance took place.

Conclusions

This short report on the life of the South African Ostrich, as we studied it in the South West African veld, describes some of our findings. While one may think of the Ostrich as a leftover from a group of relatively primitive birds, we are more inclined to point out the phylogenetic accomplishment in the form of highly complex and very functional structures, abilities, and organizations that reflect the bird's long and successful evolutionary history and made it able to survive to the present day.

The Ostrich appears as a bird highly adapted to live under extreme arid conditions and yet highly able to adjust rapidly to sudden environmental changes and exist in various ecological niches.

At the present time we have not yet analyzed most of our research material. Motor coordinations, such as walking, running, and others; individual behavior patterns, such as feeding, drinking, preening, and dust-bathing; habits of sleeping; and also the various social activities that we recorded and filmed—all these require careful analysis. The process of molting into juvenile, subadult, and adult plumages was noted, as well as various correlations between molt, age, and behavioral changes.

The acoustical communication system, both vocal and "instrumental," exceeds in the number of call notes those of most song birds. The voice-producing organ of the Ostrich, the syrinx, is considered to be so simple and generalized that it lacks tracheo-bronchial muscles and a pessulus and has hardly any specialization of the last tracheal rings. And yet, the vocal sound production of the Ostrich is manifold: it ranges from most complex and melodious phrases of the chick to the mostly hoarse and coarse guttural notes, hissings, and snort calls of the adults. All express specific internal motivation—often minutely differentiated—and all are of social importance, influencing the partner and the behavior of the group significantly. The

intra- and interspecific relationships of the Ostrich are also manifold and seem to have reached a level of complexity that equals that of mammals of very advanced social standing.

In the veld of South West Africa we found no other animal as shy and alert as the wild Ostrich. While it occupies a very low rank in the interspecific social rank order of the animals of the veld, many of the animals do rely on its alertness.

In the wild, the Ostrich is vastly different from the tame bird in captivity, especially from the one imprinted on man. Wild creature that it is, it strictly follows the rule "better safe than sorry" and flees from many a harmless animal, such as a flock of Namaqua Sandgrouse (*Pterocles namaqua*), a "joking" Pied Crow, or even a single Ostrich that seeks contact with the herd in a quick run. According to an old proverb, the Ostrich possesses a small brain and little intelligence. However, by being ever alert and ready to run, by using keen eyes and sensitive ears, and, in addition, by taking protracted safety precautions that may result in an unbelievable slowness when it encounters a new and strange situation, the Ostrich has managed to survive to the present day—but only in areas where man has not cut the thread of its life.

Summary

In the years of 1957 and 1958, and extensively in 1964, we studied the South African Ostrich (*Struthio camelus australis*) in various habitats of South West Africa.

The Ostriches are well adapted to live in the arid veld and, at the same time, are highly adaptable and able to occupy diverse ecological niches with extremely different sources of food and water supplies. The Ostriches also respond quickly to untimely and sporadic climatic and other environmental changes, and they flourish in the unpredictable and fluctuating South West African climate as successful opportunist breeders. Following the normal annual cycle of one cold-dry and one warm-rainy season, the Ostrich's reproductive activities reach a peak just before the beginning of the rainy season, but some offspring are hatched at any time of the year.

During the dry season the Ostriches are predominantly organized in superfamily units numbering up to large herds of both adult and immature birds of both sexes, and varying greatly in structure. Various social contacts are established through inter-group communication in communal pastures around water holes.

Mating bonds are predominantly polygynous-polygamous, with the most frequent association of one "major hen" with two "minor hens" and one cock in a "balanced" population. Other polygamous mating bonds and also monogamy exist and reflect the Ostrich's ability to adjust its mode of mating bond according to momentary populational conditions and needs.

Availability of sufficient food over a length of time and the social standing of the hens in the community appear to be the major factors which build up the females' reproductive potential and trigger their reproductive activities. This usually coincides with the completion of their molt.

Various prenuptial and precopulatory displays, nest-site selection, and copulatory behavior are briefly mentioned as they are shown by males and females within the herds and during reproductive isolation in their breeding territories far from the communal grounds.

Ostriches make their nests, approximately 3 meters in diameter, in dry sandy river beds or in other sandy spots. Nest-site tenacity is very strong where nesting is successful. The eggs are laid mostly during the afternoon or early evening of every other day; the hens' egg-laying often becomes synchronized.

Egg weights ranged from 755 to 1,618 grams. Most of the clutch sizes varied between 16 to 23 eggs; the extreme of 43 eggs in one nest on Etosha Pan appears to be very exceptional and reflects an "unbalanced" ratio of adult males to females in the population at the time. The maximum contributions of single females to one clutch did not exceed 8 eggs.

Incubation starts when the clutch is complete, and, during the hot daylight hours, is frequently a cooling rather than warming of the eggs. In the Namib Desert, chicks began to hatch after 39 to 42 days of incubation.

In most instances the minor hens are driven from the nest by the major hen as soon as

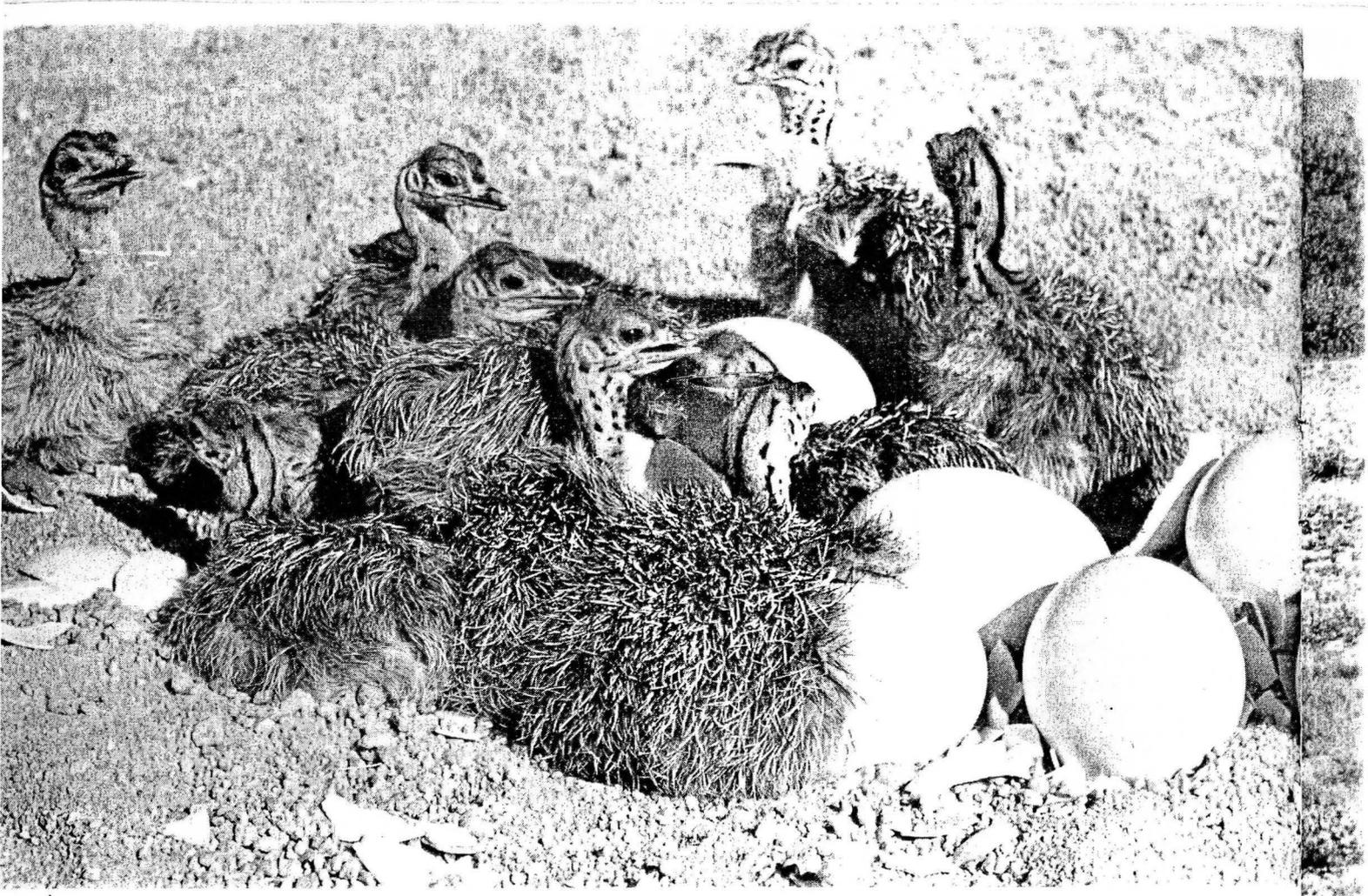


Figure 31 (*above*). An assembly of Ostrich chicks at the edge of Tinkas Nest 2, 12 December.

Figure 32 (*below*). Chicks on 13 December from the same nest, resting during their exploratory activities in its immediate neighborhood.



egg-laying is completed. In exceptional cases the latter tolerates the presence of one or several minor hens at the nest-site during the period of incubation and permits them to incubate the eggs for certain lengths of time. While the cock usually incubates from the late afternoon or evening until the following morning and the hen during the remaining daylight hours, numerous and extreme deviations from this pattern of incubation do occur.

Social contact between the chicks and the parent birds, as well as among the chicks, is initiated acoustically before hatching. The hatching process commonly begins with the formation of a hatching "window," in which the beak and one foot appear, and results usually in a complete fragmentation of the eggshell.

The major hen and the cock lead the chicks from the nest and remain associated with them for a time usually up to one year or to the beginning of another reproductive cycle. Various exceptions to this rule can be found, and inter-family adoptions of immatures do occur. Parents with chicks perform elaborate distraction displays in moments of danger.

Acknowledgments

This report on our field studies in South West Africa pertains to a research program supported through Grant GB-2167 from the National Science Foundation. In addition, the Graduate School and the Department of Zoology of the University of Florida provided a 1965 Summer Research Fellowship and equipment used in this research.

Zusammenfassung

Der kurze Bericht über den Südafrikanischen Strauss, *Struthio camelus australis*, bezieht sich auf unsere Studien in verschiedenen Biotopen Südwestafrikas, die in den Jahren 1957/58 während einer von der Deutschen Forschungsgemeinschaft finanzierten Expedition eingeleitet und 1964 mit Unterstützung von der National Science Foundation fortgeführt wurden.

Der flugunfähige Laufvogel Strauss ist für ein Leben im trockenen Veld ausgezeichnet angepasst und gleichzeitig fähig, in einer Reihe von ökologischen Nischen mit extrem verschiedenen Nahrungs- und Wasserangeboten zu existieren. Sein rasches Reagieren auf sporadische und oft unzeitgemässe Klimawechsel findet am deutlichsten Ausdruck in seiner Fähigkeit, als Gelegenheitsbrüter jede günstige Fortpflanzungsmöglichkeit zu nützen. Im normalen Wechsel von Trocken- und Regenzeit erreicht die Fortpflanzungskurve einen deutlichen Gipfel unmittelbar vor Beginn der Regenzeit. Bei den lokal typischen, mannigfaltigen Abweichungen des Klimazyklus von der Norm und den Abstufungen des Klimas in verschiedenen Breiten und Längenregionen Südwestafrikas kann man zu jeder Jahreszeit, auch in den kältesten Monaten, Straussennachzucht in kleineren Ausmassen vorfinden.

In der Trockenzeit sind die Strausse überwiegend in gemischten Verbänden vergesellschaftet, die mitunter die Grösse von Herden von 600 und mehr Vögeln beiderlei Geschlechtes und verschiedener Altersstufen erreichen. Die Zusammensetzungen der einzelnen Gruppen variieren sehr. Mannigfaltige soziale Kontakte zwischen Vögeln verschiedener Verbände führen zu neuen sozialen Verbindungen innerhalb der gemeinsamen Weidegründe in der Nähe von Wasserstellen und sind wichtig für die Formierung neuer Familienverbände.

Die Familienstruktur des Strausses ist überwiegend eine Vielehe in Form einer polygynen Polygamie. Die häufigste Verbindung besteht aus einer Haupthenne, zwei Nebenhennen und einem Hahn. In Abhängigkeit von der Struktur der Population treten auch andere Zusammensetzungen polygynen Vielehen und seltener auch Monogamie auf, die für die Anpassung des Strausses an augenblickliche soziale Anforderungen sprechen. Ausreichende Nahrungsvorräte über bestimmte Zeitspannen und die soziale Rangstellung geschlechtsreifer Hennen sind die wichtigsten Faktoren, die deren Fortpflanzungsbereitschaft bestimmen und das Fortpflanzungsverhalten gewöhnlich zu Ende der Mauser aber nicht unbedingt zu einer bestimmten Jahreszeit auslösen.

Eine Reihe von sozialen Verhaltensweisen von Hähnen und Hennen sind kurz angeführt, ebenso die Ablösung der Fortpflanzungsgruppen von den Verbänden und ihre Aufnahme des Balz- und Brutgeschäftes in den Brutrevieren.

Die im Durchmesser etwa 3 Meter messenden Nester werden in sandigen Trockenflussbetten oder in anderen Sandstellen angelegt. Ortstreue ist vielerorts so ausgeprägt, dass die Vögel das gleiche Nest für eine Reihe von Aufzuchten aufsuchen. Die Eier werden jeden zweiten Tag meistens während des späten Nachmittags oder in den frühen Abendstunden gelegt. Häufig synchronisieren die Nebenhennen ihre Eiablagen mit denen der Haupthenne. Eigewichte variierten von 755g, dem ersten Ei einer gerade geschlechtsreifen Henne, bis 1618g. Die Gelegegrössen in den verschiedenen Beobachtungsgebieten schwankten haupt-