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Tom J.
CadeRELATIONS BETWEEN RAPTORS AND COLUMBIFORM
BIRDS AT A DESERT WATER HOLE

TOM J. CADE 1964

DOVES, pigeons, and sandgrouse are notably wary in approaching the isolated and usually exposed, open water holes where they congregate in large numbers to drink in desert regions, as, for instance, in parts of Australia (Cameron, 1938) and Africa (Bowen, 1927). What are the hazards which make such obvious behavior of adaptive significance in the lives of these birds? During fieldwork carried out between 18 and 23 January and between 5 July and 11 August 1961 in the Namib Desert, I had frequent opportunities to observe flocks of columbiform birds drinking at a water hole in the dry bed of the Kuiseb River and to gain some insight into the role which diurnal raptors play in determining their approach to water.

LOCATION AND ENVIRONMENT

These observations were made at the Namib Desert Research Station located at Gobabeb, approximately 70 miles inland from Walvis Bay, in South-west Africa. An open pit dug down through sand to the water table in the bed of the Kuiseb River provides one of the six or eight sources of surface water for thousands of square miles in this region. The diameter of the pit at the level of the river bed was about 40 feet, the depth to the water, about 10 feet, while the diameter of the water surface itself was about 6 feet. The well is located approximately in the center of the riverbed, where its width is some 250 feet. On either side there are stands of rather dense riparian woods consisting mainly of *Acacia giraffae* and *Acacia albida* growing to a height of 40 to 50 feet. Vegetationless sand dunes stretch southward from the left limit of the river for hundreds of miles. Northward lies an equally vast expanse of sparsely vegetated gravel plains. Most of the birds in this region are necessarily associated with the river valley or with the better vegetated portions of the gravel plains.

OBSERVATIONS

Five species of columbiform birds were regular users of this water hole during my periods of observation. These were: *Namaqua Sandgrouse* (*Pterocles namaqua*), Speckled Rock Pigeon (*Columba guinea*), Cape Turtle Dove (*Streptopelia capicola*), Laughing Dove (*Stigmatopelia senegalensis*), and Namaqua Dove (*Oena capensis*). Mackworth-Praed and Grant (1962) can be consulted for a description of these species.

In January, 200 to 300 Namaqua Sandgrouse came to water every morning between 0800 and 1200, the majority before 1000; but in July and August the number was reduced to 50 or less, and flocks did not visit the water every day. These sandgrouse arrived over the gravel plain from sparse grasslands located about 15 to 20 miles north and northeast of Gobabeb, usually flying high in flocks of 5 to 20 birds and repeatedly uttering a characteristic flight call. Typically an incoming flock circled once or twice over the water hole and then landed on a conspicuous rocky promontory overlooking the entire river valley about 500 yards upriver from the water on the left limit. Sometimes dozens of sandgrouse, sitting with alert, up-stretched necks, accumulated on the knoll before the first groups flew down into the river bed to the water.

Small groups (possibly the same as the incoming flocks) usually began flying down into the riverbed about half an hour after the first birds had arrived on the knoll. They never flew directly down into the pit to the water but landed instead on the sandy riverbed 10 to 50 feet or more away and cautiously walked into the pit to the edge of the water. Any slight disturbance at this time caused all or part of the approaching sandgrouse to bolt and fly back to the knoll. Once at the water, some of the birds (males) immediately waded in up to their breasts to drink and wet their breast feathers, while others drank from the edge. Drinking and wetting the feathers were brief acts requiring no more than 10 to 15 seconds for completion after the water was reached. Each bird flew up directly from the spot where it had drunk, in or out of the water; and the departing groups burst forth from the pit with great commotion, gained altitude over the river, and disappeared northward over the gravel plain, usually without calling. As the first groups flew down to water in this fashion, other flocks were still arriving on the knoll, and at the peak period around 0930, groups of sandgrouse followed after one another into the pit in quick succession.

During July and August a flock of nine Rock Pigeons came fairly regularly to water at Gobabeb; but these birds did not appear every day, and the number dwindled to seven during the period of observation. These pigeons apparently came from a foraging area farther upriver, but their exact movements were not determined. They appeared at various times of the day from early morning to late evening, and when they flew into the sector of the river where the water hole is located, they invariably settled as a group in the uppermost branches of one of the tallest acacias growing on either side of the well. The pigeons often remained perched in the tree for half an hour or more before flying down to the perimeter of the pit. There they again sat for several minutes looking down at the water but seemingly hesitating to walk down into the pit to drink. If some doves or other small birds happened

to fly to the water at this time and began drinking, their behavior seemed to stimulate the pigeons, for then the latter walked hurriedly down the sloping side of the pit to the water and also began drinking. The pigeons usually walked part of the way back up the side of the pit before flying off.

Several hundred Laughing Doves and a few dozen Cape Turtle Doves came to water daily at Gobabeb. Most of these doves watered before 1000 and after 1600, but a few could be observed flying to water all through the day. Typically these doves approached the water hole flying singly or in groups of two to three along the river course and perched first in one of the tall acacias growing nearby. Particularly in the early morning and late evening periods of peak visitation, 100 to 200 doves usually accumulated in the trees before the first ones flew down to water. Many false starts were made, but once the first group of six to eight birds finally settled at the edge of the water, these doves followed after one another in a steady stream of small parties until all had watered. They left the trees with several hard flaps on a downward course, then set their wings and planed swiftly right into the pit, landing near the edge of the water. Drinking lasted only a few seconds before the doves flew out of the pit and back into the trees. At the peak periods there was a steady two-way traffic between the trees and the water, and sometimes incoming birds collided in the air with those leaving the pit.

The ground-dwelling Namaqua Dove used a different approach. Several dozen of these small, fast-flying doves watered at Gobabeb. They were much more likely to appear in the middle portion of the day than in the early morning or late evening. They came singly or in pairs and usually landed first at the edge of the riverbed on the ground under the acacias or under the stands of *Nicotiana glauca* growing farther out in the bed of the river. After sitting motionless for a few minutes, they flew quickly just over the surface of the sand and dropped down into the pit to drink. Again, they were at the water only a few seconds before flying away.

Raptors which hunted regularly in the vicinity of the water hole at Gobabeb were: an immature male Lanner (*Falco biarmicus*), a pair of Rock Kestrels (*Falco tinnunculus*), an immature male Gabar Goshawk (*Micronisus* [= *Melierax* according to some authors] *gabar*), and a pair of Chanting Goshawks (*Melierax musicus*), the male fully adult, the female just beginning molt into adult plumage. There was no indication that the kestrels paid special attention to the movements of potential prey around the water hole, but the other four raptors definitely did. The Lanner had several high perches on dead branches in the tops of nearby acacias, where he could be seen sitting and watching the water every day. At times he also circled high over the river directly above the water hole. The little Gabar Goshawk was often perched motionless inside the branches of an acacia growing near the

water, a habit which is especially conspicuous among individuals of the same species at isolated wells in the Kalahari Gemsbok National Park. The Chanting Goshawks patrolled a regular beat up and down the river past the water hole, and at times they perched on the same branches used by the Lanner. Unlike the other raptors, these goshawks also frequently flew down into the water hole to drink.

Although the remains of doves were found frequently in the vicinity, the only one of these hawks which I actually saw attacking and killing birds at the water hole was the Lanner. His usual tactic was to stoop from one of his high perches, or from a circling position over the river, when a group of doves left the acacias and set their wings to glide down into the water hole. More often than not he missed, and even when he did strike down a bird he was not always successful in retrieving it. Twice I saw him knock Laughing Doves into the riverbed, but before he could turn to pick them up, the injured birds managed to struggle into cover growing at the edge of the river.

Injured doves were seen around the water hole several times, and in one notable instance a Laughing Dove which could not fly actually walked from the protective vegetation at the edge of the riverbed, out over the open sand, down into the pit, drank, and walked back. Such birds undoubtedly fall victim to some predator sooner or later, and the Lanner may indirectly provide much of the prey eaten by less vigorous hunters like the Chanting Goshawks, as the following episode illustrates.

On 8 August at 1010 hours while watching from a blind about 20 feet from the water, I heard the Lanner stoop overhead. There was a loud whack in the air, and an injured Cape Turtle Dove fell right into the water, where it was able to support itself on some floating moss by spreading its wings and tail. The Lanner did not persist in his attack. Soon the dove stuck its beak into the water and drank deeply for several seconds, while still floating in the moss. It then managed to flap across the surface to the edge of the water, where it lay in the wet sand breathing heavily. A Laughing Dove landed at the edge of the water at 1019 but flew up in panic almost immediately, as the Lanner swooped in low over the pit. The Lanner evidently saw the injured Turtle Dove, for he returned to stoop over it twice; but the dove "froze" in a crouched posture, and the Lanner did not descend to pick it up. At 1029 the injured dove stood up and managed to walk into the dry sand to a point just where the sloping side of the pit swings upward. It then settled down again beside a stick in full sunshine and began panting.

At 1035 the female Chanting Goshawk suddenly landed at the periphery of the pit, scaring away several small birds which had been drinking. The injured Turtle Dove "froze" by the stick, and the goshawk did not appear to see it. The Chanting Goshawk had walked about halfway down into the pit

when a small flock of sandgrouse flew directly over, and their passage evidently caused the dove to bolt. It fluttered across the sandy bottom of the pit and came to rest against the grounded side of an old oil drum which was half submerged in the water. The suddenness of its movement frightened the goshawk, and she flew back to the periphery of the pit, where she stood motionless looking intently down toward the dove, which was cowering in plain sight against the drum. At 1010 the dove suddenly jerked convulsively and toppled over dead at the edge of the water by the drum. The Chanting Goshawk was still watching. At 1012 the goshawk flew down into the pit to a sector of the water on the side of the drum opposite to that where the dove lay. She waded into the water up over her toes, and during the next 12 minutes drank a total of 23 beak-fulls of water by tipping up. Next, she stepped out of the water, slowly looked about, and walked deliberately around to the back of the drum, where she stopped. Peering carefully around the drum on the side where the dove lay, she moved a little closer and suddenly struck out with one of her long legs, gripping the dove tightly with her talons. The goshawk stood erect looking about a few more seconds and then flew off at 1100 with the dove in her foot.

SUMMARY AND CONCLUSIONS

The behavior of five columbiform species at the Gobabeb water hole suggests that these birds are most vulnerable to capture while actually at the water drinking and while approaching or leaving the water across the open bed of the river. Miller and Stebbins (1964) describe instances of a parallel kind of vulnerability of quail (*Lophortyx gambelii* and *Oreortyx pictus*) during their visits to water holes in the Joshua Tree National Monument, in the Mojave Desert of California. The columbiforms have evolved a mechanism of drinking which enables them to take in a sufficient quantity of water in a very short time by sucking, an obvious advantage in reducing exposure to possible predation. See Bartholomew and Dawson (1954) for details about the drinking capacity of Mourning Doves (*Zenaidura macroura*). Secondly, in their approach to the water hole none of these columbiform species flies directly to the water to drink but waits first in some relatively protected position nearby to survey the situation.

The implication that these patterns of behavior in columbiforms have developed in response to predators is reinforced by observations on the habits of sympatric falconiforms, which do indeed hunt selectively around water holes and which do take advantage of the vulnerability of birds exposed by their use of open water. Moreover, it seems likely that these patterns of behavior are chiefly for avoiding capture by diurnal birds of prey and have

been little influenced by owls or mammalian predators, which mostly visit the water holes at night.

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DEPARTMENT OF ZOOLOGY, SYRACUSE UNIVERSITY, SYRACUSE, N. Y. 13210. 10
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