BIOLOGICAL AND ETHOLOGICAL NOTES ON *Falco peregrinus cassini* IN CENTRAL ARGENTINA

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ABSTRACT - We describe the hunting range of a pair of Peregrine Falcon (*Falco peregrinus cassini*) near Cordova Argentina. Main food was the Eared Dove (*Zenaida auriculata*) and of 9 food pursuits seen the success was 66%. The hunting strategies used are outlined. The cliff used by the peregrines was also used by several other species and of these only the raptorial species were attacked aggressively while such species as the Ringed Kingfisher (*Ceryle torquata*) was attacked as displacement activity.

The subspecies of Peregrine Falcon (*Falco peregrinus cassini*) (Plate 1) has been found nesting with greater frequency in southern Argentina than in northern Argentina. Thus, finding a pair nesting in the centre of the country (Province of Cordoba) was important for us, inasmuch as it is the most northern nest we are aware of, located in Los Reartes Valley (31°60′ S-64°50′)[1], and it provided at the same time an excellent opportunity to study the species. The synthesis of our observations that follows occurred on 12 regular visits that spanned the breeding period (our first visit was on 20 July 1977, our last on 15 January 1978).

MATERIALS

Photos were taken from a hide situated 12 m from the nest. (Plate 2). The falcons became perfectly accustomed to it immediately. Super 8 film and voice recordings were also made.

RESULTS

Daily Non-Breeding Cycle - While most hunting took place at distant hunting grounds, the rest their activities take place around the breeding cliff. Our observations indicate that the pair was resident from at least July until the end of January, and perhaps they were there year round. As the sun first struck the cliff (ca. - 0900 H in August), each bird left its separate overnight roost and flew to stumps or sticks about 400 m in front of the cliff where they preened or sunned themselves. These preening roosts were about 150 m apart.

As they flew towards roosts, the Southern Lapwing (*Vanellus chilensis*), common in the area, gave alarm calls (in spite of the fact that the peregrines never preyed on them). After 30 min of sunning and preening, they set out to hunt. The basic food for this pair consisted of the Eared Dove (*Zenaida auriculata*), which was ubiquitous. The falcons hunted independently or as a cooperative pair.

After feeding they roosted at a shaded spot on the cliff for the remainder of the day, or would bathe, until departing shortly before sunset to hunt again. At twilight their activity ceases completely, each one going to separate night roosts.

Uneaten prey was frequently cached on a ledge to be eaten the following day. They were a particularly noisy pair in their relationship, and the occasions when they were not connected in some way, either by vocalizations or visually, were rare. When 1 of the 2 returned to the gully, the 1 perched on the cliff always gave a characteristic call. Of the 2, the male disappeared from the cliff for longer periods, both in midwinter and during breeding time, when it provided the female with prey. In every case, its absences were never more than 2 h.

Territory and Home Range - The home range could be divided into 3 areas of defense in which they showed different reactions. The greatest area "defended" was the hunting ground, which covered several square kilometers and included the other 2 areas. The second was the territory they defended near the nest, of some 300 m (radius) starting from the nest. The third area was the breeding cliff, formed by the nest and its surrounding shelves. In the province of Cordoba, the limiting factor for the number of established pairs seems to be the distribution of cliffs with a sufficiently difficult approach so as to enable them to nest with relative security and not be disturbed; the other possible limiting factor, food (doves), is more than plentiful in all localities. In their "hunting ground" they displaced other competitive species [the male pursued and severely attacked an Aplomado Falcon (*Falco femoralis*) until it was expelled from the territory] or other unpaired peregrines; but they didn't attack other species that were appar-

[1]Ed. Note - *F.p. cassini* is now (1984) known to nest several hundred km northward in Salta province, the northernmost province in Argentina. The authors have since located several pairs of peregrines in the Cordova region.

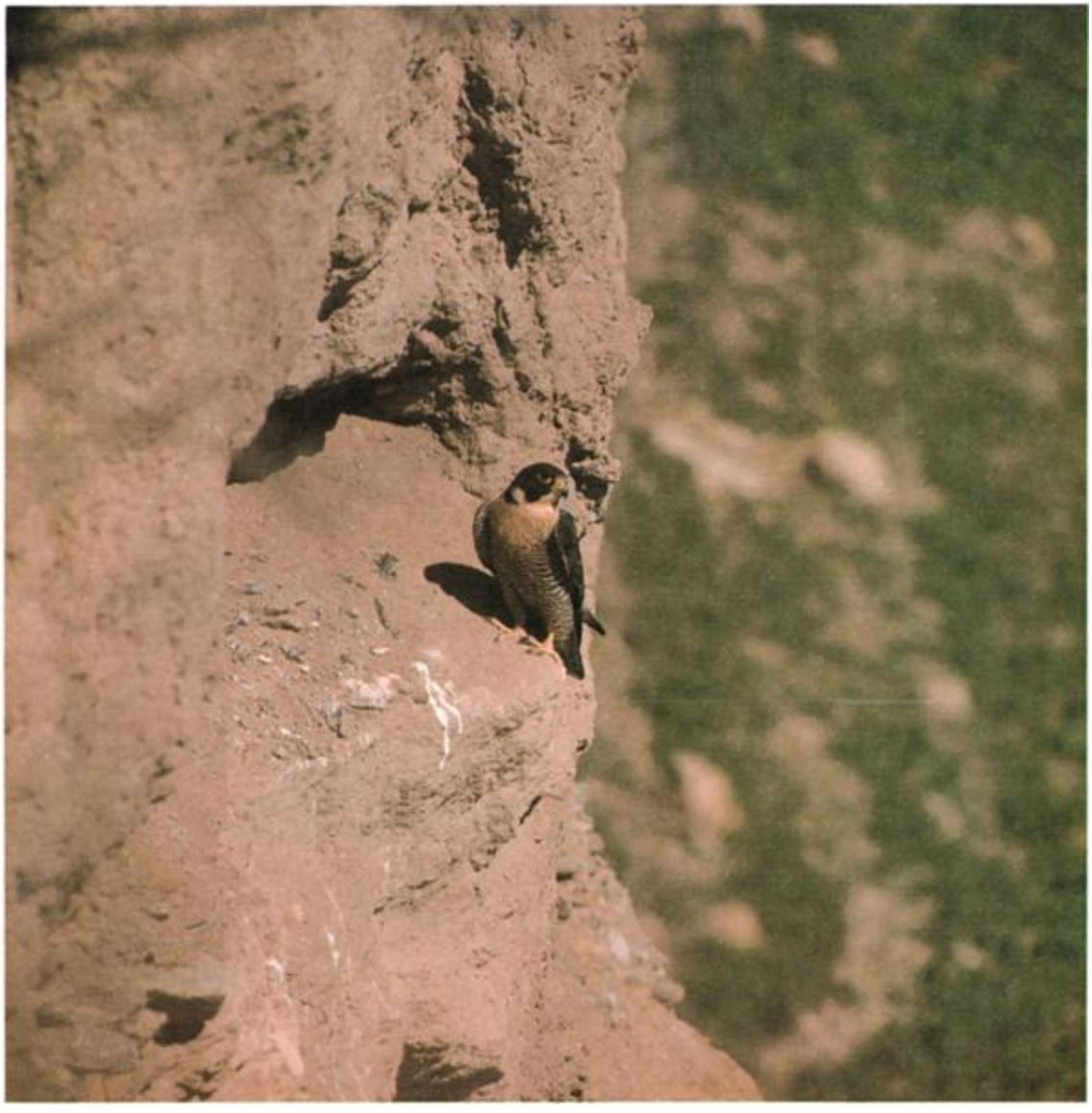

Plate 1: *Falco peregrinus cassini* at nest ledge in Cordova Province, Argentina.

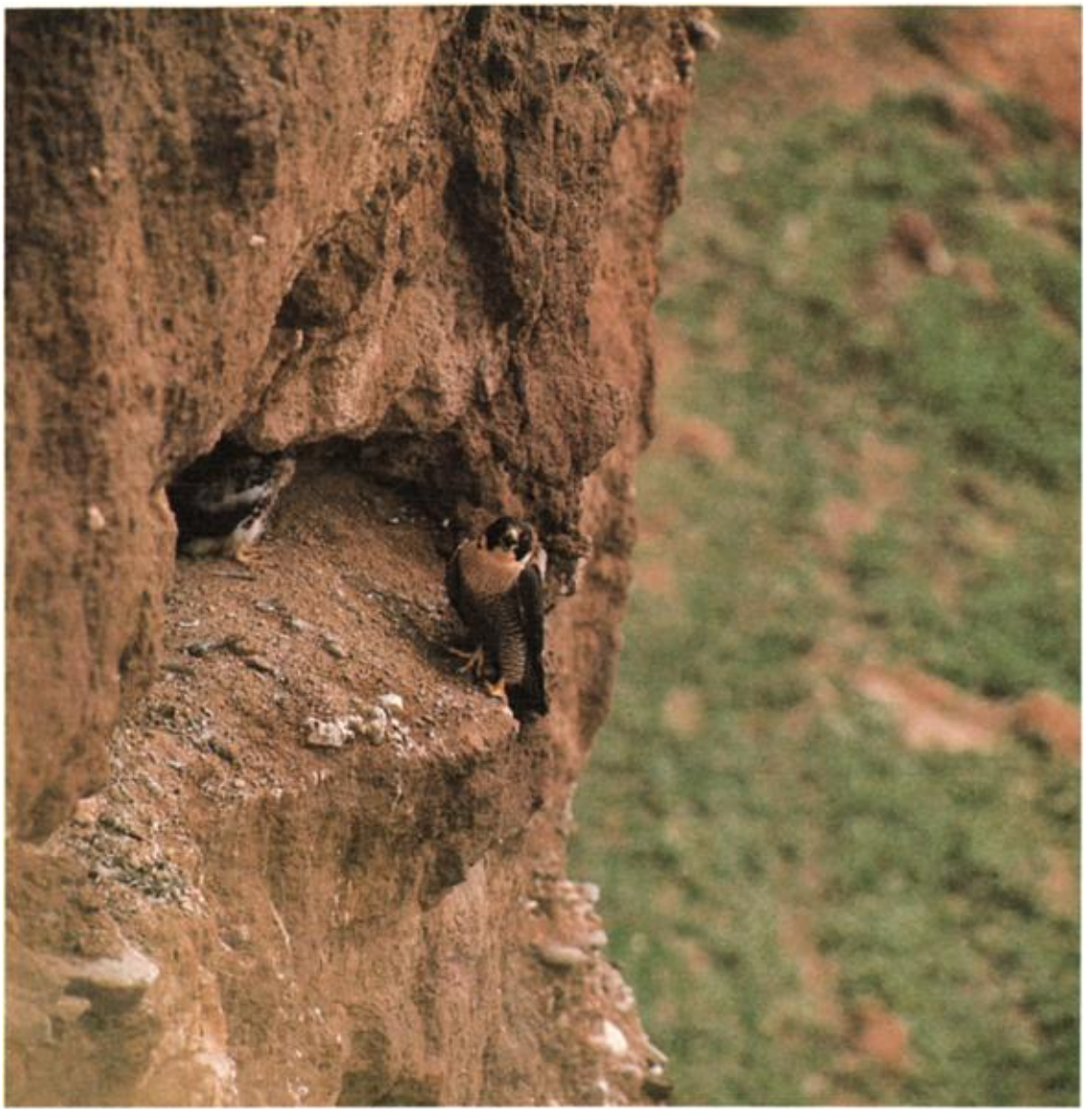

Plate 2: Female *Falco peregrinus cassini* with young at nest in Cordova Province, Argentina.

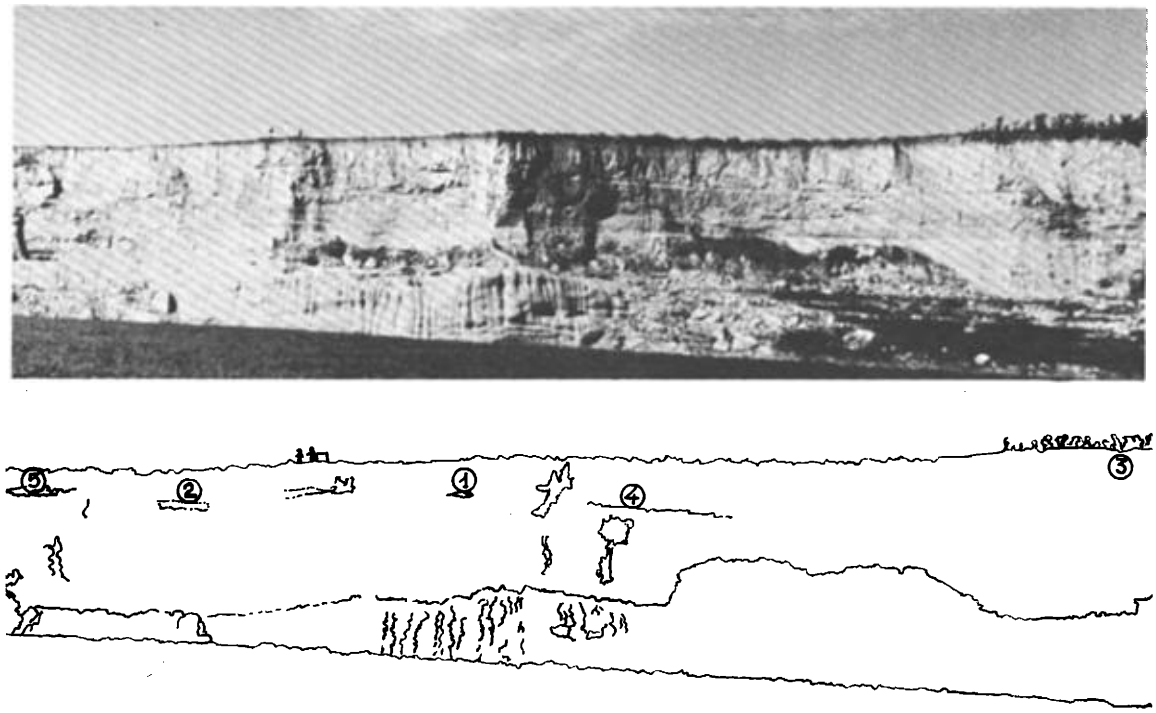

Figure 1. Cliff nest site characteristics for a pair of *Falco peregrinus cassini* nesting in Cordova, Argentina. Site 1 - Prey transfer area; Site 2 - Male's roost; Site 3 - Female's roost; Site 4 - Male plucking perch site; Site 5 - additional perch site also used for sunning.

ently non-competitive or did not serve as food (lapwings, gulls (*Larus* sp.), herons, Chimango Caracara (*Milvago chimango*), or American Kestrel (*Falco sparverius*). In attacks of other species in the "defended area", in all cases the female carried out the most aggressive defense and passed closest to the intruder. The male fulfilled the task of "support" by joining in calling, but his stoops were less decided and he nearly always watched the action flying above the female. The cliff had several characteristic points (Fig. 1) which were: the nest (1); a main eating and plucking ledge for the transference of prey(2); the male's sleeping roost (3); the female's sleeping roost (4); and a plucking and resting ledge of the male (5) also used for sunning

Food and Hunting - The principal prey remains found below the plucking perch was the Eared Dove. Below the male's roost we found the remains of Monk Parakeet (*Myopsittia monachus*) and Screaming Cowbird (*Molothrus rufoaxilaris*) as well as those of the dove. Undoubtedly the male caught smaller birds (*Sicalis, Passer, Zonotrichia*, etc.), but we didn't find their remains.

Hunting - The principal hunting ground was in front of the nest on low-lying flat ground, partly bordered by the river that was a flying route of pigeons and doves. This hunting ground was where we observed most captures. At the height of the breeding season when large young were in the nest, we witnessed the pair hunting in a highly effective method (in 9 pursuits they achieved 6 captures = 66% success). The hunting method, used with very fast flying, medium sized prey, consisted of the following: in a succession of stoops at the pigeon (one after the other), the female falcon generally hit the pigeon as it tried to watch the male, who cut off its retreat while the pigeon looked for a refuge on the cliff or in the scrub (Fig. 2).

We were particularly impressed by the synchronization of movement they showed when hunting as a pair, from the first moment until they finally caught the prey. A sequence which we frequently observed was the following: they both flew over the cliff at a height of ca. 50 m, soaring against the wind (50-60 m apart); and while making notable head movements they searched the horizon for pi-

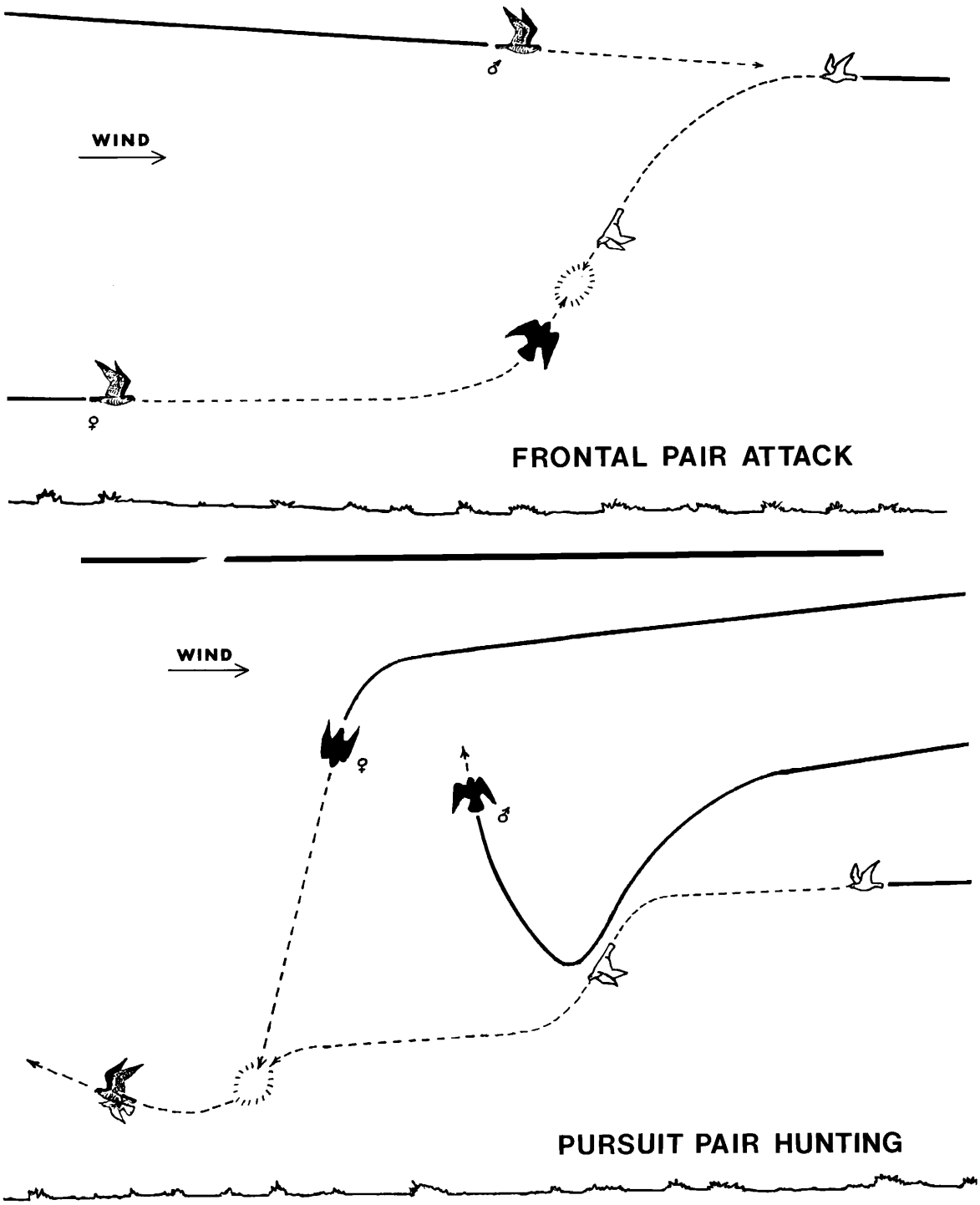

Figure 2. Hunting methods of *Falco peregrinus cassini*.

geons. The male always soared some 10 to 15 m above the female. When the male began to flap his wings, the female followed him at a distance of 30 m, beating her wings in the same rhythm. In an oblique flight, the female began to gain height, ready to stoop onto the prey which dodged the male's first dive. Most times, in the second dive, the female caught the prey. Out of 6 captures observed in 1 day, only 1 was made by the male, and the rest by the female. Similar strategies have been described and diagramed by Hustler (1983).

Young Eared Doves were more easily captured (most feathers found were from young). Some doves, nevertheless, were not able to be caught after a combined chase of more than 500 m, in which the male and female made a succession of stoops; until, to save themselves, the doves flung themselves like stones against the scrub of the cliff, while the peregrine gained height again, and, with repeated stoops to the ground tried to make the dove fly again.

Adaptation to the Surroundings and Relations with Other Species - The cliff face housed several species in addition to the peregrines. Each species seemed to coordinate their activities relative to the peregrines'. For example, a pair of the Ringed Kingfisher (*Ceryle torquata*) nesting near the falcons had to leave the cliff to save their lives when the female peregrine, molested by our presence, directed her attacks at whatever was below her. when very near, turned in the air and took the prey.

We also observed another very effective combined attack: a dove approached flying towards the falcons, in an oblique direction. The male flew out to meet it and the female, flying behind him but lower (about 5 m above the ground) made her much lower than the dove's line of flight. The dove was apparently unable to see the female falcon, but could see the male.

As it neared the male, the dove turned sharply, descending and practically hitting the female, who had by now gained sufficient speed flying low, that she only had to attack from below, rising upwards to catch her prey (Fig. 2). On this occasion the female killed and partly plucked the dove while still on the wing. Of several prey captured in 1 day, only 1 was killed on the ground, the rest in flight by biting the neck.

During the time we observed the cooperative hunting described, the nestlings were about 20 d old and the female left the nest for long periods to join the hunting male. When the male brought food to the female, he usually perched 30 m from the nest and called to the female. They were very vocal at the food exchange with a characteristic call (Fig. 3).

Considerations of Food Habits - Of several checks for food on the plucking perches, we only found remains of *Zenaida auriculata*. One, recently killed (still warm) and intact, weighted 130 g. Comparatively, the Spotted Pigeon (*Columba maculosa*), also frequent in the area, must be difficult to hunt; and it is our opinion (which we could not confirm in the field) that the male peregrine (*cassini*) could not transport in flight one of these pigeons that weighs, on average, 260 g.

All the doves were hunted and caught by direct pursuit because their size and agile flight enabled them to successfully evade a stoop. Larger prey that were difficult to carry in flight (ducks, etc.) were hunted by stooping perpendicularly from a considerable height and striking the prey. We found that the "waste factor" of this pair was high. Usually only the breast was gone from the dove. They caught about 3 doves a day and ate about 1/3 of each (40 g of muscles).

Based on the followng scenario some calculations can be made. They daily consumed the equivalent of 12% or 15% of their body weight (according to temperature and activity level). The female weighed about 900 g, the male 650 g, and a dove weighed 125 g. During the rearing period each nestling consumed the equivalent of a little more than 1 dove/d (only about 5% of this pair's diet was not doves). Thus, we calculate that the pair and the 4 nestlings raised ate approximately 1750 doves annually. On a kg basis this value is in line with that derived independently by Ratcliffe (1980).

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Several times we observed these attacks. These were not attacks to kill and eat the kingfishers. On one occasion the kingfisher came in from down river, flying low over the water directly to its nest located about 50 m from the peregrine nest. The female peregrine started a sudden vertical dive-

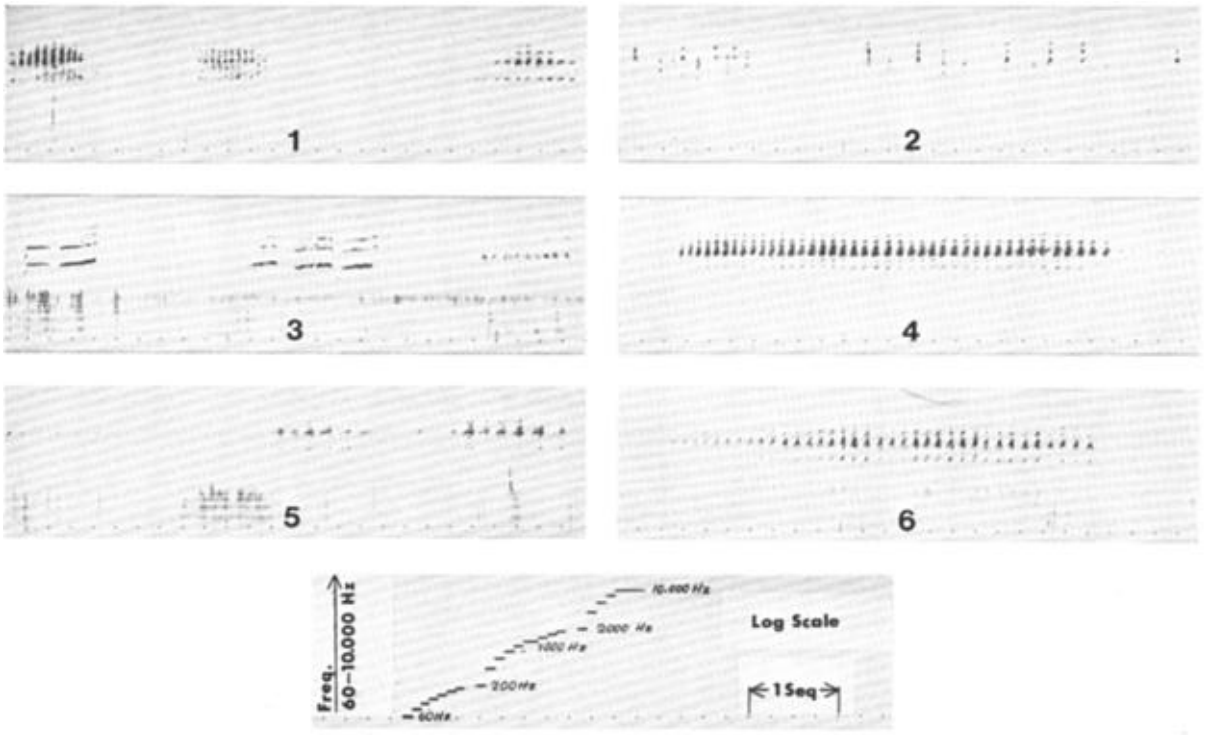

Figure 3. Miscellaneous sonogram patterns of *Falco peregrinus cassini* in central Argentina.

Pattern 1: Alarm call of nesting female. The female was stooping at us near the nest. She made the calls (chitters) only when near us. The first vocal stanza is more dense than the other two because she was close by. The call ranges from 900-4100 Hz.

Pattern 2. Contact call of the male. This call was given (*Eechip*, sometimes accompanied by ledge display) from the main eating ledge. Call frequency is from 600 - 5,000 Hz. Of note is that when the female approached him, the number of voices doubled in the same time lapse (ledge display). The latter is easily found in 1.5 sec of the sonogram from left to right. Then, when the female left, the call became more spatial after the 4th sec.

Pattern 3: Anti-aggression call of perched male. This is also a submission call, since the female, while flying, will disturb or attack the male to make him fly. From the 5.25 sec, the female was close to the male, flying over him. His voice resembles total submission to the point of being like that of the young in front of their mother (compare 1st sec of Pattern 6).

Pattern 4: Alarm call of the female with young. This sonogram reveals a more definite and persistent voice, more than when the nest contains only eggs (compare to Pattern #1). The call went from 1,000 - 5,000 Hz. In the same sonogram we found that young joined the female in the alarm call. This is noted in the difference in time between their voices, at 3.5 sec and from 4.75 sec, remaining even as the single voice at the end.

Pattern 5: Alarm call of the male. Note the difference between the alarm calls of male and female. The male call was a mixture of a wail and a typical alarm call. The wail is a single frequency call lasting ¼ sec and the alarm call, a great variation of frequencies in ¼ sec. Both male and female alarm calls range in the same frequency (compare Patter #3).

Pattern 6: Call of nestlings. Their alarm call varied from 900 - 4,200 Hz. and resembled the alarm call of the adults in structure but not in the frequency range. The calls befoare 2.5 sec were the typical submission voice, that the male performs while the female is excited, aggressive or closeby (compare Pattern #3).

Notes: a) On the horizontal scale of the sonogram, each 4 divisions is one second (sec); b) Every character found in the sonogram below the 400 Hz range identifies parasitic and background noises from the wind.

attack the instant the kingfisher passed just below her, which caused the kingfisher to dive violently and loudly into the water. What impressed us most was the stoop of the peregrine, with a sudden movement of the wings, the body down in an almost vertical position, gyrated around the body axis. The wings accelerated the speed and the body returned to its normal position only at the end of the plunge. After passing just a few centimeters over the water, with a movement of the tail and due to the high speed the peregrine gained elevation to get into position for a second attack. The kingfisher surfaced and changed its flight direction, but the second attack forced it back into the water again. After repeating the maneuver several times, the falcon finished the game, allowing the kingfisher to leave the area.

Something very similar happened with a Speckled Teal (*Anas flavirostris*) that nested on the cliff about 30 m from the peregrines. Several times, flying to its nest, it had to enter the water because of the peregrines' attacks. However, unlike the kingfisher, once in the water it did not take wing to avoid the second attack, but swam away. Despite these attacks, the teal fledged a brood of young.

A group of swallows (the Southern Martin, *Progne modesta*, and Grey-Breasted Martin, *Progne chalybea*) also shared the cliff. They nested near the night roost of the male, and their presence was noticeable whenever the peregrines were resting or far away from the cliff. We used the swallows as indicators of the presence of the falcons because when the falcons were present, the swallows flew near the bush — protected cliff. Their alarm-call told us when the male came back to the cliff with prey.

Due to changes in the environment (swelling river after heavy rainfalls that floods lower lands), some species disappear temporarily. Among them, the Southern Lapwings (*Vanellus chilensis*) and Brown-Hooded Gulls (*Larus maculipennis*) made considerable noise whenever the peregrines were flying near despite the fact that they were never attacked.

The peregrine vehemently attacked Common Caracaras (*Polyborus plancus*) to a radius of 300 - 400 m from the nest. On the other hand, the Chimango Caracara (*Milvago chimango*) was not attacked, even when coming as near as 10 m to the nest.

Once we observed the male soaring about 800 m from the cliff. Suddenly he stooped at a Common Caracara that was flying in front of the nest. On another occasion he pursued and drove away an Aplomado Falcon (*Falco femoralis*) that passed at a very high altitude over the cliff. We can confirm, however, that they do not attack either the American Kestrel (*Falco sparverius*) or the White-tailed Kite (*Elanus leucurus*). A pair of the former nested in a hole of the cliff about 500 m from the peregrines. The kite occupied two little woods of *Eucaliptus* and conifers about 400 m from the cliff.

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