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Nest-site characteristics of four raptor species in the Argentinian Patagonia.—The selection of an appropriate nest site is vital to the reproduction of birds because it determines the environment to which adults, eggs, and altricial chicks will be exposed during critical periods. In general, both nest-site selection and construction should provide the necessary protection against predation of eggs and nestlings. The environmental conditions in the nest will be affected by the nest architecture, its exposure to the winds, protection from storms, and insolation.

The objective of this study was to describe the nest and nest-site characteristics of four diurnal raptor species of the Argentinian Patagonia. There were the Grey Eagle-Buzzard (*Geranoaetus melanoleucus*), Chimango Caracara (*Milvago chimango*), Crested Caracara (*Polyborus plancus*), and Red-backed Hawk (*Buteo polyosoma*). Information on nest-site characteristics of these species is scarce over their entire geographical range (see Brown and Amadon 1968, Fraga and Salvador 1986, Jiménez and Jaksic 1990) with the exception of the Crested Caracara in North America (Palmer 1988).

Methods.—We collected data for this study in the Neuquén province, northern Argentinian Patagonia, in a circle of 60 to 70 km radius centered at the city of Junín de los Andes (39°57′S and 71°05′W), 780 m above sea level. The area belongs to the Patagonian Phytogeographic Province, Occidental District (Cabrera 1976). The vegetation is characterized by a mixed steppe of grass and shrubs. Dominant grass species are *Mullinum spinosum, Senecio* spp., *Stipa* spp., and *Poa* spp., while common shrubs are *Chacaya trinervis, Berberis darwinii,* and *Schinus molle.* Dominant trees are *Austrocedrus chilensis, Nothofagus* spp., and *Araucaria araucana.* The habitats present are great plains of 800–900 m high, dissected by steep rugged areas and valleys of different sizes. In the bottom of these valleys there are humid areas with dense herbaceous vegetation ("mallines") where dominant species are *Cortadeira araucana, Juncus* sp. and *Carex* sp. Arboreal species such as *Maytenus boaria* and *Salix humboldtiana* are concentrated in valleys and mallines. Pine plantations (*Pinus* spp.) are also present in the study area.

The weather is dry and cold, with frosts throughout almost all the year, and frequent winter snowfalls. Mean, mean highest, and lowest annual temperatures are 11, 17.4, and 2.5°C, respectively. Absolute maximum temperatures for the spring season (September–December) ranges from 30°C in September to 37°C in December, while absolute minimum temperatures were −12.3°C and −3.5°C for the same months, respectively. Annual rainfall is 600 mm, with 20% in spring. Solar radiation increases from 300 cal/cm^2 day in September to 540 cal/cm^2 day in December. Spring mean cloud cover is about 4.1 (measured in a 1–8 scale). The most important weather feature in Patagonia is strong cold winds which can reach a speed of up to 120 km/h. During spring, they blow from the Andean range, in an easterly direction, towards the Patagonian steppe (Fig. 1).

Nests were located by (1) personal inquiries to land owners and their employees, (2) vehicle trips along main and secondary roads, and (3) cross-country foot trips. We used binoculars (10 × 40) and telescopes (field scopes) (20× to 40×) to check hills, cliffs, trees, and any other potential nesting sites, and we frequently located nests by observing the adult birds.

Once the nest had been spotted and its occupant-species identified, its location was plotted on a map (topographic sheets of Argentinian Army Geographic Institute, scale 1:50,000 and 1:100,000). The nests were classified as active (with eggs or young) or inactive (repaired or in good condition). We discarded from the analyses those nests showing deterioration or any other sign of having been unoccupied the previous breeding seasons. For each nest, a field data sheet was completed with the following information (variables were based on the

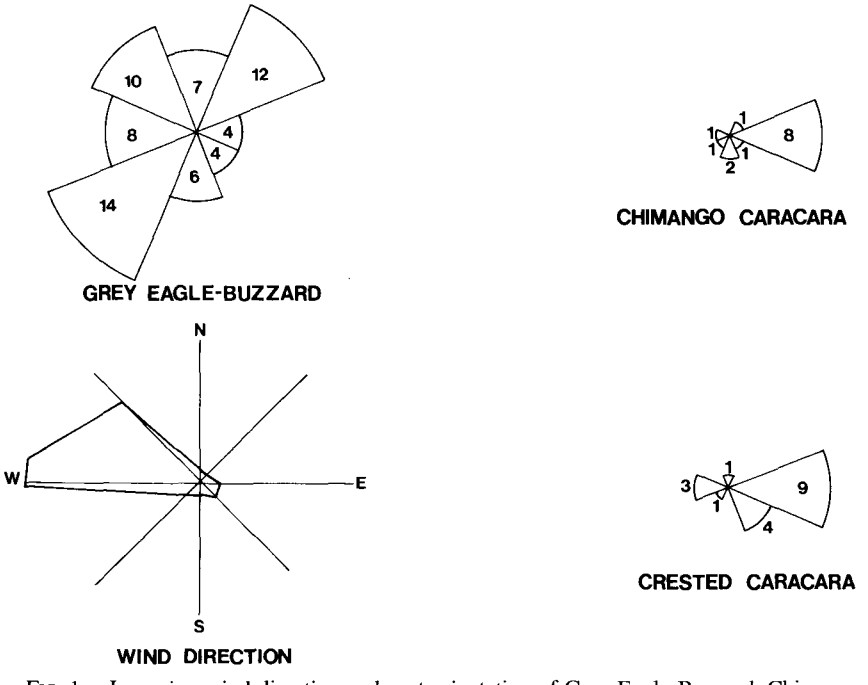

FIG. 1. Incoming wind direction and nest orientation of Grey Eagle-Buzzard, Chimango Caracara, and Crested Caracara nests in the Argentinian Patagonia. Values are total nests which are exposed in each sector.

features that were listed in previous literature as important or relevant to descriptions of nest sites) (1) substrate height: distance in meters from the base to the top (shrubs, trees and cliffs) of the substrate, (2) nest height: distance in meters from the substrate base to the nest, and (3) nest-site orientation: in the case of nests located in trees or shrubs, measured as the deviation from the north around the central vertical axis of the trunk. In the case of nests on cliffs, nest-site orientation was measured as the deviation from the north (1) of the cliff face where the nest was placed, or (2) of the nest when its orientation did not coincide with that of the cliff. Measurements were then grouped in 45° octants corresponding to orientations N, NE, E, SE, S, SW, W, NW.

Results and discussion.—Nest orientation was examined using chi-square for Grey Eagle-Buzzards and Rayleigh's test (Zar 1974) for the Chimango Caracaras and the Crested Caracaras because of insufficient data to perform a chi-square test. Critical values were selected at the 0.05 probability level for tests of significance. A total of 162 nests were located: 101 of Grey Eagle-Buzzards, 33 of Chimango Caracaras, 19 of Crested Caracaras, and 12 of Red-backed Hawks. Chimango Caracaras used a wide range of nesting substrates (trees, shrubs, cliffs, ground, and poles); a wide range was also observed for the Grey Eagle-Buzzard (trees, cliffs, and power-poles), while Crested Caracaras and Red-backed Hawks always nested in trees and shrubs (Table 1).

Grey Eagle-Buzzard nests were at midheight when they were in cliffs but tended to

TABLE 1

NEST-SITE CHARACTERISTICS OF FOUR PATAGONIAN RAPTORS

Species	Substrate	Substrate height (m)	Nest height (m)	Relative nest position relative to substrate height (%)
Geranoaetus melanoleucus[a]	Trees (8)			
	Populus tremuloides	22.5 (2)	14.0	61.0
	Austrocedrus chilensis	11.5 (2)	11.0	96.0
	Maytenus boaria	8.0 (2)	5.5	69.0
	Chacaya trinervis	5.0 (1)	5.0	100.0
	Cliffs (92)	19.34 ± 9.6 (90)	12.69 ± 8.2	64 ± 18.1
Milvago chimango[b]	*Chacaya trinervis* (3)	4.0 (3)	2.4	50.0
	Berberis darwinii (17)	2.3 ± 0.8 (17)	1.7 ± 0.4	74 ± 14.8
	Scirpus californicus (4)		0.6 ± 0.4	
Buteo polyosoma	*Schinus molle* (6)	2.4 ± 0.5 (5)	2.2 ± 0.4	92 ± 14
	Chacaya trinervis (5)	3.8 ± 0.9 (4)	30 ± 0.9	80 ± 9.0
	Salix humboldtiana (1)	4.0 (1)	3.0	75.0
Polyborus plancus	*Populus tremuloides* (14)	19.9 ± 7.8 (13)	8.0 ± 3.61	43 ± 14.5
	Maytenus boaria (1)	6.0 (1)	4.5	76.0
	Araucaria araucana (1)	13 (1)	9.0	70.0
	Berberis darwinii (1)	4.0 (1)		
	Salix humboldtiana (1)	8.0 (1)	4.0	50.0
	Nothofagus spp. (1)	5.0 (1)	5.0	100.0

[a] One nest in a power pole, not considered for calculations.

[b] Six nests on the ground and three on cliffs, not considered for calculations.

occupy the most distant extreme when they were on trees, apparently limited only by branch strength. Chimango Caracaras showed a strong tendency to place their nests in or near the central place of the substrate (Table 1). Crested Caracaras tended to occupy the lower half portion of the tree when nesting on aspens (*Populus tremuloides*), an introduced tree. The Red-backed Hawk tended to occupy distal extremes of shrubs and trees (Table 1).

Grey Eagle-Buzzard, Chimango Caracara, and Crested Caracara oriented their nests (Fig. 1), while Red-backed Buzzard showed no clear orientation, nesting in all occasions on the tops of trees and shrubs (N = 12). Compass orientation of Grey Eagle-Buzzard nests on cliffs did not differ from a random distribution ($\chi^2 = 5.54$, df = 7, $P = 0.59$), but all four tree nests were oriented to the east. Chimango Caracaras and Crested Caracaras also showed a strong tendency to orient their nest eastwards (Rayleigh's test $R = 0.58$, $P < 0.05$ and $R = 0.47$, $P < 0.05$, respectively).

Grey Eagle-Buzzards prefer to nest on trees or cliffs, depending on local substrate availability (Jiménez and Jaksic 1990). The only published descriptions of Chimango Caracara nests refer to ground nests and those of a small colony in trees (Fraga and Salvador 1986), although this species nests on a variety of substrates in Argentina. Crested Caracaras nest in shrubs and trees, including lateral branches of giant cactus in North America (Palmer 1988). Finally, information on nest-site characteristics for the Red-backed Hawk was also scarce. When trees or bushes are available it nests in them, but a ledge, telephone pole, or rock were also used as a nest-site (Brown and Amadon 1968).

Nests of large raptors can be destroyed by carnivores and humans; when predation risk is absent, large eagles may nest on the ground (Newton 1979). In our case, Grey-Eagle Buzzards seem to nest in places where the risk of mammalian predation is low (middle place on cliffs, distal extreme on trees) as do other large eagles worldwide (Newton 1979, Gargett 1991, Ferrer 1993). The Chimango Caracara, the smallest raptor considered in our study, decreases predation risk by nesting in unaccessible places such as the center of spiny shrubs and leafy tree areas. It frequently covers the upper portion of the nest with small branches and spiny leaves similar to a domed nest (Collias and Collias 1984).

Trees and shrub nests of Crested Caracaras, Chimango Caracaras and Grey Eagle-Buzzards were oriented eastward, the most protected direction from the cold westerly winds (Fig. 1). Nevertheless, when observing Grey Eagle-Buzzard nests on cliffs, we found no predominant orientation. This failure in detecting a clear orientation could be a consequence of the high density reached by this species in the study area (Travaini et al. 1992). Any possible selection could be obscured by habitat saturation that would restrict possible nest orientations for many pairs. In the Red-backed Hawk, the selection of tree and shrub tops where it nests, together with the lack of an orientation direction in its nest-sites, may be compensated for by nesting in trees or shrubs located in wind-protected, small- or medium-sized valleys (11 of the 12 nests in this study were in narrow valleys).

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Notes on egg laying and incubation in the Common Merganser.—Common Mergansers (*Mergus merganser*) are large, piscivorous, cavity-nesting ducks with a broad distribution in North America (Bellrose 1980). Their foraging habits (i.e., reliance on fish) and the sensitivity of their breeding habitat in eastern North America make them an ideal indicator species for studying the effects of environmental pollution on aquatic food webs (Haseltine et al. 1981, McNicol et al. 1990), but little is known about their nesting biology (Bellrose 1980, Afton and Paulus 1992). Here we describe egg laying, clutch size, incubation behavior, and mass loss of female Common Mergansers nesting in nest boxes in the Temagami region (47°N, 80°W) of northeastern Ontario, Canada.

Patterns of nest attentiveness and mass loss were recorded using load cell monitoring systems installed in nest boxes during egglaying (method described in Mallory and Weatherhead 1992). A "recess" was a period of time the female spent off the nest, and "nest attentiveness" was the amount of time the female spent on the nest each day, expressed as a percentage of 24 hr (Afton and Paulus 1992). Because these monitors recorded on strip charts, movements by the female while incubating are recorded as a spike along a continuous line. Thus while we were able to document the frequency of female movements during incubation, we were not able to distinguish between egg turning and comfort movements.