nests were interspersed among Black-crowned Night-Heron nests. We tried to locate only a few nests to confirm nesting and to minimize disturbance to the colony, since young ibis may die if their parents are not present to shade them from the sun (Tyler 1933). We quickly paddled around the colony and counted 85 adults flushed from nesting cover. We also observed many small groups and several lone ibis feeding in the area, which increased our overall count to nearly 200 individuals.

On 15 June 1983, while monitoring an outbreak of avian botulism (*Clostridium botulinum,* type C), we returned in an airboat to the colony site. We observed 65 nearly-fledged young in the colony; we believe many young had fledged between our visits. On 21 June 1983, we revisited the area and discovered 13 additional nests in an area adjacent to the original colony. Their contents were much later in development than those in the original colony. One nest contained three eggs, two nests contained eggs and newly-hatched young, seven nests contained downy young, and three nests contained half-grown young. Based upon our observations, we estimated the total nesting population of White-faced Ibis in the area to be about 100 to 110 pairs.

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AN ARCHAEOLOGICAL RECORD FOR THE WHITE-FACED WHISTLING-DUCK (*DENDROCYGNA VIDUATA*) IN CENTRAL PANAMA

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AND

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Large, well-preserved bone samples have been recovered at several central-Panamanian archaeological sites (Cooke 1981, 1984b). At one site, Sitio Sierra (Fig. 1), over 400 bird bone elements have been found in middens, pitfills and cemeteries (Cooke 1984a). In one refuse pile, which on ceramic evidence dates from before A.D. 500 and which lies directly over a circular structure dated to between 2015 ± 80 and 1975 ± 80 radiocarbon years (65 B.C. and 25 B.C.; Cooke 1979), RGC recovered the partial skeleton of an adult White-faced Whistling-Duck (*Dendrocygna viduata*). The bones were found close together and were excavated by hand trowelling. Twenty-two elements can be assigned confidently to a single individual, while a further 35 (mostly vertebrae and phalanges) probably belong to it. The frontal bone is intact and demonstrates the incomplete orbital ring, which is characteristic of adults of this species. (Subadults of *D. arborea, D. autumnalis* and *D. bicolor* may have incomplete eye-rings, but the unfused ends are thin and pointed, differing from the thick ends in adult *D. viduata.* For details of postcranial elements of *D. autumnalis, D. bicolor* and *D. viduata,* see Campbell 1979.)

Macrobotanical, pollen, phytolithic, faunal and human demographic evidence all point to extensive agricultural activities and deforestation in the vicinity of Sitio Sierra by the time of Christ. Organisms that prefer pond, marsh and river-edge habitats prevail in the archaeological bone samples (Cooke 1979, 1984a, b). Hence, it seems likely that the White-faced Whistling-Duck was taken locally. At the same site, and in similarly dated contexts, RGC recovered nine other elements of *Dendrocygna* from at least five different individuals. (A complete coracoid is probably from a second specimen of *D. viduata.*) Also identified were two individuals of the Muscovy Duck (*Cairina moschata*) and a single individual of the Lesser Scaup (*Aythya affinis*). Both *Cairina* and *Dendrocygna* could have been domesticated or kept in temporary captivity; several bones of young ducks that could not be identified to genus were found pressed into the compacted clay of house floors.

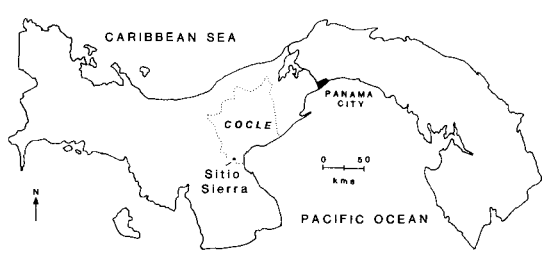

FIGURE 1. Map of Panama showing the location of Sitio Sierra and Coclé province.

The White-faced Whistling-Duck now has a disjunct distribution in the Neotropics (Blake 1977). In Panama it has not been reported since the 1940s, and the few records from before this date are from east of the Canal (Méndez 1979, Ridgely 1976:50, Wetmore 1965:140). The archaeological record from Sitio Sierra indicates that its range once included Coclé province. (*D. autumnalis* is still present in the area in small numbers; RGC saw recently-killed birds being offered for sale near Sitio Sierra in 1983.)

Pre-Columbian people are known to have affected the ranges of certain bird species. The Tufted Jay (*Cyanocorax dickeyi*) and the Great-tailed Grackle (*Quiscalus mexicanus*) were deliberately transported out of their original ranges (Haemig 1978, 1979), macaws were traded into the American Southwest (Hargrave 1970), and *Nesotrochis debooyi*, the extinct flightless rail of Puerto Rico, was probably both exterminated and carried to the Virgin Islands in prehistoric times (Olson 1983 and references cited therein).

The continuing analysis of bird bones from Panamanian archaeological middens (including the 7,000-year-old Cerro Mangote shellmound; McGimsey 1956; Cooke, Olson and Ranere, unpubl.) should provide more information on the pre-conquest distributions of other extant species whose present-day disjunct ranges are likely to have been affected by local hunting pressure.

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DEFENSE OF NEST BOXES BY WESTERN BLUEBIRDS DURING THE POST-BREEDING PERIOD

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Limited availability of usable cavities influences many aspects of the biology of secondary cavity-nesting birds. For example, density of cavities, i.e., nests and/or roosts, affects breeding (von Haartman 1971) and nonbreeding (Dhondt and Eyckerman 1980) population densities, residency status (Lundberg 1979), and mating system (Gowaty 1983). Here, I report on Western Bluebirds (*Sialia mexicana*) defending nest boxes during the post-breeding period, a behavior that may indicate a shortage of cavities.

STUDY PLOTS AND METHODS

As part of a study of the population biology of Western Bluebirds and other secondary cavity-nesters, I installed 60 nest boxes on each of three study plots, 40–60 km south of Flagstaff, Arizona, in ponderosa pine (*Pinus ponderosa*) forests. Western Bluebirds were common on the plots; during four breeding seasons, from 1980 through 1983, I inspected all boxes for nests (see Brawn and Balda 1983). All nestlings ($n = 297$) and some adult bluebirds ($n = 11$) found in boxes were banded with USFWS aluminum and colored plastic leg bands. Approximately 60% of the nestlings were sexed, based on plumage characteristics established for young Eastern Bluebirds (*Sialia sialis*) by Pinkowski (1974). Male Western Bluebird nestlings that are at least 12 days old typically are more strongly colored than females on the dorsal surface of the rectrices and remiges. Nestlings were not sexed during the 1980 and part of the 1981 breeding seasons. I visited each study plot at least once a week from mid-August until early October to investigate the activity of secondary cavity-nesters that fledged from boxes, and to assess use of boxes during the post-breeding periods. Approximately 120 hours of observation were made from 1980 through 1983.

RESULTS

I observed bluebirds defending boxes against conspecifics 57 times over the four post-breeding periods. Box defense typically consisted of a bird perching on or beside a box, interrupted by short "rushing" flights toward approaching or nearby bluebirds. Such flights usually caused the intruder to halt and/or move away, after which the defender returned to its perch.

All defenders ($n = 41$) were immature birds that had fledged from boxes during the previous breeding period. Twenty of these birds were known to be males (Table 1). Defenders of unknown sex either had not been sexed as nestlings or were not observed closely enough to confidently determine sex. Box defense was seen only within or adjacent to the defender's natal territory but the boxes from which the birds had fledged were not defended.

Defenders acted against both immature ($n = 37$) and