moved. For each class the regression lines relating standard deviation to size of species are shown in Figure 1. The correlation coefficients relating standard deviation with size of bird, after colony differences are removed, were: class A, $r = 0.47$ (n.s., $P < 0.10$); class B, $r = 0.72$ ($P < 0.01$); and class C, $r = 0.88$ ($P < 0.05$). Thus for 13 mixed-species heronries with differing heights of vegetation, species size was positively correlated with the standard deviation of nest height. Additionally, species nesting in taller trees used more space.

CONCLUSIONS

In the mixed-species heronries examined, mean nest height and standard deviations of nest height correlated positively with body size. Larger species nested higher and used more of the available vertical space than did smaller species. Although this difference relates to body size, it does not relate to the ability to acquire the resource but probably to the ability to defend that resource. Potentially, all species can nest at all heights. In the absence of larger species, smaller species nest higher in the vegetation. However, when larger species are present, they cause the smaller species to nest lower in the vegetation (Burger 1978). It seems that in competitive interactions, smaller species cannot defend as large a vertical space when large species are present. Hence, pressure from larger species compresses the range of nest heights used by smaller species. Our data support Wilson's (1975) contention that larger species use a greater range of a resource than smaller species; we extend this idea to include nesting space as a resource.

ACKNOWLEDGMENTS

We are grateful to F. Buckley, M. Gochfeld, D. McCrimmon, D. Mock and J. Wiese for valuable discussions on heron nesting behavior. This research was supported by the Rutgers Research Council, a Biological Sciences Support Grant (The American Association of University Women), and the Penrose Fund of the American Philosophical Society.

LITERATURE CITED

BROOKS, J. L., AND S. I. DODSON. 1965. Predation, body size, and composition of plankton. Science 150:28–35.

BROWN, W. L., AND E. O. WILSON. 1956. Character displacement. Syst. Zool. 5:49–64.

BURGER, J. 1978. The pattern and mechanism of nesting in mixed-species heronries, p. 45–58. *In* A. Sprunt, J. C. Ogden, and S. Winckler [eds.], Wading birds. Res. Rep. #7, Natl. Audubon Soc., New York.

DRAPER, N. R., AND H. SMITH. 1966. Applied regression analysis. J. Wiley and Sons, New York.

GALBRAITH, M. G., JR. 1967. Size selective predation on daphnia by rainbow trout and yellow perch. Trans. Am. Fish. Soc. 96:1–10.

HUTCHINSON, G. E. 1959. Homage to Santa Rosalia, or why are there so many kinds of animals? Am. Nat. 93:145–159.

KALINOSKI, R. 1975. Intra- and interspecific aggression in House Finches and House Sparrows. Condor 77:375–384.

MORSE, D. H. 1974. Niche breadth as a function of social dominance. Am. Nat. 108:818–830.

ROBBINS, C. S., B. BRUUN AND H. S. ZIM. 1966. Birds of North America. Golden Press, New York.

SCHOENER, T. W. 1965. The evolution of bill size differences among sympatric species of birds. Evolution 19:189–213.

SCHOENER, T. W. 1974. Resource partitioning in ecological communities. Science 185:27–39.

VERNER, J. 1975. Interspecific aggression between Yellow-headed Blackbirds and Long-billed Marsh Wrens. Condor 77:328–330.

WILSON, D. S. 1975. The adequacy of body size as a niche difference. Am. Nat. 109:760–784.

Department of Biology, Livingston College, Rutgers University, New Brunswick, New Jersey 08903. Address of second author: Statistics Department, Rutgers University, and New Jersey Agricultural Experiment Station, New Brunswick, New Jersey 08903. Accepted for publication 24 September 1977.

Condor, 81:307–308
© The Cooper Ornithological Society 1979

GREAT HORNED OWL PREDATION ON A SHORT-EARED OWL

CYNTHIA K. BLUHM

AND

E. KEVIN WARD

The Great Horned Owl (*Bubo virginianus*) and the Short-eared Owl (*Asio flammeus*) coexist in many regions of North America, but direct observations of Great Horned Owl predation on Short-eared Owls are rare. Killpack (1951) and Wolhuter (1968) reported carcasses of Short-eared Owls in Great Horned Owl nests during the breeding seasons in Utah and Kansas, respectively. However, neither witnessed the act of predation, or related it to the ecology of the area involved.

At 23:04 on 14 July 1978, while driving along the north shore road of the Delta Marsh in Manitoba, Canada, we saw a Great Horned Owl perched on top of a freshly killed adult Short-eared Owl. Down feathers on the head and neck of the Great Horned Owl indicated that it was a juvenile. The Short-eared Owl was bleeding from deep talon cuts in the thoracic and lumbar regions and was still warm. The Short-eared Owl may have been hunting small mammals along the dirt road when it was attacked from the air by the Great Horned Owl. Earlier in the week, other students of the Delta Waterfowl Research Station had seen Short-eared Owls hunting along the road.

The road runs between the wooded southern shore of Lake Manitoba and the Delta Marsh. The woods, composed of several species of deciduous trees, provide suitable nesting habitat for the Great Horned Owls which are permanent residents. One pair of Great Horned Owls reared young in this area in April 1978 (Peter Ward, pers. comm.). On the other side of the road the marsh vegetation is suitable habitat for the Short-eared Owl, which often nests there (Clark 1975).

Short-eared Owls prefer to hunt in open plains and marshes where they feed chiefly on smaller mammals (primarily *Microtus* spp. and *Peromyscus* spp.) plus occasional small birds and insects (Errington 1937, Clark 1975). Great Horned Owls usually feed near wooded areas and prefer to feed on medium-size mammals (snowshoe hare, *Lepus americanus*; skunk, *Mephitis mephitis*) and birds (ducks, geese, pheasants, quail, and gulls; Bent 1938). However, Great Horned Owls are opportunistic and take their prey much in the order of the ease with which it may be secured (Errington et al. 1940). Hence, preferred feeding areas of the two owls probably overlap at the woodland-marsh interface and their potential prey size also overlaps. These factors would allow the two species to come in contact. Clark (1975) indicated that Short-eared Owls tend to be crepuscular; Smith and Smith (1972) observed newly-fledged Great Horned Owls hunting between 20:00 and 24:00 in July and August. Thus their hunting times may regularly coincide. A Short-eared Owl is well within the size range of food consumed by a Great Horned Owl.

When a large raptor kills and feeds upon smaller raptors of the same trophic level (Mikkola 1976, Levin et al. 1977) the larger animal not only procures food but also annihilates a potential competitor. Our data are, however, too circumstantial to allow evaluation of this side effect.

We thank Bruce Batt, Gary Duke, George Hochbaum, and Peter Ward for their helpful comments on the manuscript.

LITERATURE CITED

BENT, A. C. 1938. Life histories of North American birds of prey. Part 2. U.S. Natl. Mus. Bull. 170.

CLARK, R. J. 1975. A field study of the Short-eared Owl *Asio flammeus*, (Pontoppidan), in North America. Wildl. Monogr. 47.

ERRINGTON, P. L. 1937. Summer food habits of the Short-eared Owl in Northeastern Iowa. Wilson Bull. 48:121.

ERRINGTON, P. L., F. HAMERSTROM AND F. N. HAMERSTROM, JR. 1940. The Great Horned Owl. Iowa Agric. Exp. Stn. Res. Bull. 277.

KILLPACK, M. L. 1951. Short-eared Owl eaten by Horned Owl. Condor 53:262.

LEVIN, S. A., J. E. LEVIN, AND R. T. PAINE. 1977. Snowy Owl predation on Short-eared Owls. Condor 79:395.

MIKKOLA, H. 1976. Owls killing and killed by other owls and raptors in Europe. Br. Birds 69:144–154.

SMITH, D. G. AND B. A. SMITH. 1972. Hunting methods and success of newly-fledged Great Horned Owls. Bird-Banding 43:142.

WOLHUTER, B. R. 1968. Second report of Great Horned Owl preying on Short-eared Owl. Bird-Banding 39:319.

Department of Ecology and Behavioral Biology, University of Minnesota, Minneapolis, Minnesota 55455, and the Delta Waterfowl Research Station, RR1, Portage la Prairie, Manitoba, Canada R1N 3A1. Accepted for publication 3 November 1978.

Condor, 81:308–311
© The Cooper Ornithological Society 1979

NESTING OF THE WHITE-WHISKERED TREE SWIFT IN MALAYA

H. ELLIOTT McCLURE

Two of the four species of crested-swifts (Hemiprocnidae) are common in central Malaya: the Crested Tree Swift (Grey-rumped Tree Swift; *Hemiprocne longipennis*) and the White-whiskered Tree Swift (Lesser Tree Swift; *H. comata*). The Crested Tree Swift is the better known because it inhabits more urban places and open forests, while the White-whiskered Tree Swift prefers deep forest. The nesting of the former species has been described by Madoc (1947, 1956). The nest of the White-whiskered Tree Swift was mentioned by Sharpe (1879) and Baker (1927) and was described by Shelford (1916 *in* Chasen 1939) as "a tiny cup of feathers and down closely cemented together with mucin, and the single pure white egg—fits accurately into it. The nest itself is attached to some slender twig at the top of a lofty tree." Activities at the nest of this species do not appear to have been reported. Accordingly, I present here my observations, made from 1959 into 1963 in the Gombak watershed in the central cordillera east of Kuala Lumpur, Malaya.

White-whiskered Tree Swifts are 14–16 cm long with 13-cm long wings. They get their "whiskered" appearance from white superciliary and mustachial feathers which extend beyond the head. The sexes are distinguishable by the color of the ear coverts, bright chestnut in males, blue-black in females.

STUDY AREA AND METHODS

I worked in a small forested valley (about 3°N, 120°E) 40 km E of Kuala Lumpur. The valley and hills were covered with very dense lowland dipterocarp tropical rain forest. A primary forest only lightly thinned by lumbering, it contained up to a thousand species of trees per square kilometer and had a canopy nearly 60 m thick. The dominant genera of Dipterocarpaceae were *Anisoptera, Balanocarpus, Dipterocarpus, Shorea,* and *Hopea.*

During 1959 and 1960, I made weekly observations of the birds along a four-km forest trail at about 200 m altitude. In 1960, at about 600 m altitude, I attached a ladder to a large tree, *Anisoptera laevis,* on the hillside and built a platform 45 m above the forest floor, from which I could look out over the valley. There were 65 species of trees in the immediate vicinity, all of which reached or rose above the forest canopy. The platform and its surroundings have been described by McClure (1964, 1966, 1977) and Medway (1972).

After I built the platform I made weekly studies from it until June 1963 and discontinued those along the trail. I usually climbed into the tree at dawn, 06:00, and remained until nearly noon. Both 7× binoculars and a 40× telescope were used in watching the animals.

GENERAL OBSERVATIONS

The Crested Tree Swift was more abundant than the White-whiskered Tree Swift at the 600-m level; in 123 observations, the former was present 92% of the time (average of four individuals per observation) while the latter was present 59% of the time ($\bar{x} = 2$). In 90 ob-