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NESTING ECOLOGY OF THICK-BILLED PARROTS

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ABSTRACT.—During a four-month search for nesting Thick-billed Parrots (*Rhynchopsitta pachyrhyncha*) in 1979, we found 55 active nests at elevations of 2,300 to 3,070 m in northwestern Mexico's Sierra Madre Occidental. All nests were in cavities of live trees or standing dead trees (snags). Pine (*Pinus* spp.) snags contained over one-half (58%) of these nests. These parrots laid two to four eggs ($\bar{x}$ = 2.9; SD = 0.65) between mid-June and late July and young flew from their nests between early September and late October. Nesting density was apparently related to availability of suitable cavities and was variable, with some nests as close as 2 m apart in the same tree. The nesting season corresponded with the maturing of pine seeds, the parrots' principal food. Commercial logging of live pines for lumber, and of pine snags for pulpwood, is eliminating large numbers of proven and potential nest sites. Forest management practices should be modified to leave some suitable trees throughout the forest as potential nest sites for Thick-billed Parrots.

Thick-billed Parrots (*Rhynchopsitta pachyrhyncha*), known locally as "guacas" or "guacamayas," inhabit the highland pine forests of the Sierra Madre Occidental in northwestern Mexico from the states of Sonora and Chihuahua south to Jalisco and Michoacan (Blake and Hansen 1942, Marshall 1957, Schnell et al. 1974). Formerly they ranged north into the forested mountain islands of southeastern Arizona and southeast to the Mexican state of Veracruz (Ridgway 1916, Wetmore 1935). These parrots breed in the northern part of their range and winter mostly on the high volcanoes in the southern part of their range (Thayer 1906, Schnell et al. 1974). They nest in tree cavities and feed primarily on pine seeds (Forshaw 1978).

The U.S. Fish and Wildlife Service (1980) listed the Thick-billed Parrot as "endangered," and the International Union for Conservation of Nature and Natural Resources considered it "vulnerable" (King 1977). The parrot was included in Appendix I of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (U.S.F.W.S. 1977), which implemented strict international trade restrictions for the species. Concern for the species has arisen owing to its near total absence from the United States since 1935 (Phillips et al. 1964), an apparent decrease of reports of it from Mexico, and increased logging and human population in the parrots' range (Monson 1965).

The nesting ecology of these birds has never been studied in detail, despite their relatively wide distribution in Mexico, their proximity to the United States, and international concern for their welfare. Thayer (1906) and Bergtold (1906) published descriptions of 10 nests and their contents found in northwestern and central-western Chihuahua. Friedmann et al. (1950) reported nesting in southwestern Chihuahua, but gave no details. Bailey and Conover (1935) reported that Brock "had taken young from cavities in trees" in the state of Durango. Our goal was to gather information on the status of breeding Thick-billed Parrots and their habitat.

STUDY AREA AND METHODS

For 92 days between mid-April and early October 1979, and for the first week of September 1980, we searched for nesting Thick-billed Parrots. Our study area was the conifer forests of the Sierra Madre Occidental in northwestern Mexico from northwestern Chihuahua (108°30′W, 30°20′N) south to central-western Durango (105°30′W, 20°0′N; Fig. 1). The Sierra Madre Occidental is a range of rugged mountains extending from northwest to southeast. It is 100 to 200 km wide and 1,200 km long with many ridges above 3,000 m (elevation above sea level) and a few peaks rising above 3,300 m. Large rivers drain to the west, dissecting the range with valleys and canyons often 1,000 to 2,000 m deep.

The conifer forests were mostly above 2,000 m elevation and consisted primarily of Arizona pine (*Pinus arizonica*), Mexican white pine (*P. ayacahuite*), and several species of oaks (*Quercus* spp.). Northern exposures of the higher ridges also had Douglas fir (*Pseudotsuga menziesii*), quaking aspen (*Populus tremuloides*), and fir (*Abies* spp.). Chihuahua pine

(*Pinus leiophylla*), Lumholtz pine (*P. lumholtzii*), Aztec pine (*P. teocote*), and Durango pine (*P. durangensis*) were also present in some areas. Identification of the pines follows Little (1962).

Temperatures in parrot nesting areas generally ranged from 10° to 25°C during the survey, with extremes of 5°C and 30°C. It rained almost daily during the summer, usually in the form of afternoon thunderstorms. The Instituto de Geografía, Universidad Nacional Autónoma de México (1977a, b) calculated that the annual average precipitation ranged from 400 to 1,100 mm for the different parts of our study area, with 56 to 70% falling during July, August, and September.

We surveyed forest habitat from an airplane for 16 h from 30 May to 2 June. We used a four-wheel drive truck to gain access to promising areas, but searched primarily on foot for the parrots and their nests. We found nests by following parrots, locating calling parrots, and knocking on the bases of prospective nest trees to raise possible occupants to the nest entrance. Using climbing spurs and belt, or technical climbing gear and a rope thrown over a limb, we climbed to and inspected nests found in sturdy trees.

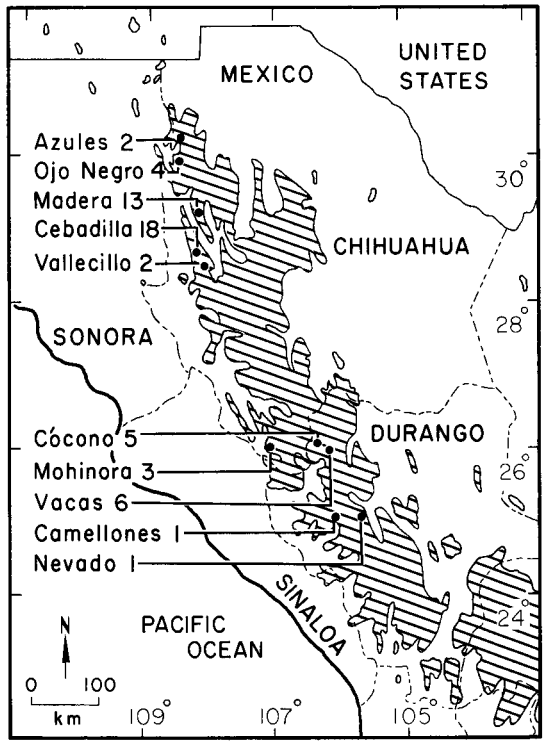

FIGURE 1. Locations and numbers of Thick-billed Parrot nests found in 1979. Location names correspond to names of nearby mountains, towns, or ranches. Heavy shading indicates areas above 2,000 m in elevation.

RESULTS AND DISCUSSION

NESTS

We found 55 Thick-billed Parrot nests in cavities in Arizona pine, Mexican white pine, quaking aspen, and Douglas fir, at elevations from 2,300 to 3,070 m. The floors of the nest cavities were covered with wood chips and, usually, parrot feathers. Table 1 summarizes measurements of nest cavities and trees. Snags (standing dead trees) contained 35 nest cavities (64%), with 32 in pines (Figs. 2, 3), two in Douglas firs, and one in an aspen. The 10 nest cavities in live pines and the two in live Douglas firs were in dead tops or in areas of dead wood, resulting probably from lightning strikes or disease. The eight nest cavities in live aspens were in areas of wood infected with *Fomes igniarius*, a perennial conk fungus that decomposes the heartwood and leaves the sapwood firm.

Parrots evidently enlarged many cavities and entrances that had been formed by natural decomposition, woodpecker foraging and nesting activity, or a combination of these processes. We found signs of gnawing at the irregular entrances and the inside walls of nest cavities. We heard an adult parrot scraping on the inside of an active nest cavity for 7 min on 18 July, and later in our study we heard gnawing at other cavities being investigated by parrots. Chewing on the interiors of nest boxes is common by captive Thick-billed Parrots as their nesting season commences (Mallet 1970, Witt 1978).

Some cavities required no modification by parrots. These were large natural cavities exposed when a tree top or large branch fell off, creating an entrance to the hollow tree. The Imperial Woodpecker (*Campephilus imperialis*) was known to make cavities large enough for a parrot nest (Thayer 1906), but this woodpecker is now extremely rare or possibly extinct (Tanner 1964).

Forty-two nest cavities (76%) were completely enclosed except for the entrance and were well protected from the rain and wind. Ten (18%) had large entrances or cracks in the cavity wall where rain could enter. Three (5%) were directly exposed to the rain because of holes in the top or no top at all. The increased exposure may reduce nesting success.

Trees on the upper halves of slopes and on ridge tops held 36 (65%) of the nests. Twenty eight nests (51%) were on slopes facing north or northeast, where the largest trees grow. Slope directions at nest sites differed significantly from random direction, using eight compass points ($P < 0.005$, chi-square).

Nesting density was variable, and apparently subject to availability of suitable sites. A

FIGURE 2. Typical Thick-billed Parrot nest site in a large pine snag in the state of Durango, Mexico. Arrow points to nest cavity entrance.

FIGURE 3. Adult Thick-billed Parrot at nest cavity entrance in fire-scarred pine snag in the state of Chihuahua, Mexico.

pine snag at Ojo Negro contained two active nests only 2 m apart, as did a live aspen at Madera. These two Madera nests were within 215 m of three other nests and within 1 km of six more. In contrast, we could find no nests within 1 km of 14 other nests in different areas.

Over the span of a year, nest cavities may deteriorate naturally or due to human activities. In September 1980, 12 nest cavities active in 1979 in northwestern Chihuahua were re-examined. Eight cavities remained in good condition, although five of these contained matted beds of grass, lichen, aspen bark, pine needles, and Abert's squirrel (*Sciurus aberti*) hairs. Holes allowing water to enter had appeared above two nest cavities in pines. A pine snag containing a nest cavity had been removed, probably for paper pulp, and an aspen site had been knocked over, probably during a logging operation. Two nestling parrots were found dead in an aspen cavity that remained in good condition, but had been disturbed by recent logging of surrounding trees. This nest represents the only confirmed re-use of a nest cavity in a subsequent year. Parrots had apparently nested only sparsely in these areas during 1980, so we can draw no conclusions as to why so many proven nest cavities had not been re-used.

CAVITY INVESTIGATION AND COURTSHIP

We watched Thick-billed Parrots investigating cavities before nesting had begun and on several occasions throughout the breeding period. On 30 April three parrots inspected a cavity in the dead top of a live pine, before any nests were known to be active. While one parrot perched near the cavity entrance and another perched higher in the tree, the third climbed up and down along the entrance crack and peered into the cavity for about 10 min. All three then flew away together. Upon our return in September we found that the tree had been felled for lumber; the dead portion containing the cavity was left on the ground. There was no evidence of recent nesting, but two scraped-out areas in the cavity suggested possible nesting in the past.

We observed courtship behavior and copulation by parrots on 23 July at Madera. While perched in a large Douglas fir snag, the pair preened each other's heads, upper bodies, and

cloacal regions for about 10 min. The female (sex later determined by role during copulation) then moved to the end of the limb, followed by the male. Four times they imitated behavior involved in transferring food from male to female, moving their heads up and down and touching beaks. They then copulated for about 90 s, the male with one foot on the female's back, barely visible under her wing, while his other foot remained on the perch. This behavior was similar to that described by Jeggo (1974) for captive Thick-billed Parrots. The female then investigated cavities in the snag for 5 min. Entering one hole and emerging from another, she moved through the maze in the decaying tree. We did not find parrots at this snag again, either during the following three days of our stay or during a subsequent visit in mid-September. On 14 July at Azules, we observed similar copulation by another pair near their nest that already contained two eggs.

Cavity investigation apparently serves functions other than fulfilling the immediate need for a nest site. We found pairs of parrots investigating seven other trees with cavities between July and September 1979, and another cavity in September 1980. None of these cavities contained an active nest, to our knowledge, during the year of observation. Some cavities were very small or in poor condition, while others were seemingly perfect, compared to active nests we had seen. When examining one cavity on 23 July that two parrots had investigated the day before, we found an apparently ideal nest, but no eggs. Two parrots were seen at the cavity again in mid-September, two days after a Northern Flicker (*Colaptes auratus*) had roosted inside. On 6 September 1980 a pair was at a shallow cavity in a pine snag at Cebadilla. One gnawed on the inside walls for 5 min, scratched and sat on the wood-chip floor for 3 min, and perched in the entrance for 45 min, while the other perched in a nearby snag. The two then traded places and the second bird inspected the cavity and sat in the entrance for 15 min before both flew away. We do not know the ages or breeding status of these parrots.

EGGS AND INCUBATION

Eggs were laid from mid-June to late July during our study. Smith (1907) and Wetmore (1935) reported Thick-billed Parrots in juvenile plumage in southeastern Arizona during late August, which suggests a late-May egg date based on length of nesting period reported in this paper. Bent (1940) mentioned a 10 May egg date, but gave no location or other details.

In captivity, Thick-billed Parrots lay one, two, or three eggs at intervals of two or three

TABLE 1. Measurements of Thick-billed Parrot nests and nest trees.

Characteristic	Nests[a] in *Pinus* No.	*Pinus* Range	*Pinus* Mean ± SD	*Populus* No.	*Populus* Range	*Populus* Mean ± SD	*Pseudotsuga* No.	*Pseudotsuga* Range	*Pseudotsuga* Mean ± SD	Total No.	Total Range	Total Mean ± SD
Height of tree (m)	42	12–35	21.1 ± 5.2	9	23–34	27.1 ± 4.4	4	17–24	22.0 ± 3.4	55	12–35	22.1 ± 5.4
Diameter of tree at 1.4 m height (cm)	42	48–107	69.3 ± 13.6	9	43–66	55.8 ± 7.7	4	91–115	101.8 ± 11.2	55	43–115	69.5 ± 16.2
Height of nest entrance above ground (m)	42	9–28	16.7 ± 4.8	9	8–20	15.9 ± 3.6	4	16–23	18.9 ± 3.0	55	8–28	17.1 ± 4.0
Width of nest entrance (cm)	12	8–25	11.4 ± 4.8	8	8–15	10.1 ± 2.2	3	8–13	10.0 ± 2.6	23	8–25	10.8 ± 3.8
Height of nest entrance (cm)	12	8–36	16.0 ± 7.8	8	8–13	9.4 ± 1.6	3	10–25	15.0 ± 8.7	23	8–36	13.6 ± 6.9
Depth of nest cavity below entrance (cm)	12	8–150	50.6 ± 35.6	8	23–68	39.6 ± 13.1	3	28–68	49.7 ± 20.2	23	8–150	46.7 ± 27.4
Average inside diameter of nest cavity near floor (cm)	12	23–33	26.3 ± 3.4	8	23–40	26.5 ± 6.0	3	23–43	34.7 ± 10.4	23	23–43	27.4 ± 5.9
Diameter of tree at nest (cm)	11	30–51	41.0 ± 7.3	8	33–53	43.4 ± 6.9	3	41–56	50.0 ± 7.9	22	30–56	43.1 ± 7.5

[a] Nests were measured in both live and dead trees as follows: *Pinus*, 10 live, 32 dead; *Populus*, 8 live, 1 dead; *Pseudotsuga*, 2 live, 2 dead; total, 20 live, 35 dead.

days. Incubation, done entirely by the female, begins with the laying of the first egg and lasts 25 to 28 days for each egg ($\bar{x}$ = 26 days for 13 eggs; Lint 1966, Dyson 1969, Jeggo 1974, Witt 1978).

The mean clutch size was 2.9 (SD = 0.65) for the 21 nests with eggs or newly-hatched young estimated to be less than 10 days old. This mean may be low, as we did not recheck 4 of the 6 two-egg nests and 2 of the 12 three-egg nests and cannot be sure if these clutches were complete. The only three nests that contained clutches of four eggs were among the eight nests in live aspens at Madera, which averaged higher clutches overall ($\bar{x}$ = 3.3, SD = 0.71, not statistically different; Mann-Whitney *U*-test).

Differences in the development of sibling, wild Thick-billed Parrots indicate that incubation began before clutches were complete. We did not determine the length of incubation in the wild. We assume that the female alone incubated the eggs, based on observations of captive parrots reported above, and on one observation we made of an incubating parrot that left the nest and assumed the female's role during copulation with her mate.

During seven observations at six nests the females spent between 3 and 4 h on their eggs before leaving to take food from their mates, when they were off their eggs from 4 to 9 min at a time. The adults usually perched within sight of the nest tree while transferring food. They were not secretive near the nest, often calling from the nest entrance and while en route. Both adults spent the night in the nest.

NESTLING PERIOD

Eggs hatched between mid-July and late August in the 17 nests we checked, and young parrots took their first flights between early September and late October. Based on observations of four nests that had newly-hatched young in late July and early August, we assume that young stay in the nest at least seven weeks, as the nests were still occupied in mid-September. The young apparently remain no longer than 10 weeks, as two of the nests were empty when we rechecked them in early October.

Newly hatched chicks were blind and nearly naked, having only a sparse covering of white down. Records of captive Thick-billed Parrots show that the eyes begin to open at 6 days and are fully open at 16 days, when some pin feathers are beginning to erupt (Jeggo 1974). The young are well feathered at 36 days and gain complete juvenile plumage by 56 days.

The female remained with the newly-hatched chicks while the male continued to bring her food every 2 to 6 h. At times she left her young for rarely over 10 min to take food from her mate perched nearby; he sometimes followed her into the nest after the food transfer. Otherwise the male entered the nest while the female remained with her young, staying for about 10 min, though sometimes for 30 min or more, feeding the female and possibly the young as well.

As the young grew, the female spent progressively less time at the nest, leaving and arriving with her mate. After the young were about 20 days old both adults would leave the nest early in the morning, returning at usually 2 to 5 h intervals and remaining for 10 to 60 min. Longer absences of 6.2 to 7.2 h were recorded once for adults from three nests with young estimated to be 32 to 47 days old. Upon their return one adult would enter the nest to feed the young, whose "enh-enh-enh" feeding calls became more easily heard with age. The other adult often waited a few minutes, then followed its mate into the nest, but we do not know if both adults were involved in feeding the young. Once, both adults spent separate consecutive four-minute periods in the nest and feeding calls were heard each time, indicating that both adults probably fed the young in this instance.

When the young were nearly ready to fly, the adults spent longer periods near the nest, perching in nearby trees, and calling to the young, who called while sitting in the nest entrance. The young were completely feathered, distinguishable from the adults by a pale bill, a gray featherless ring around the eye, and no red feathers behind the eye. We watched two of three young in a nest at Madera make their first flights three hours apart on 3 October. Each young flew capably as it left the nest, although one made a 30-s stop on the ground nearby before heading out over the valley. Both adults, exchanging calls with the young, joined them and escorted them out of our sight and hearing. We do not know where these young spent the night, but both adults returned to spend the night with the one remaining young. On 4 October a young parrot left another nest at Madera during much excited calling with its parents. The adults escorted it out of the area and did not return to spend the night in the nest with the one remaining young. These adults had spent the previous two nights away from their nest and it is possible that they stayed with one or more other young who had already left the nest.

NESTING SUCCESS

We investigated seven nests at Madera and Cebadilla twice, once during the incubation or hatching period and again when there were

older young (estimated to be 25–45 days old). Three of these nests showed no loss, two lost one individual each, and two were short two individuals. The average number of eggs or young per nest decreased from 3.1 to 2.3.

We found most of the feathers and one foot of a young parrot, whose flight feathers were almost completely out of their sheaths, on the ground below a nest that still contained young. The feathers were spread over an area about twice the size of the bird and had been plucked without any visible tooth-marks, suggesting that it had been eaten by a raptor.

In one nest at Cebadilla we suspected total failure. Forty-eight days after we had found three eggs in the nest we observed an Abert's squirrel peering from the nest entrance, and no parrot activity. It is unlikely that young could have flown before seven weeks of age. We did not climb to this nest again because of danger encountered on the first climb.

In early September 1980, we found two dead parrots (approximately 20–30 days old) in the cavity of a live aspen which had also been used for nesting in 1979. Logging had recently taken place around the nest tree.

POST-NESTING FAMILY GROUPS

Family groups were seen after the young had left the nest. On 24 September at Nevado we watched a flock of 12 parrots fly over a ridge. Four split off from this group and flew just out of sight. We climbed to the area where they had gone and found two adults feeding on the cones of Mexican white pine. After 30 min they flew to a nearby tree and fed two pale-billed juveniles. One young bit at an old attached cone. Later, an adult broke off a green cone and carried it to just in front of one of the young birds. The adult held the cone with one foot, nibbled at it a couple of times, then dropped it.

On 5 October at Madera, two adults with two juveniles flew to a nest tree that had contained three large nestlings three weeks before. One adult entered the nest hole four times while the other stayed on a nearby limb with the young, feeding one and then preening the other. The adult in the nest entrance flew to the limb, landing about 1 m away from the young, and its mate joined it. They remained there until after we left, 20 min later. We do not know if this was the pair that had nested there.

FOODS AND FEEDING

Pine seeds are the parrots' principal food throughout the year (Wetmore 1935, Marshall 1957, Schnell et al. 1974). The pine seeds' period of peak abundance corresponded with the parrots' breeding season. Arizona pine and Mexican white pine were the common species in the nesting areas and the usual food sources. In July, adult parrots ate the small soft seeds from the immature cones, but by September when young parrots began leaving their nests, the seeds were fully developed yet still in closed cones. These mature Arizona pine seeds were 6 to 7 mm long in cones 5 to 10 cm in length, and the Mexican white pine seeds were 9 to 12 mm long in 20 to 40 cm long cones.

When eating seeds of smaller cones, such as those from Arizona pines, a parrot would first cut the cone from a branch with its beak and then climb or fly to a more stable perch, carrying the cone in its bill. It held the cone with one foot, shredded the scales with its beak, extracted and cracked the seeds, and then ate the embryos, dropping the shredded cones with their scales still attached. The Mexican white pine cones were usually too large to hold and manipulate, so the parrots left them attached, and extracted and cracked all the seeds they could reach, often while hanging upside down from the limb or base of the cone. One parrot might feed alone, but more often parrots fed together in groups of up to 40 ($\bar{x} = 8$, SD = 10, $n = 17$), and the number would fluctuate as some parrots left and others joined the flock.

The parrots accumulated pine resin on their beaks and feet as they ate. Their breast feathers and feathers near their beaks became stained brown from the resin, but feathers did not appear to become seriously matted. The parrots removed much of the resin by preening, stropping their beaks on branches, nibbling at their toes, and chewing on twigs.

Although the parrots concentrated mostly on the two common pines during our observations, they occasionally ate the small Aztec pine seeds (4 mm long) found at Nevado and Camellones. They are also known to eat seeds from Chihuahua pine, Ponderosa pine (*P. ponderosa*), Pinyon (*P. edulis*), and Mexican pinyon (*P. cembroides*; Smith 1907, Wetmore 1935), and have been recorded eating acorns (*Quercus* spp.), terminal buds of Chihuahua pine and Lumholtz pine, cherry seeds (*Prunus capuli*), and a leguminous plant (Wetmore 1935, Blake and Hansen 1942, Stager 1954).

The pine-cone crop varied from year to year, and this may affect how the parrots use an area. We found fewer parrots in early September 1980 than we found in the same areas in 1979, but mature Arizona pine cones were smaller and less numerous, and we found no mature Mexican white pine cones. Marshall (1957) found that populations of Thick-billed Parrots shift from year to year in different ranges in the northern Sierra Madre Occidental and he related the shift to the crop of pine cones.

HABITAT CHANGE AND CONSERVATION

Commercial logging of live pines for lumber and pine snags for pulp wood has changed much of the forest and eliminated many nest sites suitable for Thick-billed Parrots. Commercial logging began in the early 1900's and the industry has steadily grown ever since (Loock 1950). Under government regulation, pines are selectively cut, usually when their diameters exceed 40 to 50 cm at breast height (1.4 m). Only one of the 42 nests in pines was in a tree smaller than 50 cm in diameter at breast height. Snag cutting is not regulated by the government, and pine snags are being completely removed from accessible areas throughout Chihuahua and northern Durango to provide raw materials for a pulp mill in Chihuahua. This mill has been in operation for 15 years and consumes 1,800 metric tons of wood per day (Secretaría de Agricultura y Recursos Hidráulicos 1979).

Thick-billed Parrots are currently not critically endangered, but they are vulnerable and increasingly threatened throughout their breeding range by loss of nesting habitat. The decreasing population of these parrots is apparent to long-term residents of logged areas (Lanning and Shiflett 1981). Breeding parrots of this species are now found only in undisturbed remote areas, in disturbed areas with a few remaining suitable nest sites, and in islands of forest on steep slopes and ridges that are not accessible or currently economical to log.

The parrots suffer little direct persecution. They are rarely kept as pets because they do not "talk." They neither raid agricultural crops nor appear to be a food for humans.

Forest management practices need to be modified to conserve Thick-billed Parrot nesting habitat. Properly located and managed reserves could protect several prime nesting areas, but no such reserves currently exist, and their creation seems remote considering the present economic pressures in the region. A more feasible approach may be to reform forestry practices to allow some large pine snags and some large live pines of low commercial value to remain throughout the forest to provide potential nest sites for Thick-billed Parrots.

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Condor 85:73

RECENT PUBLICATIONS

Avian Use of Sheyenne Lake and Associated Habitat in Central North Dakota.—Craig A. Faanes. 1982. U.S. Fish and Wildlife Service, Resource Publication No. 144. 24 p. Paper cover. No price given. This modest little document is important far beyond its title or size, owing to the imminent destruction of the location under study. The study area is the planned site of the Lonetree Reservoir, the principal water-regulation reservoir for the Garrison Diversion Unit of the U.S. Bureau of Reclamation. The methods of study are thorough (census plots stratified by habitat within randomly selected 16.2-ha tracts), the data analysis is statistical, and the descriptive material is convincing. Both the high populations and diversity of birdlife are unusual. Faanes attributes this to the "close interspersion of many native habitats, several of which are unique in North Dakota." The information in this report is important for resource-management decisions, since at full capacity, the reservoir will occupy 8,128 ha that are now wetlands, upland native prairie, woodlands and cropland. The author clearly shows that the area is biologically rich, and in many ways unique. His study raises the crucial question as to whether the flooding of these habitats represents the best biological and sociological decision. Annotated species list, appendix of common and scientific names of plants mentioned, maps.—J. Tate.

Birds of New Caledonia and the Loyalty Islands. Volume 1.—F. Hannecart and Y. Letocart. 1980. Les Editions Cardinalis. 150 p. No price given. Source: 67 Route de Ouemo, P.O. Box 229, Noumea, New Caledonia. This volume deals with the more common birds of the island of New Caledonia (approximately 1,770 km E of Australia) and its offshore islands (Loyalty Islands and the Isle of Pines). A planned second volume will deal specifically with the Loyalty Islands (Ouvea, Lifou, Mare), and with hard-to-find species. Just under 70 species are illustrated, with excellent photographs by the authors. Each species occupies facing pages, with a full-page photograph opposite one to three smaller photographs and both French and English descriptions. The accounts lack meaningful information and the English versions further suffer in translation. Some of the full-page photographs have been turned 90° from their captions, giving the disconcerting impression that some baby birds are about to fall from the nest, and that some adults are perched on their heads. References are sparse and incomplete. Indexes of photographs and scientific names, color map.—J. Tate.

Proceedings of the Northeastern Breeding Bird Atlas Conference.—Edited by Sarah B. Laughlin. 1982. Vermont Institute of Natural Science, Woodstock, VT. 122 p. Paper cover. $12.00 postpaid. Source: V.I.N.S., Woodstock, VT 05091. Over the past decade, many counties, states, and provinces in the U.S. and Canada have followed European examples in undertaking grid-based atlases of their breeding birds. In order to share information and attack common problems, a conference of representatives of surveys in the northeast (where most of the effort has been thus far) was held in November 1981, hosted by the Vermont Institute of Natural Science. Its proceedings included summaries of 12 state and provincial projects, but were chiefly practical reports on all aspects of organizing and carrying out a breeding bird atlas. Particular attention was given to formulating recommendations for standardized codes of breeding criteria and for choosing an atlas grid. While the conference was immediately beneficial to the atlases represented, its deliberations will be invaluable to future sponsors of such projects.

Steps Toward Better Scientific Illustrations.—Arly Allen. 1982. Allen Press, Lawrence, Kansas. 36 p. Paper cover. $3.00 ($2.00 apiece when five or more copies are ordered together). Source: Allen Press, Inc., P.O. Box 368, Lawrence, KS 66044. "The preparation of illustrations for scientific articles demands the same professional attention required in the preparation of the text. This booklet deals with some of the problems of preparing photographs and artwork to achieve the best printed results at the least cost [and with the least delay]." It is not a complete manual but a brief and practical guide to designing scientific illustrations in consideration of modern engraving and printing processes. The revised edition has been reprinted after several years when it was unavailable. If you intend to submit an illustrated manuscript to a journal, instruct yourself with this booklet, along with the books by Day and MacGregor (noticed in Condor 82:75, 258).