Observations on Nesting of the American Bittern in Northwest Minnesota

W. DANIEL SVEDARSKY

Northwest Experiment Station, University of Minnesota, Crookston, MN 56716

ABSTRACT — Nine upland nests of the American bittern (Botaurus lentiginosus) were found from 1990 to 1992 in a northwest Minnesota study area. Principal habitats included a restored bulrush marsh, a floodwater storage pool, and various kinds of upland vegetation. Egg-laying was initiated as early as 15 May in 1992, with an average clutch size of 4.4, somewhat larger than most reports. Two clutches contained six eggs. Nests were located in tall (> 0.6 m) and dense (V.O.R.=4.4 dm) cover, with five of the nine in a 1-ha portion of the study area. An incubation period of 22-23 days was observed and six of nine (66.6%) nests were successful. We estimated that 21 young fledged from five nests. Prey, particularly leopard frogs (Rana pipiens), were abundant and believed to be a favored food of nesting American bitterns. A bittern pair density of about one pair per 17 ha was observed in this study.

Key words: *Botaurus lentiginosus*, American bittern, restored wetland, flood control project, Minnesota

The American bittern (*Botaurus lentiginosus*) has a wide breeding distribution which includes the southern half of Canada and most of the U.S. except the extreme southern third (Hands et al. 1989). However, Hands et al. report that Breeding Bird Survey data of the U.S. Fish and Wildlife Service collected since 1966 indicate that the species has declined about 4% per year in Minnesota, Wisconsin, and Michigan and probably other north central states as well. The species is considered endangered in Illinois, Indiana, and Ohio. Coffin and Pfannmuller (1988) note that the species is of "Special Concern" status in Minnesota and that apparently suitable habitat is unoccupied, particularly in the southern part of the state. This paper reports on observations of American bittern nesting made from 1990 to 1992 during a biological inventory of a multi-purpose flood control project in northwest Minnesota and includes one nest found 0.8 km from the study area on an adjacent prairie.

STUDY AREA

The study was conducted at the 176 ha Burnham Creek Wildlife Management Area, a flood-control and wetland-restoration project completed in 1989 and located 25 km southeast of Crookston, MN. The area contained a 30-ha flood pool (Fig. 1) generally less than 2 m deep but with 3-5-m deep portions where borrow material was obtained for dike construction. Submergent vegetation, mainly *Potamogeton* spp., occurred in about half of the pool, and minnows were present.

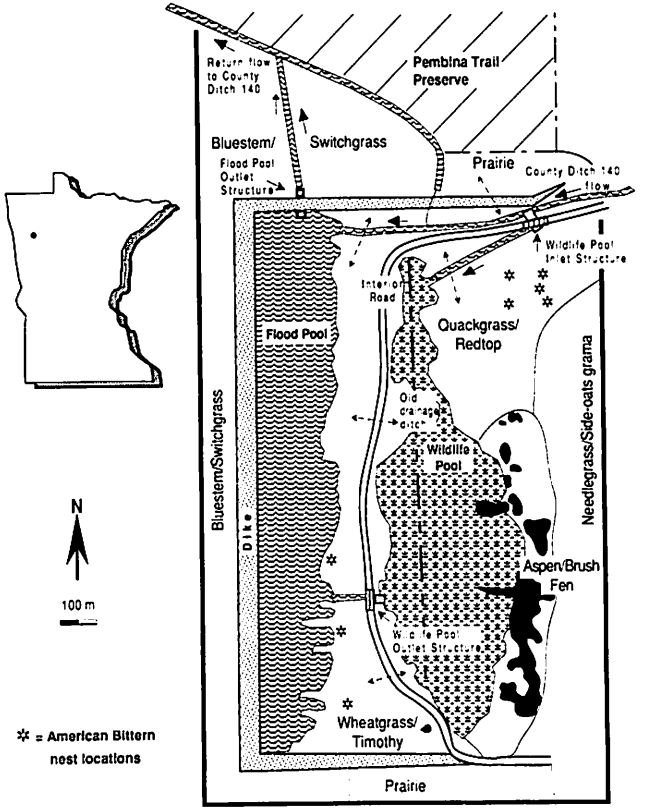

Figure 1. Burnham Creek Wildlife Management Area and American bittern nest locations, Polk County, Minnesota, 1990-1992.

The 30-ha wildlife pool contains a restored marsh, a 4-m wide plugged drainage ditch, a shallow wetland at the north end with developing emergent vegetation, and a 12-m-wide inlet channel. The restored marsh is dominated by hardstem bulrush (*Scripus acutus*) in deeper areas and cattail (*Typha* spp.), softstem bulrush (*S. validus*), reed (*Phragmites communis*), whitetop (*Scolochloa* festucacea), and sedges (*Carex* spp.) in shallower areas. The area surrounding the wildlife pool contained native and tame grasses and forbs and was periodically flooded with up to 8 cm of water when wildlife pool levels were high after heavy runoff. Upland habitats were as follows:

Prairie - Dominated by big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), and other native species.

Aspen/Brush Fen - A hummocky seep area dominated by sedges, reedgrass (*Calamagrostis* spp.), willows (*Salix* spp.), trembling aspen (*Populus tremuloides*), and other forbs and grasses.

Wheatgrass/Timothy - Planted in 1988, dominated by wheatgrasses (*Agropyron intermedium, A. smithii*), quackgrass, (*Agropyron repens*), timothy (*Phleum pratense*), bluegrass (Poa spp.), sweet clover (*Melilotus* spp.), with seep areas dominated by reed canary grass (*Phalaris arundinacea*), bulrush, and sedges.

Bluestem/Switchgrass - A moist site planted with native species in 1988, dominated by big bluestem, switchgrass, Indian grass, and redtop (*Agrostis stolonifera*), with intermixed weedy forbs.

Quackgrass/Redtop - A moist site planted with native grass species in 1988 but mostly dominated by quackgrass, redtop, Canada thistle (*Cirsium arvense*), sowthistle (*Sonchus uliginosus*), and sweet clover.

Needlegrass/Side-oats grama - A dry site planted in 1988, dominated by green needlegrass (*Stipa viridula*), side-oats grama (*Bouteloua curtipendula*), hoary alyssum (*Berteroa incana*), and sage (*Artemesia* spp.).

Dike - A rather steep, sloping site planted in 1988, dominated by wheatgrasses, switchgrass, and side-oats grama.

METHODS

American bittern sightings were recorded in a general wetland bird survey conducted twice weekly by observing from a vehicle on the interior and dike roads (Fig. 1) from mid-March until freeze-up. Bittern observations were also recorded when conducting other field work in the study area. About four visits per week were made to the study area during the intensive study period (1990 and 1991) and about one per week during 1992.

Two methods were used for nest searching. Upland habitats were searched by using a cable-chain drag (Higgins et al. 1969) pulled by two all-terrain vehicles. Upland habitats were searched three times in 1990 (22, 23 May; 14, 15 June; and 10, 11 July), twice in 1991 (29, 30 May and 25, 26 June), and once in 1992 (3 June). Wetland habitats were searched three times in 1990 and 1991 by 2-5 personnel wading abreast (4, 7, 10 June; 22, 26, 28 June; and 9, 12 July in 1990, and 31 May, 2, 3 June; 27 June; and 9, 12 July in 1991). After laying or incubating adults were flushed, flags were placed 10 m from nests and locations were plotted on a field map. Structural characteristics of nest sites were measured at the time of discovery by placing a Robel pole (Robel et al. 1970) in the nest and averaging 100% visual obstruction readings (V.O.R.) taken from four directions. The dominant vegetation at nest sites was qualitatively determined. Nests were checked weekly to determine hatching success and/or to monitor fledging development.

RESULTS AND DISCUSSION

American bitterns were first observed on the study area on 30 April in 1990 and 16 May in 1991. However, earlier arrivals may have been undetected due to their inconspicuousness except when flying or vocalizing. Adults were mostly observed along wetland edges, but in summer were also found in upland grassland sites.

Nine nests were found in upland sites by using the cable-chain (Table 1). Nests were in cover that was taller (mostly >0.6 m) and denser (V.O.R. of 4.4 dm) than other upland habitats searched on the study area (about 0.5 m high and V.O.R. of 3.3 dm). From observations in South and North Dakota, Duebbert and Lokemoen (1977) also reported a preference for tall, dense cover by upland nesting American bitterns and found 61 of 72 nests in vegetation more than 0.6 m high. Five of the nine nests in this study were found in a 1-ha portion of the study area (Fig. 1) with nest numbers 28-90 and 29-90 located 79 m apart and nests 56-91 and 58-91, 42 m apart. These pairs of nests were active concurrently. Nest 64-91 was located 85 m from both nest 58-91 and nest 56-91, but it was initiated later and could have been a renesting effort by the female of nest 58-91, whose nest had been destroyed by 6 June 1991 (Table 1). This close spacing of nests is commonly reported in the literature (Forbush 1925, Vesall 1940, Middleton 1949, Duebbert and Lokemoen 1977). Forbush (cited in Vesall 1940) suggested that this could reflect the gregarious nesting tendencies of herons. No nests of American bitterns were found in the 30-ha Wildlife Pool although one least bittern (*Ixobrychus exilis*) nest was found in dense bulrush, situated 20 cm above water that was 0.6 m deep. Much of this wetland contained water in excess of the 20-46 cm depth preferred by American bitterns (Hands et al. 1989). One nest (48-91) was located in a seep area containing 5 cm of standing water when discovered on 30 May 1991.

Egg laying was initiated in four nests during late May and June, which is similar to the pattern reported by Duebbert and Lokemoen (1977) for 19 of 38 clutches in central North Dakota and north central South Dakota. The earliest egg date in this study was 15 May 1992, but Vesall (1940) found two American bittern nests near St. Paul, MN, in which the first egg had been laid by 1 May. Vesall's observations were made about 300 km south of this study area and may reflect phenology differences between the two sites.

Although the sample size is small, the mean clutch size of 4.4 noted in this study (Table 1) was larger than the 3.7 noted in Hands et al. (1989) and 3.8 reported by Duebbert and Lokemoen (1977). Duebbert and Lokemoen found only 3 of 41 clutches to contain 6 eggs compared to 2 of 9 clutches in this study.

Nest 48-91 was found during egg laying and checked during hatching, which provided accurate information on the incubation period. The adult was flushed from two eggs at 1200 hr on 30 May. Six eggs were present by 6 June, and at 1600 hr on 24 June, five young were present (one newly hatched), with the remaining egg pipping. Assuming that American bitterns commence incubation with the laying of

Table1. Characteristics and outcomes of American bittern nests at the Burnham Creek Wildlife Management Area in northwest Minnesota, 1990 -1992.

Nest no.	Date found	Completed clutch size	Estimated date of first egg	Cover type	V.O.R. (dm)[1]	Nest fate
9-90	15 June 1990	4		Quackgrass	6.9	Nest destroyed by 28 June. Eggs gone. Fox?
28-90	10 July 1990	4	20 June	Quackgrass/redtop	5.5	3 young and 1 infertile egg when last checked on 26 July.
29-90	10 July 1990	3		Quackgrass/redtop	5.3	Nest destroyed by 26 July. Shells mixed with nesting material. Skunk?
48-91	30 May 1991	6	29 May	Timothy/reed canary	4.3	Six young present on 26 June. Adult found dead near nest on 8 July and no young present.
56-91	30 May 1991	5	27 May	Switchgrass/quackgrass	3.5	Five young present on 24 June. One young present on 8 July and trails near nest suggested presence of other young.
58-91	30 May 1991	4		Sweet clover/ smooth brome	3.8	Nest destroyed by 6 June. Tooth marks on shell suggested mink.
64-91	25 June 1991	6	8 June	Quackgrass/ sweet clover	3.6	Six young in nest on 8 July.
35-92	3 June 1992	4	25 May	Reed canary	4.0	Four young present on 20 June. Trails around nest on 13 July suggested presence of young.
15-92	1 June 1992	4	15 May	Bluestem	2.5	Three large young present on 20 June.
x		4.4			4.4 dm	

[1] V.O.R. = Visual Obstruction Reading, the height in decimeters at which there is 100% visual obstruction of a Robel density pole.

the first egg and that eggs are laid at the rate of one per day, then the period from the laying of the last egg to the hatching of the last egg was 22 or 23 days, depending on whether the second or third egg was laid on 30 May. Vesall (1940) reported a period of 24 days, but he was observing nests a month earlier under cooler conditions than this observation.

Six of the nine (66.6%) nests were successful (at least one egg hatched) compared to 57% observed by Duebbert and Lokemoen (1977). Evidence at destroyed nests suggested that red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*) and mink (*Mustela vison*) each accounted for the loss of a nest, but raccoon (*Procyon lotor*) and Richardson's ground squirrels (*Spermophilus richardsonii*) were also present on the study area and are known egg predators.

The presence of cable-chain drag vehicle tracks may have contributed to the loss of nests 9-90 and 48-91 by enhancing predator access. Vehicle tracks were 2 m from nest 9-90 and actually straddled nest 48-91. Kirsch (1969) found vehicle tracks increased predator movements in idle cover in North Dakota and believed that nesting success was reduced accordingly.

American bitterns hatch asynchronously as a result of incubation commencing shortly after the onset of egg laying. Consequently there was a marked size difference in the young, particularly in larger clutches (Fig. 2). Adults vary in their attentiveness to young. Most adults flew at least 100 m when nests were initially found or checked. However, one adult flew only 30 m from the nest (no. 28-90)

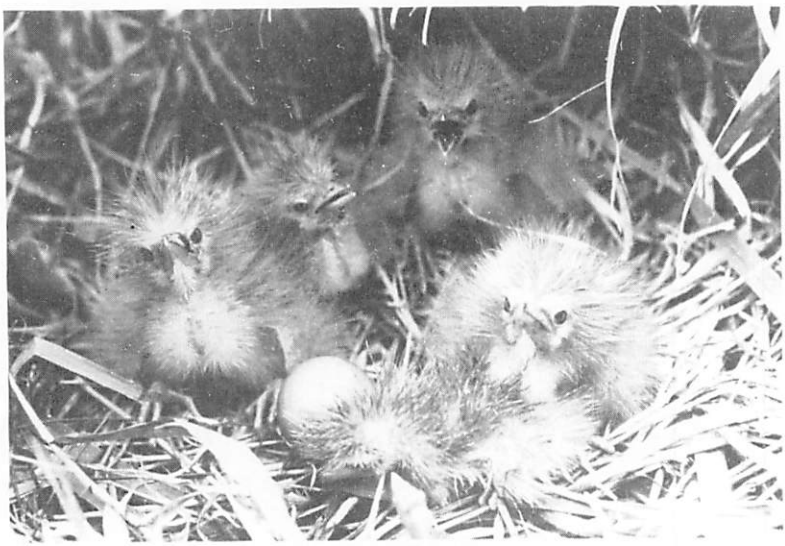

Figure 2. Five American bittern young and an egg in the process of pipping. Burnham Creek Wildlife Management Area, 24 June 1991. Note size difference in young.

when discovered by the cable-chain drag on 10 July 1990. On 13 July, the adult gave repeated threat vocalizations before flushing from the nest containing a newly hatched young and again flew less than 30 m. On 6 July, the adult stayed with three, 10-13 day-old young and actively defended them with threat vocalizations and beak strikes. Young tended to stay in the nest for about one week and reacted to visitors with hissing and gaping bills. They commonly made a striking movement with their bill and then tumbled forward. After about one week of age, young tended to slip away from the nest when disturbed and would hide in the surrounding cover. Nests containing older young had a network of trails going out from the nest, suggesting that young were hunting for prey nearby.

Fledging success can only be estimated, but as many as 21 young may have fledged from five of the nine nests (Table 1). Since an adult was found dead near nest 48-91, it is assumed that all six young died or were killed. The adult may have been killed defending the young from a predator, although no conspicuous injuries were noted on the partially decomposed adult.

Prey appeared to be readily available during the study. Small mammals, grasshoppers, dragonflies, snakes, and tiger salamanders (*Ambrystoma tigrinum*) were all present, but leopard frogs (*Rana pipiens*) were particularly abundant. On 6 July 1990, eight nearly mature leopard frog tadpoles per square meter were estimated to be present in more open water areas of the wildlife pool. They had generally moved into upland areas by early August, and on 29 August 1990, a vehicle driven once through the interior road killed approximately one frog per 25 m, providing another indication of their abundance. Leopard frog reproduction did not appear to be as high in 1991 as in 1990 but more adult frogs were present earlier in the season as the young from 1990 emerged from overwintering sites. The effect of this available food resource on nesting is unknown, but nests were initiated about one month earlier and clutch sizes tended to be larger (5.3 vs 3.7) in 1991 than in 1990. The clutch size of two 1992 nests was 4.0, and frog numbers appeared comparable to 1991.

The relationship between leopard frogs and American bitterns was not clearly established in this study, but frogs are a preferred food, and Coffin and Pfanmuller (1988) suggested that the large decline in frogs may partially explain the decline in American bittern numbers. This study area appears to provide ideal habitat for leopard frogs. The wildlife pool meets the following criteria of Hine et al. (1981) for an ideal frog breeding pond: (1) within 1.6 km of hibernaculum (flood pool), (2) spring depth of 1.5 m or more to provide appropriate open water/cover ratio (wildlife pool actually less than this in spring of 1990), (3) two-thirds of pond circumference with littoral vegetation for egg mass attachment and escape cover, (4) gradual sloping bottom to promote emergent vegetation, (5) open water to allow appropriate warming, (6) surrounding land appropriate summer habitat for adults and juveniles, and (7) water present most of time but drys up periodically to eliminate fish predation possibility. I have been engaged in field work in northwest Minnesota since 1969 and have not observed leopard frogs near this abundance since the summer of 1970 (Fig. 3).

Figure 3. Concentration of young-of-the-year leopard frogs along wetland edge at the Burnham Creek Wildlife Management Area, 22 August 1990.

In this study area, all American bitterns were observed in an 80-ha area inside the dike, east of the flood pool to the east edge of the wildlife pool and including the quackgrass/redtop habitat where five nests were located (Fig. 1). They were never observed close to trees, very near the flood pool dike, or in water deeper than 15 cm. Most (80%) of the incidential observations were along wetland edges with gradual slopes and a predominance of emergent vegetation, mostly cattails and softstem bulrush. Probably three pairs in 1990 and perhaps four in 1991 nested in the area previously described for a density of about one pair per 27 ha. If the deeper (>15 cm) water areas of the wildlife pool are excluded as American bittern habitat, the nesting density would be about one pair per 17 ha. The habitat area needed by American bitterns is not well understood, but Brown and Dinsmore (1986) found American bitterns in Iowa to be associated mainly with marshes from 11-20 ha. This area association is probably related to the food resource needed to rear young, but food was felt to be non-limiting in this study.

RECOMMENDATIONS FOR FURTHER RESEARCH

This study presented some questions pertinent to the ecology and management of wetland habitats for American bitterns: (1) What is the role of prey abundance on date of nest initiation, clutch size, and fledging success? (2) How important are leopard frogs as a food item for American bitterns? (3) How can

marsh management strategies, particularly water level manipulation, affect frog abundance by altering reproduction and overwintering conditions? (4) What factors cause clumped distribution of nests? Does it relate to ideal nesting habitat? Related birds? A nesting gregariousness carried over from a time when the species was a colonial tree nester?

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