Renesting by Long-billed Curlews in north-eastern Nevada

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We report evidence of renesting by breeding Long-billed Curlews *Numenius americanus*, in north-eastern Nevada, USA. On two occasions, marked adults were observed incubating second clutches following the loss of first clutches. Additionally, we recorded a bimodal distribution of clutch completion dates, with a secondary peak, indicative of renesting. As it was previously believed that Long-billed Curlews were limited to a single nesting attempt per year, this finding is vital to our understanding of this imperilled species' breeding biology, and is an important consideration for future studies of Long-billed Curlew.

INTRODUCTION

Renesting, following a failed nesting attempt, is common among shorebirds (Charadrii) especially among species breeding in temperate regions (Evans & Pienkowski 1984). In breeding environments where nest predation is high, and/or when environmental effects that can end a nesting attempt are unpredictable (e.g., flooding or severe weather), renesting can be highly advantageous as it affords individuals a second chance to produce young within a given breeding season. Renesting is typically observed when food supply is high (Evans & Pienkowski 1984, Lank *et al.* 1985), among females in good condition (Hipfner *et al.* 1999), and is more likely to occur early in the breeding season (Amat *et al.* 1999). In populations where renesting is not observed, such ecological conditions as limited food supply and/or a short breeding season are likely to exist (Evans & Pienkowski 1984).

When renesting is common for a species, yet is found not to occur in a particular breeding situation (e.g. year, population or region), this may allow for the identification of conditions necessary for renesting to occur. Similarly, when a population of a species not known to renest exhibits this phenomenon, this also may present an opportunity to determine conditions necessary for renesting to occur. Such information can have considerable implications for management strategies.

The Long-billed Curlew *Numenius americanus* is a large, temperate breeding North American shorebird, which nests in grassland habitats throughout the intermountain west as well as in areas of the Great Plains (Dugger & Dugger 2002). Curlews begin nesting in late March to late April, depending on geographic location, and hatching regularly occurs in May and June (Allen 1980, Jenni et al. 1981, Pampush 1981, Cochran 1983, Paton & Dalton 1994). Long-billed Curlews exhibit a strictly monogamous mating system, with both parents providing care for a single clutch of four eggs (Bent 1929, Allen 1980). Many studies of Long-billed Curlew breeding biology have been conducted (Bicak 1977, King 1978, Allen 1980, Redmond & Jenni 1986, Cochran & Anderson 1987, Pampush & Anthony 1993, Paton & Dalton 1994), yet renesting has not been documented (Dugger & Dugger 2002). As a result, it has been generally accepted that this species does not renest following a failed nesting attempt.

We observed renesting by Long-billed Curlews breeding in north-eastern Nevada. These observations consist of marked birds incubating second clutches shortly after the loss of their first clutches. Additionally, we offer corroborating evidence in the form of clutch completion dates exhibiting a bimodal distribution with a distinct secondary peak, indicative of renesting. These observations demonstrate that Long-billed Curlews are indeed capable of renesting, at least in north-eastern Nevada, and that renesting in this population may be common. This has considerable implications for curlew management, population modelling and for future studies of Long-billed Curlew breeding biology.

METHODS

We studied a large population of Long-billed Curlews during the spring and summer of 2003 in northern Ruby Valley, Nevada, USA (40°41'52"N, 115°14'00"W, elevation 1800 m). Spring runoff from the Ruby Mountains to the west and the East Humboldt Range to the north-east irrigates hay meadows on cattle ranches located along a narrow strip at the western and northern ends of the valley, as well as the Ruby Lake National Wildlife Refuge to the south. The majority of the valley is composed of dry desert-scrub habitat and areas of bare soil.

The climate of Ruby Valley is typical of the Great Basin, with cool, wet winters and hot, dry summers. However, due to the high elevation of Ruby Valley (1800 m), spring and summer temperatures generally are cooler than most Great Basin sites, rarely exceeding 35°C.

Our study area consisted of two large cattle ranches (totalling approximately 1800 ha) comprised of irrigated hay meadows and dry, desert-scrub habitat. We conducted bimonthly censuses of Long-billed Curlews along established transect lines beginning in late April and continuing through early July. When possible, we noted sex, based on bill length and shape (Allen 1980).

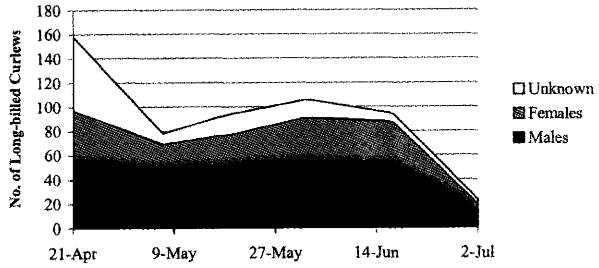

Fig. 1. Number of Long-billed Curlews by sex counted at two cattle ranches in northern Ruby Valley, NV.

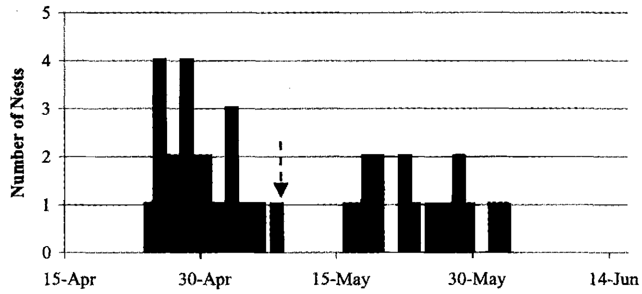

Fig. 2. Distribution of Long-billed Curlew clutch completion dates in 2003. The dashed arrow represents the median clutch completion date of 8 May.

Nest searches were initiated in early April and continued through June. Upon locating a nest, we calculated the clutch completion date (when possible) and monitored the nest every 2–3 days until failure or hatch. Nests found prior to clutch completion were visited daily to determine when the final egg was laid. When nests were found after clutch completion, eggs were floated to determine stage of development (Westerskov 1950, Hays & Lecroy 1971), and to estimate clutch completion date. When nests were found during hatching, we estimated clutch completion date by backdating 28 days. This corresponds to the mean incubation period of hatched clutches in which clutch completion was directly observed (Graul 1971, Allen 1980, Redmond & Jenni 1986, this study).

Adult Long-billed Curlews were captured at the nest using a 1 m diameter dip net dropped over the incubating bird. When this method of capture failed, a 1.5 m bownet trap was placed around the nest and activated by trip wire. Each captured adult was weighed, measured and given a unique combination of three colour bands and one aluminium band. Eleven adults also received a small (1.4 g) radio transmitter glued to their aluminium band (Holohil Systems Ltd.).

RESULTS

The number of adult Long-billed Curlews on the study area remained fairly static during the nesting season and was approximately 80–100 individuals (Fig. 1). The large number of curlews recorded in late April (n = 158) was due to the presence of transient flocks that did not remain to breed.

We located 46 Long-billed Curlew nests, and determined clutch completion dates for all but three. The median clutch completion date was 8 May. However, clutch completion dates exhibited a distinct bimodal distribution with a major mode occurring at the end of April, and a minor mode occurring in late May (Fig. 2). Of the 43 nests in which clutch completion date was known, 26 were completed between 24 April and 8 May (a span of 15 days), and 17 were completed between 16 May and 2 June (a span of 18 days). We found no nests completed between 9 May and 15 May. Nesting density was high with most nearest neighbour distances measuring less than 300 meters.

We captured and banded seven males and six females incubating clutches at 12 nests (at one nest both the male and female were captured). Of these: five males and one female were captured at six nests with clutches completed before 9 May (early clutches); and two males and five females were captured at six nests with clutches completed after 15 May (late clutches).

Of six early clutches in which at least one incubating bird was banded, four hatched and the parents did not initiate second clutches. However, two birds, one male and one female captured and banded at separate early nests, were observed incubating second clutches after the loss of their first clutches. The first nest of the banded male was depredated on 14 May, after 19 days of incubation (completed 25 April). This male was then observed incubating a second clutch initiated on 21 May (7-day interclutch interval) and located 175 m from his first nest location. However, it was uncertain whether this male retained his mate from his first nesting attempt, as the female was not banded. The early clutch with the banded female was also depredated on 14 May, but after only nine days of incubation (completed 5 May). This female was then observed incubating a second (replacement) clutch initiated on 20 May (6-day interclutch interval) and located 135 m from her first nest location. Again, it was not known if this female retained her mate from her first nesting attempt.

Of the six late clutches in which incubating birds were caught and banded, four hatched and two were depredated. None of these banded birds were observed to renest following the hatching or failure of their clutches.

DISCUSSION

Although common among shorebirds, renesting by curlews (Genus *Numenius*) has been documented in only two of eight species: the Eurasian Curlew *N. arquata* (Currie *et al.* 2001) and the Whimbrel *N. phaeopus* (Grant 1991). Renesting is also suspected to occur in the Bristle-thighed Curlew *N. tahitiensis* (Marks *et al.* 2002), but has not been positively confirmed. Of the five remaining curlew species in which renesting has not been documented, research that would enable the detection of renesting is lacking in four species: Eskimo Curlew *N. borealis*, Little Curlew *N. minutus*, Slender-billed Curlew *N. tenuirostris* and Eastern Curlew *N. madagascariensis*. Conversely, a great deal of research has been conducted on breeding Long-billed Curlews (Bicak 1977, King 1978, Allen 1980, Cochran & Anderson 1987, Pampush & Anthony 1993, Paton & Dalton 1994), including a detailed, multi-year study using marked birds (Redmond & Jenni 1986) and yet renesting has not been detected.

In the present study, at least two Long-billed Curlews renested (clearly replacement laying by a female in one instance) following the loss of their first clutches. Furthermore, three lines of evidence suggest that renesting may be common in our study population. First, the number of Long-

Table 1. Breeding chronology of Long-billed Curlews at five locations. Locations are listed in order of decreasing latitude. *Allen (1980) reported an earliest clutch initiation date of 2 April, which we transformed into an earliest clutch completion date of 7 April, assuming six days of egg-laying, for the purpose of comparison. Paton & Dalton (1994) did not report specific dates for earliest clutch completion and earliest hatching.

Location	Earliest arrival	Earliest clutch completion	Earliest hatching	Source
South-eastern Washington	17 March	7 April*	11 May	Allen 1980
North-eastern Oregon	16 March	1 April	1 May	Pampush 1981, Pampush & Anthony 1993
South-western Idaho	20 March	9 April	5 May	Jenni *et al.* 1981, Redmond 1984, Redmond 1986
Ruby Valley, Nevada	6 April	24 April	23 May	Hartman & Oring, this study
Great Salt Lake, Utah	30 March	Late April	Late May	Paton & Dalton 1994

billed Curlews remained fairly constant throughout the breeding season (Fig. 1). Therefore, late clutches do not appear to belong to late-arriving breeding pairs. While the number of females in the counts did increase in late May (Fig. 1), this is most likely due to the hatching of early clutches, and the emancipation of females from incubation duties. As females incubate during the day (Allen 1980, also witnessed in this study), they would be less visible during morning transects until nesting ceased. Second, the frequent territorial and courtship displays preceding the initiation of early clutches (mid-April), were rarely observed before the initiation of late clutches (mid-May), suggesting that males had already established territories and that pairs had already formed. Finally, the secondary peak observed in clutch completion dates, after a seven-day period in which no nests were completed (Fig. 2) suggests that many, if not all late clutches were in fact renesting attempts.

Contrary to our observations, Redmond & Jenni (1986) found no evidence of renesting over a five-year study involving 42 marked adults. This discrepancy may be the result of differences in habitat and corresponding differences in food quality and abundance. The curlews that Redmond & Jenni studied nested in dry, short grass uplands in southwestern Idaho, whereas our site was wet and included tall grass hay meadows containing abundant invertebrate prey such as earthworms (Annelida), and crickets and grasshoppers (Orthoptera). Greater prey availability and prey quality in Ruby Valley hay meadows may provide female curlews with the energy required to produce second clutches. It is notable that females captured in southwestern Idaho (Redmond 1986) were, on average, 100 g lighter than females captured in Ruby Valley, Nevada (Hartman & Oring, unpublished data).

Interestingly, Long-billed Curlews arrive, begin nesting, and hatch chicks approximately 2–3 weeks later in Ruby Valley, Nevada than in other locations, with the exception of Great Salt Lake, Utah (Table 1). However, staging and departure of Long-billed Curlews in Ruby Valley is similar to that of other locations, occurring in late June through early August (Dugger & Dugger 2002). Thus, it does not appear that Long-billed Curlews renest in Ruby Valley, Nevada because they have a prolonged breeding season. In fact, it appears that breeding duration is limited in Ruby Valley relative to other sites.

Not taking into account the possibility that late clutches may actually be second nesting attempts may lead to erroneous conclusions about various aspects of curlew breeding biology. For example, in this study, 43 nests were completed over a 40-day period (24 April–2 June), suggestive of a high degree of breeding asynchrony. However, if all late clutches were actually renesting attempts, then all first clutches were completed over just a 15-day period (24 April–8 May), which is highly synchronous. Furthermore, inadvertently classifying second nests as the first nests of late-breeding pairs, can lead to incorrect conclusions about curlew breeding behaviour, life history strategies and reproductive decisions.

Environmental differences, such as food availability, food quality and habitat type, as well as differences in breeding chronology existing over the Long-billed Curlew's breeding range may explain differences in renesting propensity. As renesting may allow for greater productivity than previously realized, conservation efforts directed toward this part of the reproductive cycle could be of substantial importance for recovery of this imperilled species. Further investigations are needed to determine how widely renesting occurs in the Long-billed Curlews' breeding range, and how this phenomenon affects productivity in this species.

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Male Long-billed Curlew sitting on nest in north-eastern Nevada, USA.