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Whooping Crane (/Species-Account/bna/species/whocra/introduction/)

American Avocet (/Species-Account/bna/species/ameavo/introduction/)

Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

Authors: Robinson, Julie A., J. Michael Reed, Joseph P. Skorupa and Lewis W. Oring

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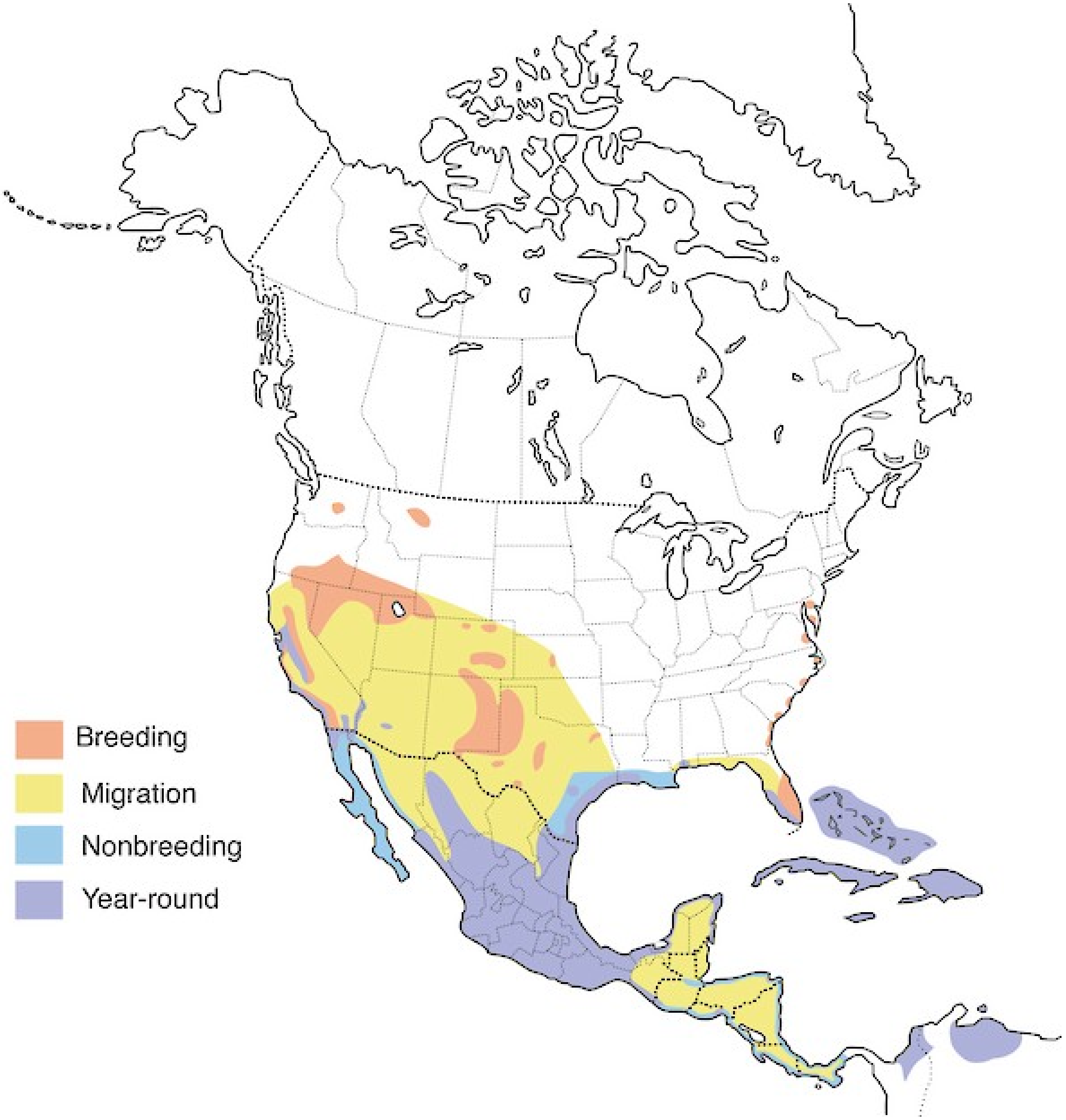

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Figure 1. Distribution of the Black-necked Stilt in North and Middle America and the western Caribbean.

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This species also breeds in South American and the Hawaiian Islands. See text for details.

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Adult male Black-necked Stilt

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Note glossy black back; females are browner. ; photographer William L. Newton

The Black-necked Stilt is a study in contrasts. Its shiny black wings and back oppose the white breast, and both are accentuated by long, bright red legs. Undisturbed, stilts wade through shallow wetlands and flooded fields with a careful grace. When disturbed during the breeding season, however, all semblance of grace disappears. Agitated stilts yap incessantly, dive at predators, and feign mortal injuries. After a day of field work near breeding stilts, the yapping echoes in one's head until the next morning when the sound is renewed by the continuing calls of vigilant parents.

Numbers of an endangered subspecies, the Hawaiian Stilt (*H. m. knudseni*, in Hawaiian, Ae'o, "one standing tall"), were reduced by hunting pressure, habitat loss, and predation by introduced vertebrates to as few as 200 individuals in the early 1940s. With intensive management, including a ban on shooting, numbers have now (1990s) recovered to more than 1,400 individuals. Hawaiian Stilts occur in lowland coastal wetlands on six of the eight major Hawaiian islands. Adult male and adult female Hawaiian Stilts have more black on the head and neck than mainland males, whereas the head markings of immature Hawaiian Stilts resemble their mainland counterparts (Figure 2 (https://download.ams.birds.cornell.edu/api/v1/asset/24991131)). The Hawaiian Stilt is nonmigratory except for seasonal movements between adjacent islands. Another subspecies, the White-backed Stilt (*H. m. melanurus*) occurs in South America, but is not treated in this account. The focus of this account is on North American populations of Black-necked Stilt (*H. m. mexicanus*; excluding its range in Middle America and northern South America) and on the Hawaiian Stilt.

Because Black-necked Stilts often share habitat with American Avocets (*Recurvirostra americana*), some characteristics of avocets often are attributed mistakenly to stilts. Breeding stilts are far less gregarious than are avocets, and were it not for their joining in antipredator displays, stilts probably would be considered territorial rather than semicolonial. Stilts tend to use wetlands with more emergent vegetation than avocets, especially flooded fields. However, both species congregate on human-made evaporation ponds to consume abundant brine flies. Although use of evaporation ponds might seem to ensure that suitable habitat will be available for stilts in the future, these ponds also accumulate contaminants in their food webs. Embryo deformities associated with selenium contamination in irrigation drain water were first identified at Kesterson National Wildlife Refuge and later at the many evaporation ponds of the Tulare Basin, CA. The harmful effects of selenium on hatching success have been documented, and the effects on chick growth and survivorship are under study. The cumulative effects of wetland contamination and shifts in habitat availability on stilt populations remain elusive.

Research on Black-necked Stilts has focused on behavior and population ecology. Robert B. Hamilton (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)) described and compared the behaviors of Black-necked Stilts and American Avocets in California. The conspicuous antipredator behaviors were studied in depth by Tex A. Sordahl (Sordahl 1980 (/Species-Account/bna/species/bknsti/references#REF38515), Sordahl

1981a (/Species-Account/bna/species/bknsti/references#REF14274), Sordahl 1982 (/Species-Account/bna/species/bknsti/references#REF4433), Sordahl 1984 (/Species-Account/bna/species/bknsti/references#REF38516), Sordahl 1986 (/Species-Account/bna/species/bknsti/references#REF4434), Sordahl 1990 (/Species-Account/bna/species/bknsti/references#REF2095), Sordahl 1994 (/Species-Account/bna/species/bknsti/references#REF55412), Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)) in Utah. Robert A. James, Jr. (James 1991b (/Species-Account/bna/species/bknsti/references#REF39816), James 1995b (/Species-Account/bna/species/bknsti/references#REF39817)) studied parental sex roles in southern California. American Avocets and Black-necked Stilts also have been a primary focus of ecotoxicological studies of the effects of irrigation drainwater on breeding waterbirds (e.g., studies by Harry M. Ohlendorf, Joseph P. Skorupa, and unpublished work of Carolyn M. Marn). Most recently, Julie A. Robinson and Lewis W. Oring (Robinson 1996b (/Species-Account/bna/species/bknsti/references#REF4422), Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)) conducted population studies of hundreds of marked individuals in California, Nevada, and Utah, providing data on migratory movements, natal and breeding dispersal, population regulation, and population spatial structure.

Appearance (/Species-Account/bna/species/bknsti/appearance) ›

Introduction (/Species-Account/bna/species/bknsti/introduction)

Appearance (/Species-Account/bna/species/bknsti/appearance)

Systematics (/Species-Account/bna/species/bknsti/systematics)

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Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
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Sections

Systematics

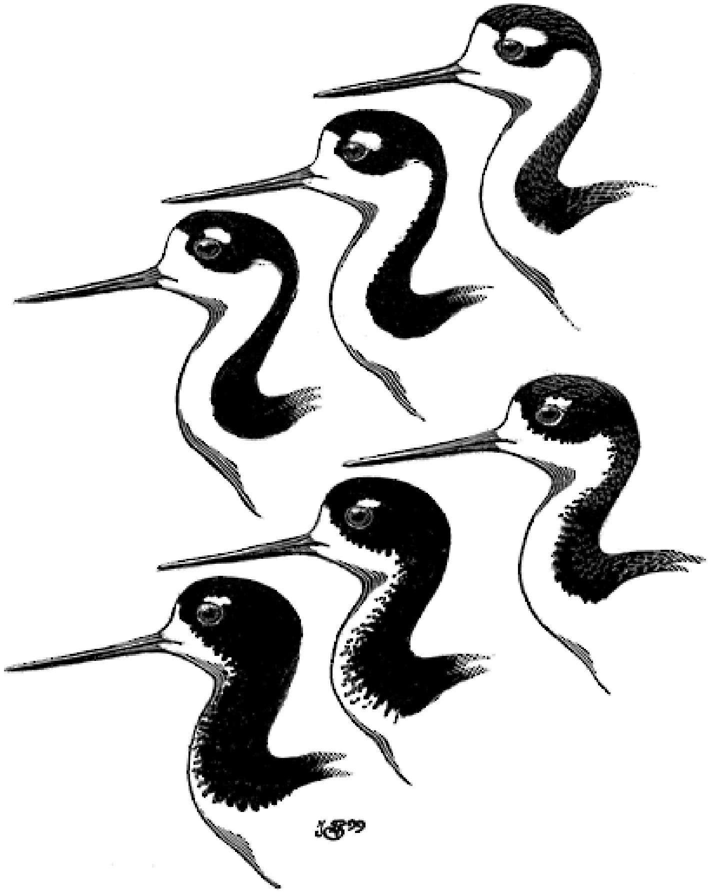

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Fig. 2. Stilt head plumages: Hawaiian vs. Black-necked. ✚ **Enlarge (https://download.ams.birds.cornell.edu/api/v1/asset/24991131)**

A comparison of the head plumages of Black-necked Stilts (Himantopus mexicanus mexicanus, top row) and Hawaiian Stilts (H. m. knudseni, bottom row). Each row, left to right: male, female, subadult. Drawing by N. John Schmitt.

Ongoing debate over species limits of stilts (genus *Himantopus*) has led to a confusing array of classifications. This account follows the classification adopted by the Am. Ornithol. Union (American Ornithologists' Union 1998a (/Species-Account/bna/species/bknsti/references#REF63025)), who treat all taxa of stilts in the Americas and the Hawaiian archipelago as a single species (*H. mexicanus*) apart from taxa elsewhere in the world (see Related species, below).

Geographic Variation

No geographic variation described within North American populations, but no comprehensive study available. Birds of Galapagos archipelago may have shorter tarsi on average (Hellmayr and Conover 1948 (/Species-Account/bna/species/bknsti/references#REF54131)). Hawaiian birds larger and more extensively black than mainland populations of the Americas (see *H. m. knudseni*, below).

Subspecies

Three subspecies recognized: *H. mexicanus mexicanus* (Black-necked Stilt), *H. m. knudseni* (Hawaiian Stilt), and *H. m. melanurus* (White-backed Stilt). Each may warrant species rank, although nominate *mexicanus* and *knudseni* are thought most closely related and sometimes classified together as a separate species apart from *melanurus* (Blake 1977 (/Species-Account/bna/species/bknsti/references#REF56139)). Am. Ornithol. Union (American Ornithologists' Union 1998a (/Species-Account/bna/species/bknsti/references#REF63025)) designated each as a subspecies “group” both to acknowledge past treatments of each as a separate species (e.g., Ridgway 1919 (/Species-Account/bna/species/bknsti/references#REF58543)) and to highlight important differences among them.

H. m. mexicanus (P. L. S. Müller, 1776). Breeds from w. and s. North America south through Middle America and the West Indies to n. South America and Gala-pagos Is. Main concentrations in llanos of Colombia and Venezuela; also in coastal w. Ecuador and Peru (south to Lima; Blake 1977 (/Species-Account/bna/species/bknsti/references#REF56139)) and scattered sites in An-dean highlands to s. Peru (Lake Junín), where southern limit uncertain (most highland birds resemble nominate *mexicanus*, but birds with *melanurus* traits occur seasonally and predominate in the south, e.g. nw. Argentina; Fjeldså and Krabbe 1990 (/Species-Account/bna/species/bknsti/references#REF29278)). White of forehead does not extend over crown; black of hindneck relatively narrow, not extending to sides of neck, and continuous with back; lores almost entirely white. Measurements (mm) with range and mean (in parentheses) from Ridgway 1919 (/Species-

Account/bna/species/bknsti/references#REF58543): male (*n* = 19)—wing chord 214–232 (222.4), tail 67–76 (72.9), culmen 59.5–70 (65.3), tarsus 98–119 (108.8); female (*n* = 15)—wing chord 202.5–218 (211.8), tail 65.5–71.5 (69.3), culmen 61–67 (63.9), tarsus 95.5–109 (103.6). See Appendix 3 (/Species-Account/bknsti/appendix/APP1002811) for measurements of live birds.

H. m. knudseni Stejneger, Stejneger 1887 (/Species-Account/bna/species/bknsti/references#REF11106) . More or less resident on major islands of Hawaiian archipelago (see Distribution: Outside the Americas, above). Pattern of black and white on crown and neck similar in overall appearance to nominate *mexicanus* but adults of *knudseni* show greater extent of black on forehead and cheeks; black of hindneck extends forward to sides of neck and slightly onto upper breast (more extensive on males); posterior half of lores black; tips of uppertail-coverts and rectrices blackish; back and scapulars of female *knudseni* blacker (blackish-brown instead of brown) than female of nominate *mexicanus*; white spot above the eye generally smaller, but varies a great deal and commonly absent (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). Averages larger than nominate *mexicanus* in wing, tail, culmen, tarsus, and mass (see Appendix 3 (/Species-Account/bknsti/appendix/APP1002811) for measurements of live birds).

H. m. melanurus Vieillot, 1817. Resident in s. South America from e.-central Peru (chiefly east of Andes) and central Bolivia east to se. Brazil (s. Mato Grosso, São Paulo, Rio de Janeiro) and south to s. Argentina (Chubut; Canevari et al. 1991 (/Species-Account/bna/species/bknsti/references#REF44047)) and s. Chile. In Chile, found from Atacama to Llanquihue, with concentrations from Aconcagua to Concepción (Johnson 1972a (/Species-Account/bna/species/bknsti/references#REF22863), Blake 1977 (/Species-Account/bna/species/bknsti/references#REF56139)). Presumed to intergrade with nominate *mexicanus* described from ne. Peru and Minas Gerais, Brazil (Hellmayr and Conover 1948 (/Species-Account/bna/species/bknsti/references#REF54131), Blake 1977 (/Species-Account/bna/species/bknsti/references#REF56139)); apparently intermediate specimens cited from ne. Brazil (Short 1975 (/Species-Account/bna/species/bknsti/references#REF29932)). Captive *mexicanus* and *melanurus* have produced a hybrid offspring (Lint 1959 (/Species-Account/bna/species/bknsti/references#REF4411)). Relationship and pattern of intergradation between *mexicanus* and *melanurus* in need of study. Conspicuous white collar across upper back is most reliable character differing from nominate *mexicanus*; crown usually white (variable, however) with black strap connecting eye to black nape. Size intermediate between nominate *mexicanus* and *knudseni* . Measurements (mm) with range and mean (in parentheses) from Blake (Blake 1977 (/Species-Account/bna/species/bknsti/references#REF56139)): male (*n* = 10)—wing flat 215–244 (233.5), tail 72–86 (79.5), culmen 65–76 (71.1); female (*n* = 9)—wing flat 215–232 (225.3), tail 68–82 (77.3), culmen 68–74 (70.1).

Related Species

Worldwide, there are 6–8 taxa of stilts (genus *Himantopus*), which vary from an all black form to forms with differing patterns of black and white on the head and neck (“pied” forms). Taxonomic arrangement of these is complex and unsettled, partly because their evolutionary relationships are poorly understood, and partly because systematists have used differing notions of species limits. Taxa are essentially allopatric (a few are narrowly sympatric) and separable on plumage and biometrics. Interestingly, a similar taxonomic problem exists among the oystercatchers (genus *Haematopus*), a more diverse group of black or black and white shorebirds that are closely related to stilts.

Relationship of the Black-necked Stilt (including taxa *mexicanus*, *knudseni*, and *melanurus*) to other stilts in the genus is uncertain. The 3 other taxa of stilts include: *himantopus*, Black-winged Stilt, Eurasia and Africa (includes *meridionalis* of South Africa and *ceylonensis* of Sri Lanka, 2 weakly differentiated forms sometimes recognized as subspecies); *leucocephalus*, White-headed Stilt (or Pied Stilt), Java east to island of New Guinea and south throughout Australia and parts of New Zealand; *novaezelandiae*, Black Stilt, endemic to New Zealand. While some combine all stilts into a single species (e.g., Johnsgard 1981 (/Species-Account/bna/species/bknsti/references#REF11375)), most authorities divide these taxa into 2 species, elevating *novaezelandiae* to species status and placing all other taxa as subspecies under *himantopus* (e.g., Pierce 1996b (/Species-Account/bna/species/bknsti/references#REF39828)). Others accord species status to each taxon except *knudseni*, which is placed under *mexicanus*, resulting in 5 separate species (e.g., Sibley and Monroe 1990 (/Species-Account/bna/species/bknsti/references#REF64578)). All forms may constitute a superspecies (Mayr and

Short 1970 (/Species-Account/bna/species/bknsti/references#REF62684)). These arrangements, however, are more conjecture than fact due to lack of comprehensive study of evolutionary relationships among the various groups. Interestingly, South American *melanurus* and Australian *leucocephalus* are more similar in plumage to each other than to geographically adjoining stilt taxa.

The family Recurvirostridae includes the stilts in the genus *Himantopus* and 2 other genera: *Recurvirostra* (avocets) and *Cladorhynchus* (Banded Stilt, *C. leucocephalus*, monotypic genus restricted to Australia). Phylogenetic analysis of skeletal characters places *Himantopus* basal ("primitive") to a clade containing the avocets and Banded Stilt (Chu 1995 (/Species-Account/bna/species/bknsti/references#REF2471)). This whole group, in turn, is most closely related to the Ibisbill (*Ibidorhyncha struthersii*) of central Asia, a species that has in the past been classified in the Recurvirostridae. Stilts, avocets, and Ibisbill are all closely related to oystercatchers (*Haematopus*) within a lineage of plover-like birds placed in suborder Charadrii (Sibley and Ahlquist 1990 (/Species-Account/bna/species/bknsti/references#REF7594), Chu 1995 (/Species-Account/bna/species/bknsti/references#REF2471), American Ornithologists' Union 1998a (/Species-Account/bna/species/bknsti/references#REF63025)). Suggestion that flamingos (Phoenicopteridae) might be derived from stilt-like ancestor (Olson and Feduccia 1980a (/Species-Account/bna/species/bknsti/references#REF2090)), is refuted by molecular data (Sibley and Ahlquist 1990 (/Species-Account/bna/species/bknsti/references#REF7594), Mindell et al. 1997 (/Species-Account/bna/species/bknsti/references#REF39821)).

Hybridization

An extralimital (possibly escaped) Black-necked Stilt female nested and hatched chicks with a male Black-winged Stilt in the Netherlands (Meininger 1993 (/Species-Account/bna/species/bknsti/references#REF55408)). Captive Black-necked Stilt and American Avocet have produced hybrids (Principe 1977 (/Species-Account/bna/species/bknsti/references#REF4421)).

‹ Appearance (/Species-Account/bna/species/bknsti/appearance)
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Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

Appearance

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Adult male Black-necked Stilt

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Note glossy black back; females are browner. ; photographer William L. Newton

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Adult female Black-necked Stilt, Hawaii, October

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, Oct 11, 2006; photographer D. Paulson

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Juvenile Black-necked Stilt, Salinas, California, 19 July 2006.

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, Jul 19, 2006; photographer Brian L. Sullivan

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Downy young Black-necked Stilt, Louisiana, May

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, May 30, 2005; photographer N. Smith

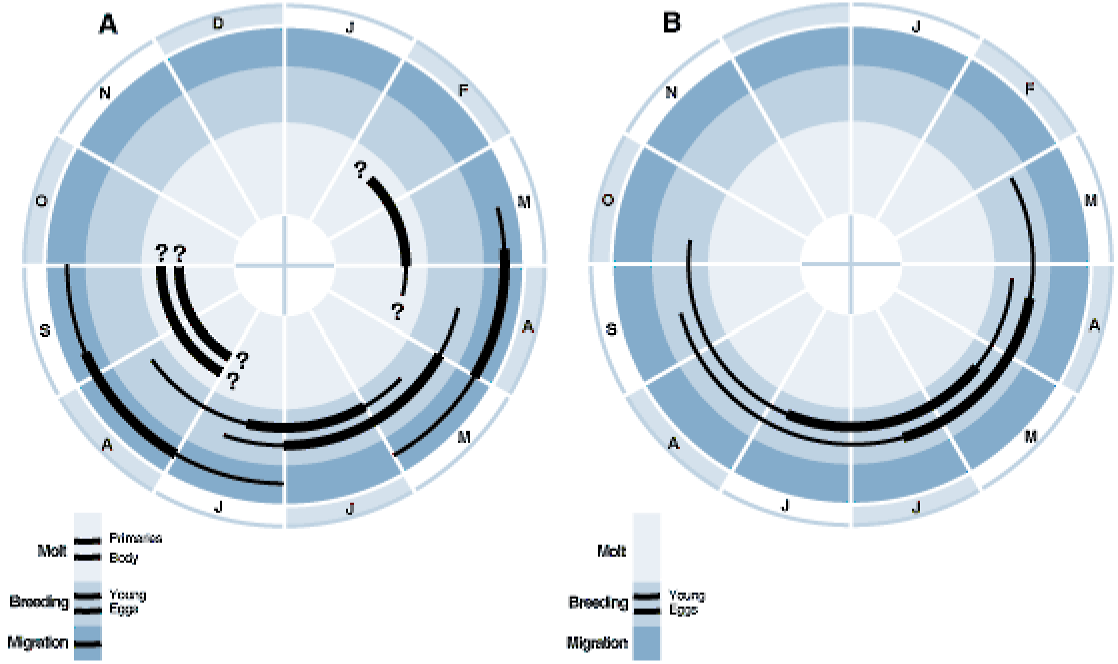

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Figure 5. Annual cycles of Black-necked and Hawaiian stilts.

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A. Black-necked Stilt breeding (ne. California; JAR and LWO) and migration (central California to Sonora; JAR, LWO, and C. Marn), molt data approximate. B. Hawaiian Stilt (O'ahu; Coleman 1981, Chang 1990).

(https://download.ams.birds.cornell.edu/api/v1/asset/24983731)

Downy-juvenile young Black-necked Stilt, Florida, June

+ Enlarge (https://download.ams.birds.cornell.edu/api/v1/asset/24983731)

Downy young, molting into juvenal plumage; Collier Co., FL, 22 June 2004, Jun 22, 2004; photographer N. Smith

Large, very long-legged black-and-white shorebird (35–39 cm long including 5.7–7.0 cm bill; wingspread to 71 cm; 136–220 g). Adult male in Alternate (breeding) plumage has upper portion of head, back of neck, back, and wings shiny black, spot above eye and remaining plumage white except tail, which is sepia to pale gray, and a pink tinge to the upper breast. Iris red. Bill black and very slightly recurved. Extremely long red legs, half web between middle and outer toe, hallux lacking. Adult male in Basic plumage similar but without gloss and without pinkish tinge on breast. Adult female differs from Alternate male having a brown tinge to back and scapulars, black somewhat paler and without gloss, breast without pink tinge, iris paler; Basic plumage somewhat more muted than Alternate plumage. Legs shorter in female than in male (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). Juvenile plumage has similar pattern to adult but dark feathers of upperparts brown with buff margins creating a scalloped effect; primaries and secondaries tipped white showing as white trailing edge to wing in flight. Immatures similar to adults but some dark feathers tipped with white and white-tipped flight feathers retained. See Systematics: subspecies for characteristics of races in Hawaiian Is. and South America.

Similar Species

Black-necked Stilt is unique in appearance in North America and unlikely to be confused with any other species within its range. Black-winged Stilt (*H. himantopus*), accidental vagrant to Alaska (Zeillemaker et al. 1985 (/Species-Account/bna/species/bknsti/references#REF4446)), similar except head and neck all white or smudged with dark gray, never sharply contrasted black and white or with white mark above eye. Downy young Black-necked Stilt distinguished from American Avocet chicks by pinkish tinge in leg color, minimal degree of foot webbing, and lack of hallux.

Molts

No complete quantitative study of molts and plumages. Descriptions below for *H. m. mexicanus* based on Bent (Bent 1927 (/Species-Account/bna/species/bknsti/references#REF57779)), Palmer (Palmer 1967d (/Species-Account/bna/species/bknsti/references#REF4419)), Jehl (Jehl 1968b (/Species-Account/bna/species/bknsti/references#REF57238)), Prater et al. (Prater et al. 1977 (/Species-Account/bna/species/bknsti/references#REF60702)), James (James 1991b (/Species-Account/bna/species/bknsti/references#REF39816)), Paulson (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)) and salvaged specimens of JAR and LWO. Colors, when capitalized, follow Smithe 1975 (/Species-Account/bna/species/bknsti/references#REF61281) . Ridgway (Ridgway

1919 (/Species-Account/bna/species/bknsti/references#REF58543)) noted that females from Florida (*n* = 5) had back and scapulars that were a "darker grayish brown" than those from the w. U.S. (*n* probably = 4), but it is unclear whether these differences apply to Definitive Basic, Definitive Alternate, or both plumages.

Hatchlings

Completely downy; upperparts Light Drab (119C), finely mottled Drab Gray (119D), with a broken Sepia (219) streak down crown and back. In some individuals, two Sepia lines extend from the shoulder region toward the rump, in others the lines fuse at the mid-back and continue toward the rump as a single stripe (Jehl 1968b (/Species-Account/bna/species/bknsti/references#REF57238)). Various Sepia and Jet Black blotching and spotting on crown and back. Sides of head and neck paler and unmarked. Underparts creamy whitish, nearly pure white on belly.

Juvenile Plumage

Prejuvenile molt begins at approximately 3 wk, but development rates can vary greatly at different sites. Development begins first on the scapulars, back and breast; last on the tail. Molting especially pronounced in crown and nape throughout molt.

Similar to Definitive Basic female but dark areas finely mottled with Drab Gray or dull white, back and wings have Drab Gray or Flesh Ochre (132D) feather margins, inner primaries and secondaries Sepia with white tips forming white line along rear edge of wing when open. Sexes similar.

Basic I Plumage

Prebasic I molt partial; body plumage replaced (contra Bent 1927 (/Species-Account/bna/species/bknsti/references#REF57779)), but degree to which body plumage replaced unknown, a few wing coverts and tertials replaced but most retained. All juvenile primaries and secondaries probably retained.

Male. Similar to Definitive Basic male except black feathers, particularly on head and hindneck, tinged Sepia, and some have white or whitish tips that grad-ually wear away. White tips on retained Juvenile secondaries and inner primaries also gradually reduce through wear.

Female. Similar to Basic I male except dark areas more brownish.

Alternate I Plumage

Prealternate I molt incomplete, molt includes some body feathering and probably some flight feathers. Timing of molt unknown, probably before or during Mar, as in Definitive Alternate, but may extend later into the summer (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)).

Male. Similar to Definitive Alternate male with new plumage characterized by metallic sheen on black areas, but part of black feathering with light tips (Palmer 1967d (/Species-Account/bna/species/bknsti/references#REF4419)). However, males in this plumage may not be distinguishable from Definitive Alternate males in all cases.

Female. Similar to Definitive Alternate female except dark feathers of head, nape, and upperparts intermixed with some white or Pale Neutral Gray (86) feathers.

Definitive Basic Plumage

Definitive Prebasic molt probably complete; occurs Aug and Sep, probably during or after migration, but Paulson (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)) noted wing molt on breeding grounds. Palmer (Palmer 1967d (/Species-Account/bna/species/bknsti/references#REF4419)) noted that the second Prealternate molt might not in fact produce the Definitive plumage and hypothesized that the species might undergo 2 Prealternate molts before achieving Definitive plumage in which “dark areas are uninterrupted by any light markings.”

Male. Similar to Definitive Alternate male except black areas without gloss and tinged Sepia on back of head and hindneck, breast without pinkish tinge, and tail Sepia with grayish tinge.

Female. Similar to Definitive Alternate female except dark feathering more muted in coloration.

Definitive Alternate Plumage

Definitive Prealternate molt probably partial, includes at least some back, scapular and breast feathers; timing uncertain, probably during Mar, before spring migration.

Male. Top of head (except forehead) extending to just below eye, through back of neck, back, scapulars, and upper surface of wing Jet Black, lower surface of wing also Jet Black except for white basal lesser underwing coverts and axillars; tail Pale Neutral Gray; spot extending back and up from eye, forehead, sides of head below middle of cheeks, remaining underparts, and lower back through uppertail-coverts white. Black feathering with slight greenish-blue gloss, and white breast feathers often tinged slightly with Pale Pinkish Buff (121D).

Female. Similar to Definitive Alternate male except dark areas somewhat paler and without gloss, head and neck noticeably paler (towards Sepia), back, scapulars, and tertials sepia to Grayish Horn color. Underparts white without pinkish tinge.

Hawaiian Stilt

Basic I plumage has dark patterning on head and neck that resembles female Definitive Alternate of *mexicanus* . Definitive Basic and Definitive Alternate males and females have more black along sides of neck and cheeks. Female has somewhat more black on cheeks and forehead than *mexicanus* female, while male is even more extensively black in these areas and has more black on sides of neck, extending slightly onto upper breast. White spot above the eye varies among individuals from large to nonexistent, and does not differ between sexes (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). Uppertail-coverts tipped blackish. Tail grayish with grayish-black tip (darker than on *mexicanus*); outer margins of the feather tips gray, inner margins white, except middle pair which has both margins gray (Stejneger 1887 (/Species-Account/bna/species/bknsti/references#REF11106)).

Bare Parts

Bill And Gape

Bill Jet Black, often dulled by thin film of mud.

Iris

In male Red (at its brightest probably Spectrum Red, 11). Less vivid in Definitive Basic plumage than in Definitive Alternate plumage. Female iris less vividly colored than male. Sometimes brownish next to pupil. Iris color of juveniles brown (Hawaiian Stilt, Telfer 1972 (/Species-Account/bna/species/bknsti/references#REF39836), Telfer 1973a (/Species-Account/bna/species/bknsti/references#REF4436)).

Legs And Feet

Legs and feet slightly muted Ruby (10); small hexagonal scales all around. Legs and feet of female less vivid than male, also less vivid during Definitive Basic plumage than during Definitive Alternate. In young flighted birds (Basic I) legs light pink, however Telfer (Telfer 1973a (/Species-Account/bna/species/bknsti/references#REF4436)) noted that leg color was not a reliable indicator of age in Hawaiian Stilts. Feet unwebbed except a small bit of webbing between outer and middle toes; hallux absent.

Linear Measurements

Appendix 3 (/Species-Account/bknsti/appendix/APP1002811) . Churchill Co., NV: male bill length (exposed culmen) 61.7 mm ± 6.4 SD (range 57-69); male wing chord 229.7 mm ± 7.5 SD (range 221-234); male tarsus 109.3 mm ± 4.0 SD (range 105-113, *n* = 3; JAR and LWO). Cache Co., Utah: male bill length 60 mm; male wing chord 219 mm; male tarsus 110 mm (*n* = 1); female bill length 64 mm, female wing chord 213 mm, female tarsus 110 mm (*n* = 1; T. A. Sordahl, unpubl.). Measurements of specimens also are reported in Ridgway 1919 (/Species-Account/bna/species/bknsti/references#REF58543) and Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082) .

Mass

Appendix 3 (/Species-Account/bknsti/appendix/APP1002811) . Churchill Co., NV: male mass (breeding season while incubating) 159.3 g ± 8.5 SD (range 151-168, *n* = 3; JAR and LWO). Cache Co., Utah: male 166 g (*n* = 1), female 176 g (*n* = 1; T. A. Sordahl unpubl.). Tulare Basin, CA: male mass (breeding season while incubating) 166 g ± 11.4 SD (range 148-172, *n* = 6; JPS).

Introduction (/Species-Account/bna/species/bknsti/introduction)

Systematics (/Species-Account/bna/species/bknsti/systematics)

Demography and Populations (/Species-Account/bna/species/bknsti/demography)

Conservation and Management (/Species-Account/bna/species/bknsti/conservation)

Priorities for Future Research (/Species-Account/bna/species/bknsti/priorities)

Acknowledgments (/Species-Account/bna/species/bknsti/acknowledgments)

About the Author(s) (/Species-Account/bna/species/bknsti/aboutauthors)

Multimedia (/Species-Account/bna/species/bknsti/multimedia/photos)

Tables and Appendices (/Species-Account/bna/species/bknsti/appendices)

References (/Species-Account/bna/species/bknsti/references)

Recommended Citation

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American Avocet (/Species-Account/bna/species/ameavo/distribution/)

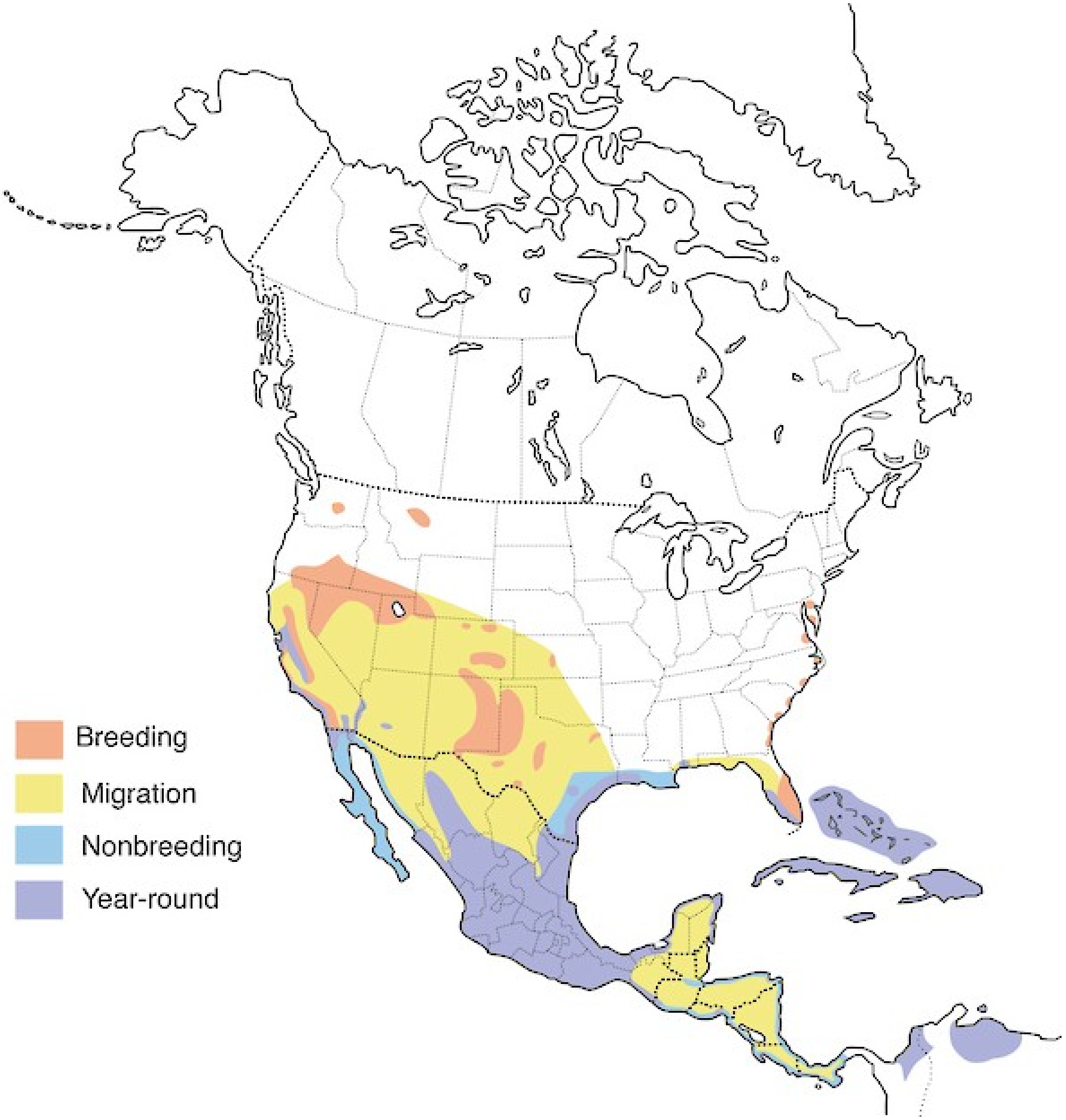
Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

Distribution, Migration and Habitat



(https://download.ams.birds.cornell.edu/api/v1/asset/31959251)

Figure 1. Distribution of the Black-necked Stilt in North and Middle America and the western Caribbean.

+ Enlarge (https://download.ams.birds.cornell.edu/api/v1/asset/31959251)

This species also breeds in South American and the Hawaiian Islands. See text for details.


Canada
United States
North Atlantic Ocean
Mexico
Venezuela
Colombia
Brazil

Map data ©2017

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eBird range map for Black-necked Stilt

Generated from eBird observations (Year-Round, 1900-2017)

Explore more on eBird (https://ebird.org/ebird/map/bknsti?scrollwheel=true&draggable=true&mapType=roadmap)

Distribution in the Americas

Breeding Range

Figure 1 (https://download.ams.birds.cornell.edu/api/v1/asset/25009581) . Distribution always dependent on suitable local habitats. In general, species occurs from w. and s. North America south through Central America, West Indies, to s. South America; also Hawaiian Archipelago. The following discussion only covers subspecies *H. m. mexicanus*, which occurs south to n. South America, and *H. m. knudseni* (Hawaiian Archipelago; see Outside the Americas, below).

Pacific Coast. Breeds in coastal California from Marin Co. south to San Diego Co. (Small 1994 (/Species-Account/bna/species/bknsti/references#REF7103); detailed s. California breeding localities in Garrett and Dunn 1981 (/Species-Account/bna/species/bknsti/references#REF56454)) and west of the Sierra Nevadas in inland central California from Shasta Co. south through Sacramento and San Joaquin valleys to Kern Co. (Small 1994

(/Species-Account/bna/species/bknsti/references#REF7103)). In inland s. California resident at Salton Sea, also locally along the Colorado River and at Phoenix, AZ (Monson and Phillips 1964 (/Species-Account/bna/species/bknsti/references#REF13922), Wilbur 1987 (/Species-Account/bna/species/bknsti/references#REF18784), Small 1994 (/Species-Account/bna/species/bknsti/references#REF7103)). Breeds in n. Baja California Norte and Pacific coast of Mexico from Sinaloa to Chiapas (Howell and Webb 1995 (/Species-Account/bna/species/bknsti/references#REF62109)). Breeds along Pacific coast of Central America in Guatemala (also uncommon breeder in interior lowlands; Land 1970 (/Species-Account/bna/species/bknsti/references#REF29159)), and locally in coastal El Salvador (Howell and Webb 1995 (/Species-Account/bna/species/bknsti/references#REF62109)). Also breeds in the Golfo de Nicoya, Costa Rica (Stiles and Skutch 1989 (/Species-Account/bna/species/bknsti/references#REF24711)), but rarely breeds elsewhere in Costa Rica or Panamá (Stiles and Skutch 1989 (/Species-Account/bna/species/bknsti/references#REF24711)).

Interior. In Great Basin, breeds in s. Oregon east of the Cascades (Klamath, Lake, Harney, and Malheur Cos., rare further north; Gilligan et al. 1994 (/Species-Account/bna/species/bknsti/references#REF56692)) and breeds east of the Sierra Nevada in California in Modoc and Lassen Cos., but not in most of ne. Nevada (Alcorn 1988 (/Species-Account/bna/species/bknsti/references#REF1827)). Northern limit of Great Basin range is s. Idaho (Stephens and Sturts 1991 (/Species-Account/bna/species/bknsti/references#REF7106)), especially Snake River Valley (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)); eastern limit is n. Utah (Walters and Sorenson 1983 (/Species-Account/bna/species/bknsti/references#REF6422)), but recently extended into sw. Wyoming (Oakleaf et al. 1992 (/Species-Account/bna/species/bknsti/references#REF38095)), southern limit is Yerington, NV (Alcorn 1988 (/Species-Account/bna/species/bknsti/references#REF1827)). Additional breeding colonies now occur along the Mississippi River from s. Louisiana north to w. Tennessee, se. Missouri, and sw. Illinois (M. Robbins pers. comm.).

Extremely sparse breeder in southwestern range from s.-central Colorado (Rio Grande and Alamosa Cos.; Andrews and Righter 1992 (/Species-Account/bna/species/bknsti/references#REF20836), Kingery 1998b (/Species-Account/bna/species/bknsti/references#REF55742)) and ne. New Mexico (from Los Pinos south to Las

Vegas [NM], Roswell, and Carlsbad; Bailey 1928b (/Species-Account/bna/species/bknsti/references#REF7228)); rarely in Union and San Miguel Cos. (Johnsgard 1979a (/Species-Account/bna/species/bknsti/references#REF61582)) and most regularly in ne. Pecos Valley, middle Rio Grande Valley, and the Carlsbad area (Hubbard 1978c (/Species-Account/bna/species/bknsti/references#REF28607)); and throughout the western half of the Texas panhandle and at scattered locations elsewhere in n. and w. Texas (Texas Breeding Bird Atlas unpubl.).

Also breeds locally in e.-central Washington (Rohwer et al. 1979 (/Species-Account/bna/species/bknsti/references#REF4424)), scattered small colonies as far north as Potholes Reservoir (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385); see Historical changes, below), w.-central Montana (Montana Bird Distribution Records Committee 1992 (/Species-Account/bna/species/bknsti/references#REF11723)), n.-central (Jackson, Larmer, Weld Cos.) and se. Colorado (Bent, Crowly, Kiowa, and Otero Cos.; Andrews and Righter 1992 (/Species-Account/bna/species/bknsti/references#REF20836), Kingery 1998b (/Species-Account/bna/species/bknsti/references#REF55742)), and central Kansas (Cheyenne Bottoms and Quivera National Wildlife Refuge; Johnsgard 1979a (/Species-Account/bna/species/bknsti/references#REF61582), Thompson and Ely 1989 (/Species-Account/bna/species/bknsti/references#REF14250)).

Atlantic Coast. Breeds in a few scattered areas along the Atlantic Coast from Delaware Bay (along coast of Delaware from Bombay Hook I., DE, southward; Paxton et al. 1987 (/Species-Account/bna/species/bknsti/references#REF27959), Hess et al. 2000b (/Species-Account/bna/species/bknsti/references#REF9678)); also recent breeding record along Delaware River in Philadelphia, PA (Santner 1992a (/Species-Account/bna/species/bknsti/references#REF4428)), and Chesapeake Bay (Deal I., MD; Armistead 1987 (/Species-Account/bna/species/bknsti/references#REF32027)); also breeds regularly at Chincoteague Refuge, VA (Scott and Cutler 1969 (/Species-Account/bna/species/bknsti/references#REF4429), Kain 1987b (/Species-Account/bna/species/bknsti/references#REF14660)). In N. and S. Carolina and Georgia breeds at a few scattered locations along Atlantic Coast (Dinsmore 1977 (/Species-Account/bna/species/bknsti/references#REF4405), Post and Gauthreaux 1989 (/Species-Account/bna/species/bknsti/references#REF57751)). In Florida, recorded from Okaloosa, Wakulla, Hamilton, and Duval Cos. southward; common in Everglades and abundant at Lake Okeechobee (Stevenson and Anderson 1994b (/Species-Account/bna/species/bknsti/references#REF55525)). Accidental breeder from McKay Bay (Tampa) as far west as Pensacola and Mobile, AL (Stevenson and Anderson 1994b (/Species-Account/bna/species/bknsti/references#REF55525)).

West Indies. Widespread breeder throughout the West Indies from the Bahamas, Greater Antilles, Cayman Is., and Virgin Is., south to s. Lesser Antilles, but rare south of Guadeloupe and in portions of the n. Bahamas (Brudenell-Bruce 1975 (/Species-Account/bna/species/bknsti/references#REF58563), Raffaele 1989 (/Species-Account/bna/species/bknsti/references#REF7180), Downer and Sutton 1990 (/Species-Account/bna/species/bknsti/references#REF2806), Garrido and Kirkconnell 1993a (/Species-Account/bna/species/bknsti/references#REF7618), Raffaele et al. 1998 (/Species-Account/bna/species/bknsti/references#REF57325)).

Western Gulf of Mexico and Interior Mexico. Breeds along Gulf Coast from sw. Louisiana north to Calcasieu, Jefferson Davis, Acadia, and Lafayette Parishes (S. Cardiff pers. comm.) with scattered breeding occasionally throughout the state (e.g., breeding records in Caddo, Bossier, and Natchitoches Parishes; P. Dickson pers. comm.), west through Texas (north to San Antonio, rarely to Austin; Oberholser 1974c (/Species-Account/bna/species/bknsti/references#REF61013)). In Mexico breeds along the Gulf Coast from Taumalipas and e. Nuevo León south to Tabasco and in narrow coastal band around Yucatán Peninsula (Howell and Webb 1995 (/Species-Account/bna/species/bknsti/references#REF62109)), and in the interior from central Chihuahua, south to the Isthmus of Tehuantepec (Howell and Webb 1995 (/Species-Account/bna/species/bknsti/references#REF62109)).

South America. Resident n. South America with main concentrations east of Andes in llanos of Colombia and Venezuela south to n. Peru, e. Ecuador, and Amazonian ne. Brazil; also on Galápagos Is. (American Ornithologists' Union 1998a (/Species-Account/bna/species/bknsti/references#REF63025)). In Colombia along Caribbean coast, Cauca and Magdalena Valleys, and Sabana de Bogotá (Hilty and Brown 1986 (/Species-

Account/bna/species/bknsti/references#REF29359)). Venezuela north of the Orinoco River, including Caribbean islands, also south of Orinoco in nw. Bolívar along the Río Paragua and in n. Amazonas (De Schauensee and Phelps 1978 (/Species-Account/bna/species/bknsti/references#REF4061), American Ornithologists' Union 1998a (/Species-Account/bna/species/bknsti/references#REF63025)). Trinidad and Tobago (uncommon; ffrench 1991a (/Species-Account/bna/species/bknsti/references#REF60923)). In Guyana (coastally and along Arbary and Berbice Rivers; Snyder 1966 (/Species-Account/bna/species/bknsti/references#REF4432)), Suriname, and French Guyana, to ne. Brazil (Amapá and the lower Amazon to central Minas Gerias north of the Rio São Francisco; Ruschi 1979 (/Species-Account/bna/species/bknsti/references#REF4426)). Peruvian coast as far south as Lima (Blake 1977 (/Species-Account/bna/species/bknsti/references#REF56139)), and south in Andes to central Peru, though southern limit of nominate *mexicanus* uncertain. See Systematics: subspecies for range of *H. m. melanurus*, which occurs south of nominate *mexicanus* .

Other Records. Extralimital breeding records north of the Pacific Coast range at Humboldt Bay, CA (Small 1994 (/Species-Account/bna/species/bknsti/references#REF7103)), in desert southwest near Las Vegas, NV (Alcorn 1988 (/Species-Account/bna/species/bknsti/references#REF1827)), and in Arizona (rarely near Chandler, Painted Rock Reservoir, and Tucson; more commonly at Phoenix; Monson and Phillips 1964 (/Species-Account/bna/species/bknsti/references#REF13922)). Other interior breeding records from sw. Illinois (Mckee and Fink 1995 (/Species-Account/bna/species/bknsti/references#REF4412)), Missouri (Stoddard Co.; Robbins and Easterla 1992 (/Species-Account/bna/species/bknsti/references#REF22867)) and Tennessee (Memphis; Coffey 1985 (/Species-Account/bna/species/bknsti/references#REF4402)). Along the Gulf Coast, sporadic breeding records throughout inland Louisiana (S. Cardiff pers. comm.).

Tendency to range widely and to be transported by storms makes extralimital sightings of summer nonbreeders common, and these can herald future breeding records. Following a history of extralimital summer sightings in Alberta, two pairs bred near Edmonton, Alberta, in 1977 (Dekker et al. 1979 (/Species-Account/bna/species/bknsti/references#REF4404)). Confirmed nesting records occur erratically in Alberta south of Edmonton (Beaverhill Lake, New Dayton, Calgary, Grassland Natural Region, the Parkland; Semenchuk 1992

(/Species-Account/bna/species/bknsti/references#REF55543)). Since 1977, 3 confirmed breeding records from Saskatchewan (Blackstrap, Bradwell, and Unity; Smith 1996b (/Species-Account/bna/species/bknsti/references#REF55615), C. L. Gratto-Trevor pers. comm.).

Other summer sightings: Vancouver, British Columbia, in May (Roberson 1980 (/Species-Account/bna/species/bknsti/references#REF16796)); Alberta (Pakowski Lake, Lethbridge, Airdrie, Stirling Lake, St. Albert, Irricana, Longdon, and Brooks; Semenchuk 1992 (/Species-Account/bna/species/bknsti/references#REF55543)); Timmins, Ontario, in Sep following a hurricane (Godfrey 1966 (/Species-Account/bna/species/bknsti/references#REF59349)); S. Dakota (South Dakota Ornithologists' Union 1991 (/Species-Account/bna/species/bknsti/references#REF15508)); Minnesota in Jul (Stevens Co., Roseau Co.; Buer and Buer 1989 (/Species-Account/bna/species/bknsti/references#REF4398), Winkelman 1989 (/Species-Account/bna/species/bknsti/references#REF32041)); Iowa (Kent and Dinsmore 1996 (/Species-Account/bna/species/bknsti/references#REF19075)); West Virginia (Argabrite 1994 (/Species-Account/bna/species/bknsti/references#REF39807)); s. Newfoundland in Jun and s. New Brunswick (Amos 1991 (/Species-Account/bna/species/bknsti/references#REF58276)); Bermuda (Amos 1991 (/Species-Account/bna/species/bknsti/references#REF58276)).

Winter Range

Pacific Coast and Interior. In central California between Colusa and Sacramento National Wildlife Refuge, Glenn Co., and in the San Joaquin Valley from Sacramento south to Kern Co. (Small 1994 (/Species-Account/bna/species/bknsti/references#REF7103)). Near San Francisco Bay and along the Pacific Coast from Ventura Co. to San Diego Co. (Small 1994 (/Species-Account/bna/species/bknsti/references#REF7103)); usually in Orange and San Diego Cos. and at Pt. Mugu and rare elsewhere in s. California (Garrett and Dunn 1981 (/Species-Account/bna/species/bknsti/references#REF56454)). Resident at Salton Sea in inland s. California, with occasional wintering along the Lower Colorado River Valley (Rosenberg et al. 1991 (/Species-Account/bna/species/bknsti/references#REF56157)), and near Phoenix, AZ (Bystrak 1974 (/Species-

Account/bna/species/bknsti/references#REF4400), Monson and Phillips 1964 (/Species-Account/bna/species/bknsti/references#REF13922)). Occasionally seen in winter near Loving, NM (Hubbard 1978c (/Species-Account/bna/species/bknsti/references#REF28607)).

Florida and Gulf Coast. In Florida winters along the Atlantic and Gulf Coasts and interior from Coot Bay, St. Petersburg, Tampa, and Polk Co. south (Stevenson and Anderson 1994b (/Species-Account/bna/species/bknsti/references#REF55525)). Winters in sw. coastal Louisiana (as far east as Lafayette Parrish as far north as Calcasieu; S. Cardiff pers. comm.). Rare on the upper Texas Gulf Coast, but winters from the central Gulf Coast to Rio Grande delta (Oberholser 1974c (/Species-Account/bna/species/bknsti/references#REF61013)).

West Indies. Resident throughout breeding range in the West Indies but sometimes becomes scarce outside breeding season (Brudenell-Bruce 1975 (/Species-Account/bna/species/bknsti/references#REF58563), Raffaele 1989 (/Species-Account/bna/species/bknsti/references#REF7180), Downer and Sutton 1990 (/Species-Account/bna/species/bknsti/references#REF2806), Garrido and Kirkconnell 1993a (/Species-Account/bna/species/bknsti/references#REF7618), Murphy 1994a (/Species-Account/bna/species/bknsti/references#REF32033), Sordahl 1996a (/Species-Account/bna/species/bknsti/references#REF4435), Raffaele et al. 1998 (/Species-Account/bna/species/bknsti/references#REF57325)).

Mexico, Central and South America. Winters throughout entire breeding range in Mexico, Central America, and South America, except probably does not winter in Trinidad or Tobago (ffrench 1991a (/Species-Account/bna/species/bknsti/references#REF60923)). During winter, range also expands to include all of Baja California, the entire Pacific coast from n. Sonora south to central Panama, and the Caribbean coast from Guatemala to central Panama, but more numerous along Pacific coast (Ridgely and Gwynne 1989 (/Species-Account/bna/species/bknsti/references#REF42705), Stiles and Skutch 1989 (/Species-Account/bna/species/bknsti/references#REF24711), Howell and Webb 1995 (/Species-Account/bna/species/bknsti/references#REF62109)).

Distribution Outside the Americas

Hawaiian subspecies occurs on all major islands of Hawaiian Archipelago from Ni'ihau I. eastward to Hawai'i I. except Läna'i and Kaho'olawe Is. (Pratt et al. 1987 (/Species-Account/bna/species/bknsti/references#REF58236), American Ornithologists' Union 1998a (/Species-Account/bna/species/bknsti/references#REF63025)). Has occurred at least once on Läna'i (Engilis and Pratt 1993 (/Species-Account/bna/species/bknsti/references#REF7468)), and occurrence on Hawai'i thought due to relatively recent recolonization after several decades of absence (Munro 1944a (/Species-Account/bna/species/bknsti/references#REF12316), Paton et al. 1985 (/Species-Account/bna/species/bknsti/references#REF4420), Banko 1988b (/Species-Account/bna/species/bknsti/references#REF32028)).

Extralimital presence of 3 Black-necked Stilts in Netherlands and Belgium 1991–1992 probably due to escapes from captivity; one female bred with Black-winged Stilt (Meininger 1993 (/Species-Account/bna/species/bknsti/references#REF55408)).

Nature of Migration

Short to medium-distance continental migrant from U.S. to Mexico and Central America. Migrants stop for prolonged periods at intermediate sites throughout the migratory period (Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423), C. Marn unpubl. data). In the western U.S., greatest migration concentration through central California, Salton Sea, CA, and Great Salt Lake, UT. Greater use of intermountain area of U.S. (Nevada, Utah, Idaho, and w. Montana) than Great Plains (Skagen and Knopf 1993 (/Species-Account/bna/species/bknsti/references#REF13863)). Migration in Mexico, Central and South America unstudied. Resident in Mexico, Central America, South America, Hawaiian Is., and Galapagos Is. Many authors suggest seasonal movements within the resident zone.

Sex ratios of marked migrant stilts in Tulare Basin (central California) were skewed toward females (10:7; p = 0.067 different from 1:1; Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)). However, previously mated pairs and groups of siblings also were seen together in the Tulare Basin (Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)), suggesting some family groups might migrate together.

Timing and Routes of Migration

Spring

Northbound movement from Apr to May, as early as mid-Mar and as late as Jul.

Pacific Coast and Interior. Departs lower Colorado River Valley (Arizona and California) mid-Mar to mid-May (evenly throughout the period; Rosenberg et al. 1991 (/Species-Account/bna/species/bknsti/references#REF56157)). Departs coastal Oregon mid-Apr, but as early as early Apr and as late as mid-May (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)). Vagrants appear in British Columbia from late Apr to mid-May (Campbell et al. 1990a (/Species-Account/bna/species/bknsti/references#REF15960)).

In interior, arrives nw. Nevada mid-Apr and as early as Mar (Alcorn 1988 (/Species-Account/bna/species/bknsti/references#REF1827)). Migration pulse through ne. California is late Mar–Apr (JAR and LWO). Arrives in e. Oregon late Mar to mid-Apr; sw. Idaho and interior Washington in mid-Apr; interior British Columbia in late Apr (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)). Often vagrant throughout western coastal Oregon and inland valleys in Apr and May (Gilligan et al. 1994 (/Species-Account/bna/species/bknsti/references#REF56692)). Arrives n. Utah late Mar (Sordahl Sordahl 1981a (/Species-Account/bna/species/bknsti/references#REF14274), Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)). Earliest arrivals in Kansas mid-Mar (Thompson and Ely 1989 (/Species-Account/bna/species/bknsti/references#REF14250)). Dates of spring vagrants: Oklahoma, Apr to May

(Baumgartner and Baumgartner 1992 (/Species-Account/bna/species/bknsti/references#REF6921)); Indiana, early May (Mills 1990 (/Species-Account/bna/species/bknsti/references#REF32032)); Ohio, May and Jul (Peterjohn 1989b (/Species-Account/bna/species/bknsti/references#REF56491)); Iowa, Apr to May (Dinsmore et al. 1984 (/Species-Account/bna/species/bknsti/references#REF53496), Kent and Dinsmore 1996 (/Species-Account/bna/species/bknsti/references#REF19075)); S. Dakota, May (South Dakota Ornithologists' Union 1991 (/Species-Account/bna/species/bknsti/references#REF15508)).

Atlantic Coast, Florida, West Indies. Arrival in Florida (Orlando, Kissimmee, Key Largo) mid-Feb, and in Pensacola as early as early Mar and as late as early Jun (Stevenson and Anderson 1994b (/Species-Account/bna/species/bknsti/references#REF55525)). Usually seen north of Florida during spring migration only. Atlantic Coast arrivals S. Carolina, early Apr (Post and Gauthreaux 1989 (/Species-Account/bna/species/bknsti/references#REF57751)); Virginia, mid-Apr (Kain 1987b (/Species-Account/bna/species/bknsti/references#REF14660)); Delaware, mid-Mar to mid-Apr (breeding; Hess et al. 2000b (/Species-Account/bna/species/bknsti/references#REF9678)); Maryland, 7 Apr to 1 Jun (Davidson 1996 (/Species-Account/bna/species/bknsti/references#REF39811)); New Jersey, Apr to May (Leck 1984 (/Species-Account/bna/species/bknsti/references#REF8511)); Massachusetts, May and Jun (Veit and Petersen 1993 (/Species-Account/bna/species/bknsti/references#REF17580)). New Jersey and Massachusetts records probably represent overshoots north of regular breeding areas. Vagrant in Bermuda, almost always in spring (mid-Apr to late Jun; Amos 1991 (/Species-Account/bna/species/bknsti/references#REF58276)). Arrives Bahamas in Apr (Brudenell-Bruce 1975 (/Species-Account/bna/species/bknsti/references#REF58563)), Puerto Rico and Virgin Is. in Mar (Raffaele 1989 (/Species-Account/bna/species/bknsti/references#REF7180)).

Mexico and Western Gulf of Mexico. Departs Sonora in Apr, interior Mexico in Mar (Howell and Webb 1995 (/Species-Account/bna/species/bknsti/references#REF62109)). Passes through Texas mid-Mar to mid-May (Oberholser 1974c (/Species-Account/bna/species/bknsti/references#REF61013)).

Fall

Southbound movement from Aug to Sep, as early as Jun and as late as Oct.

Pacific Coast and Interior. Passes through coastal Washington in early Aug and coastal Oregon mid-Aug to early Sep (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)). Seen as a vagrant in w. Oregon less often than in spring (Gilligan et al. 1994 (/Species-Account/bna/species/bknsti/references#REF56692)). Pass through Lower Colorado River Valley from early Jul to mid-Sep, with peak from late Jul to end of Aug (Rosenberg et al. 1991 (/Species-Account/bna/species/bknsti/references#REF56157)).

Accumulates in e. Oregon in early Aug (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)), departs in Aug and early Sep and as late as mid-Oct (Gilligan et al. 1994 (/Species-Account/bna/species/bknsti/references#REF56692)). Migration pulse through ne. California begins in late Jul; last departures in late Sep (JAR and LWO). Departs nw. Nevada in Aug, as late as early Sep (Alcorn 1988 (/Species-Account/bna/species/bknsti/references#REF1827)). Departs n. Utah by early Oct (Sordahl 1981a (/Species-Account/bna/species/bknsti/references#REF14274)). Latest departure from Kansas in early Sep (Thompson and Ely 1989 (/Species-Account/bna/species/bknsti/references#REF14250)). Vagrant fall sightings: South Dakota, Jul–Sep (South Dakota Ornithologists' Union 1991 (/Species-Account/bna/species/bknsti/references#REF15508)); w. Missouri, late Aug to Oct (Robbins and Easterla 1992 (/Species-Account/bna/species/bknsti/references#REF22867)).

Atlantic Coast, Florida, West Indies. Departs Dela–ware by mid-Sep (Hess et al. 2000b (/Species-Account/bna/species/bknsti/references#REF9678)); Maryland during late Aug (Davidson 1996 (/Species-Account/bna/species/bknsti/references#REF39811)); S. Carolina beginning in mid-Aug (Post and Gauthreaux 1989 (/Species-Account/bna/species/bknsti/references#REF57751)). Arrival in Florida from mid-Aug to late Oct, as early as Jul and as late as Nov (Stevenson and Anderson 1994b (/Species-Account/bna/species/bknsti/references#REF55525)). Departs Bahamas in early Sep and as late as early Nov (Brudenell-Bruce 1975 (/Species-Account/bna/species/bknsti/references#REF58563)), Puerto Rico and Virgin Is. in Oct (Raffaele 1989 (/Species-Account/bna/species/bknsti/references#REF7180)).

Mexico and Western Gulf of Mexico. Pass through Texas from late Jul to mid-Oct, as late as Dec (Oberholser 1974c (/Species-Account/bna/species/bknsti/references#REF61013)). Migrants arrive in both Sonora and interior Mexico beginning in Aug (Howell and Webb 1995 (/Species-Account/bna/species/bknsti/references#REF62109)).

Routes

No systematic information available. Pacific Coast stilts presumably move along the coast. Stilts from western interior move through San Joaquin Valley. Stilts banded at Honey Lake, Lassen Co., ne. California, were resighted at migration stopovers in inland central California (Tulare Basin; Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)). Birds banded at Honey Lake also wintered in central California (Sacramento National Wildlife Refuge [NWR], Grasslands Water District; JAR and LWO).

There is evidence that the migration routes of stilts from Great Salt Lake lead them to the same wintering areas as stilts from the w. Great Basin. A hatch-year stilt banded in Utah was recovered in winter near Navojoa, Sonora, and a 2-yr-old stilt from Utah was seen in the Tulare Basin in Sep 1993 (Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)).

Hawaiian Stilt migrates between Kaua‘i and Ni‘ihau Is. in response to seasonal changes in water availability (Munro 1939a (/Species-Account/bna/species/bknsti/references#REF12254), Telfer 1971 (/Species-Account/bna/species/bknsti/references#REF55413), Telfer 1974 (/Species-Account/bna/species/bknsti/references#REF39837), Engilis and Pratt 1993 (/Species-Account/bna/species/bknsti/references#REF7468)).

Migratory Behavior

See above.

Control and Physiology of Migration

No information available.

Habitat in Breeding Range

Edges of salt ponds, sewage ponds, or shallow inland wetlands, but usually in fresher parts of wetland with emergent vegetation (including cattails [*Typha latifolia*], bulrush [*Scirpus* spp.], and sedges [*Carex* spp.] in the wettest areas); also flooded lowlands or permanently flooded pastures. Nests on short emergent vegetation stubble over water and on dikes, islands, or high spots with sparse vegetation such as glasswort (*Salicornia* spp.) and saltgrass (*Distichlis* spp.). Occasional nests constructed on algal mats. Strong tendency to nest on human-made impoundments (Dinsmore 1977 (/Species-Account/bna/species/bknsti/references#REF4405), JPS, JAR, and LWO). See also Breeding: nest site, below.

Nonmigratory Populations

In ne. Venezuela, found year round in fresh and brackish lagoons and saltwater lagoons surrounded by mangrove forest; also in flooded lowlands during the rainy season (McNeil 1971 (/Species-Account/bna/species/bknsti/references#REF4413)). On the island of St. Croix, in dry areas of salt ponds, in adjacent uplands, and on constructed mounds of vegetation within the saltwater (W. Knowles pers. comm.).

In Hawaiian Is.: islets, islands, edges of shallow ponds, and mud flats where water is fresh to saline (up to 116 ppt recorded; Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)) and ancient fishponds constructed by Hawaiians (Morin 1994 (/Species-Account/bna/species/bknsti/references#REF12208)). In most wetlands, the predominant vegetation is invasive and introduced, and must be controlled by active management. Characteristic associated wetland plants include nonnative pickleweed (*Batis maritima*) and nonnative California grass (*Brachiaria mutica;* Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). Other characteristic wetland plants include *Paspalum* spp. (seashore paspalum or knotgrass), native ʻaeʻae or water hyssop (*Bacopa monnieri*), native ʻäkulikuli or sea purslane (*Sesuvium portulacastrum*), the native sedge makaloa (*Cyperus laevigatus*), and the native sedge kaluhä (*Bolboschoenus maritimus*; M. Morin pers. comm.). Nesting almost exclusively on human-maintained wetlands because others are too overgrown. Also uses edges of taro ponds (Broshears 1979 (/Species-Account/bna/species/bknsti/references#REF39808)), but harvest and deliberate flooding of the ponds often affect reproduction (JMR).

Habitat in Migration

Salt marshes, shallow lagoons with muddy shores, salt ponds, evaporation ponds and other impoundments, rice fields. Evaporation ponds, agricultural croplands, and managed wetlands most heavily used habitats in California Central Valley (Shuford et al. 1994a (/Species-Account/bna/species/bknsti/references#REF9160)).

Habitat in the Winter Range

Rice fields, salt marshes, and, rarely, marine shores. In Florida (Dinsmore 1977 (/Species-Account/bna/species/bknsti/references#REF4405)): impounded settling ponds rimmed with knotgrass (*Paspalum vaginatum*) and saltbush (*Baccharis* sp.). In Central America and South America, mangrove swamps, with stilts moving back into grassland pools and flooded lowlands during rainy periods (Wetmore 1965b (/Species-Account/bna/species/bknsti/references#REF55635), McNeil 1971 (/Species-Account/bna/species/bknsti/references#REF4413)). Stilts wintering in Sinaloa, w. Mexico, were evenly distributed throughout interior parts of coastal bays; birds were nearly always in pairs (Engilis et al. 1998 (/Species-Account/bna/species/bknsti/references#REF13873)).

Historical Changes to the Distribution

Breeding Range

Pacific Coast. Before 1950, present in “limited numbers” around San Francisco Bay in summer and fall, with a few stragglers in winter (Grinnell and Wythe 1927 (/Species-Account/bna/species/bknsti/references#REF28493)). Possibly responding to interior habitat conditions, breeding in salt pond habitat in South San Francisco Bay increased to >600 pairs in 1981 (Shuford 1993a (/Species-Account/bna/species/bknsti/references#REF27730)).

Interior. Breeding range in w. U.S. has expanded northward over last 20 yr. Species has been sighted as an occasional visitor in British Columbia and Manitoba; successful nests in Alberta (Chapman et al. 1985 (/Species-Account/bna/species/bknsti/references#REF4401)) and Saskatchewan (Salisbury and Salisbury 1989 (/Species-Account/bna/species/bknsti/references#REF4427)). Of 14 Saskatchewan sight records, 10 occurred since 1977 (Smith 1996b (/Species-Account/bna/species/bknsti/references#REF55615)). Breeding first suspected in Washington state in 1960, confirmed in 1973, and at least 5 nest-ings at 3 localities documented in 1977 (Rohwer et al. 1979 (/Species-Account/bna/species/bknsti/references#REF4424)). Extralimital breeding in 1977 attributed to drought in w. U.S., but has continued to be reported (e.g., in Washington in 1979; Rohwer et al. 1979 (/Species-Account/bna/species/bknsti/references#REF4424); Canada in 1987 and 1989; Wedgwood and Taylor 1988 (/Species-Account/bna/species/bknsti/references#REF4443), Salisburg and Salisburg Salisbury and Salisbury 1989 (/Species-Account/bna/species/bknsti/references#REF4427)). Black-necked Stilts now established as local breeders in Washington (Pothole Res. and rarely to Reardan; Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)). Unusual numbers seen in w. Oregon (Willamette Valley) in 1981, 1984 (130 individuals), 1985 (70 individuals) and 1987 (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)). Coastal sightings in Washington and Oregon have increased in parallel with increases in birds in the interior (Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)). An 1894 breeding record from Port Qu'Apelle, Saskatchewan, has been questioned (Godfrey 1966 (/Species-Account/bna/species/bknsti/references#REF59349)) but might be valid since the record was also from a period of widespread drought (Smith 1996b (/Species-Account/bna/species/bknsti/references#REF55615)). Since the late 1980s the breeding range has expanded north along the Mississippi River from s. Louisiana to w. Tennessee, se. Missouri, and sw. Illinois (M. robbins pers. comm.).

Atlantic Coast. In 1800s, bred along North American Atlantic Coast as far north as New Jersey (Ridgway 1919 (/Species-Account/bna/species/bknsti/references#REF58543)), with sightings of stragglers as far north as Rockland, ME (Knight 1908 (/Species-Account/bna/species/bknsti/references#REF9234)) and Grand Manan, New Brunswick (Forbush 1912 (/Species-Account/bna/species/bknsti/references#REF51570)). Range contracted due to spring and summer shooting, and by 1840 species rarely seen north of Georgia (Forbush 1912 (/Species-Account/bna/species/bknsti/references#REF51570)). Present breeding usually only as far north as Delaware. A few stilts seen in New Jersey each summer, and breeding records there would not be surprising (Leck 1984 (/Species-Account/bna/species/bknsti/references#REF8511)). Reintroduction attempt in New Jersey in 1952 was unsuccessful (Leck 1984 (/Species-Account/bna/species/bknsti/references#REF8511)). Regular breeding in coastal Delaware (Hess et al. 2000b (/Species-Account/bna/species/bknsti/references#REF9678)) and multiple records of breeding stilts in Maryland, and Pennsylvania since 1962 (records in Holgersen 1971 (/Species-Account/bna/species/bknsti/references#REF55407), Santner 1992a (/Species-Account/bna/species/bknsti/references#REF4428), Davidson 1996 (/Species-Account/bna/species/bknsti/references#REF39811)) suggest that stilts might return to breed in their pre-extirpation range in e. U.S.

Gulf Coast and Florida. Recent occasional breeding records in nw. Louisiana probably related to construction of water control structures for navigation (P. Dickson pers. comm.). Florida breeding range has also expanded recently. In 1932, only as far north as Seminole and Orange Cos., Kissimmee, and Punta Gorda. Recent records have extended from Tampa to Pensacola; also Mobile Bay, AL (Stevenson and Anderson 1994b (/Species-Account/bna/species/bknsti/references#REF55525)).

Winter Range

Mexico and Western Gulf. Wintering range has expanded along the Gulf Coast over the last 20–30 yr. Once confined to Cameron Parish in extreme sw. Louisiana, now commonly winters throughout the broader rice-growing regions of Louisiana (S. Cardiff pers. comm.; see The Americas, above).

Fossil History

Tertiary

Membership of several fossil genera in Recurvirostridae (Brodkorb 1967 (/Species-Account/bna/species/bknsti/references#REF57718)) has been questioned (Olson 1985d (/Species-Account/bna/species/bknsti/references#REF10883)). An extinct species of stilt, *H. olsoni,* from late Miocene of Arizona was characterized by longer legs and larger, stouter skeletal elements (Bickart 1990b (/Species-Account/bna/species/bknsti/references#REF59244)) relative to recent stilts.

Pleistocene

Worldwide, three species of stilts known from Pleistocene fossils (Brodkorb 1967 (/Species-Account/bna/species/bknsti/references#REF57718)). In North America, fossil stilts from Pleistocene conspecific with recent Black-necked Stilt. Fossils found at Fossil Lake, OR (Howard 1946 (/Species-Account/bna/species/bknsti/references#REF25086)), and Smith Creek Cave, NV (Howard 1952 (/Species-Account/bna/species/bknsti/references#REF22860)). In contrast to American Avocets, Black-necked Stilts have not been found in the Pleistocene avifaunas of the McKittrick or La Brea tar pits, and it is possible that the two species were not sympatric in California at that time (Miller and DeMay 1942 (/Species-Account/bna/species/bknsti/references#REF4414)).

Holocene

Prehistoric sites in the same areas as McKittrick (Kern Co., CA) and Rancho La Brea (Los Angeles Co., CA) yield remains of both Black-necked Stilt and American Avocet (Miller and DeMay 1942 (/Species-Account/bna/species/bknsti/references#REF4414)). One bone (<500 yr old) from each species identified from Indian kitchen middens at Buena Vista Lake, CA (Demay 1942 (/Species-Account/bna/species/bknsti/references#REF11667)). A prehistoric record of *H. m. knudseni* is known from Oʻahu I. (Table 5 in Olson and James 1991 (/Species-Account/bna/species/bknsti/references#REF39103)).

Systematics (/Species-Account/bna/species/bknsti/systematics)

Diet and Foraging (/Species-Account/bna/species/bknsti/foodhabits)

Conservation and Management (/Species-Account/bna/species/bknsti/conservation)

Priorities for Future Research (/Species-Account/bna/species/bknsti/priorities)

Acknowledgments (/Species-Account/bna/species/bknsti/acknowledgments)

About the Author(s) (/Species-Account/bna/species/bknsti/aboutauthors)

Multimedia (/Species-Account/bna/species/bknsti/multimedia/photos)

Tables and Appendices (/Species-Account/bna/species/bknsti/appendices)

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Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

Diet and Foraging

Feeding

Feed day and night (Robert et al. 1989 (/Species-Account/bna/species/bknsti/references#REF19854)).

Main Foods Taken

Aquatic invertebrates, also fish (Hawaiian Stilt; Telfer Telfer 1973a (/Species-Account/bna/species/bknsti/references#REF4436), Telfer 1976 (/Species-Account/bna/species/bknsti/references#REF4437)).

Microhabitat For Foraging

While wading, tend to feed in shallow water at any depth up to the height of the breast (approximately 130 mm for males, 110 mm for females; Hawaiian Stilt, Telfer 1973a (/Species-Account/bna/species/bknsti/references#REF4436)). Avoid getting the breast wet. Some evidence that depths used are slightly different for avocets and for male and female Black-necked Stilts (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)); difference is primarily related to longer legs of male stilt.

In Hawaii, stilts cluster to feed around delivery pipes carrying water runoff from sugar cane fields (Telfer 1973a (/Species-Account/bna/species/bknsti/references#REF4436)).

Food Capture And Consumption

Hamilton (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)) described 3 visual feeding methods: Pecking, Plunging, and Snatching. Pecking method consists of visual search for prey while standing still or walking slowly, followed by a quick jab of the bill to capture prey on mud or near water surface; head does not go under water. In Plunging method, head and upper breast enter water to capture food from within the water column. Snatching method involves capture of a flying insect with bill. Black-necked Stilts also feed using tactile methods, but these have only been observed in wintering areas (Robert and McNeil 1989a (/Species-Account/bna/species/bknsti/references#REF11387), Cullen 1994 (/Species-Account/bna/species/bknsti/references#REF32030)).

In another food capture method, Scythe-like Sweeps, bird walks or runs and swipes the head and bill through water or liquid mud (compare to Single Scythe and Multiple Scythe described for American Avocets by Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). In Head Immersion behavior, bird immerses its head and a portion of its neck in the water while feeling in the soft mud. Hamilton's (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)) Plunging and Robert's and McNeil's (Robert and McNeil 1989a (/Species-Account/bna/species/bknsti/references#REF11387)) Head Immersion may not be completely distinct. Visually locates and pecks at brine shrimp (*Artemia salina*) on the surface of the water, and brine flies (Ephydridae, *Ephedra* spp.) along the shoreline.

Robert and McNeil (Robert and McNeil 1989a (/Species-Account/bna/species/bknsti/references#REF11387)) quantified feeding behaviors at a wintering site in ne. Venezuela. During nighttime, visual and scything methods were used equally (*n* = 38 and 33 observations respectively; unknown number of individuals). During daytime, feeding predominantly visual when winds were calm; switched to tactile plunging when winds >30 km/h. In a separate sampling study (Robert et al. 1989 (/Species-Account/bna/species/bknsti/references#REF19854)), stilts were seen foraging in 66.7% of nighttime observations, but only on 1.9% of daytime observations (day *n* = 54, night *n* = 102).

At least for some prey items, greater foraging success has been observed in groups than solitarily (Burger 1980a (/Species-Account/bna/species/bknsti/references#REF4399)). Hatch-year Black-necked Stilts in Texas spent more time foraging than adults, and foraged later in the day than did adults (Burger 1980a (/Species-Account/bna/species/bknsti/references#REF4399)).

Hawaiian Stilt feeds using Scythe-like Sweeps and Plunging (Ohashi and Burr 1977 (/Species-Account/bna/species/bknsti/references#REF39824), Telfer and Burr 1978 (/Species-Account/bna/species/bknsti/references#REF39839)). Also trap fish by concentrating them in shallow water (Telfer Telfer 1975 (/Species-Account/bna/species/bknsti/references#REF44310), Telfer 1976 (/Species-Account/bna/species/bknsti/references#REF4437)).

Diet

Major Food Items

On salt ponds: brine shrimp, brine flies, and terrestrial insects (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). In freshwater wetlands (Wetmore 1925b (/Species-Account/bna/species/bknsti/references#REF18618)): crawfish (*Cambarus* sp.); water-boatmen (Hemiptera, Corixidae); adult and larval beetles (Coleoptera), especially crawling water-beetles (Haliplidae), predaceous diving beetles (Dysticidae), water-scavenger beetles (Hydrophilidae), and aquatic species of weevils (Curculionidae); fly larvae (Diptera), especially soldier flies (Stratiomyiidae) and brine flies (Ephydridae); snails (Gastropoda); small fish (carp [*Cyprinus carpio*] and sunfish [Centrarchidae]); and frogs (Anura).

Vertebrate prey are an important part of the diet of Hawaiian Stilts (70% of foraging time spent pursuing fish; Telfer 1975 (/Species-Account/bna/species/bknsti/references#REF44310)); including fish (Mozambique tilapia [*Tilapia mossambica*] and mosquito fish [*Gambusia affinis*]) and tadpoles (*Bufo* spp.; Telfer and Woodside 1977 (/Species-Account/bna/species/bknsti/references#REF44311)). Also consume invertebrates such as water boatmen, beetles, and possibly brine fly larvae (Ohashi and Telfer 1977 (/Species-Account/bna/species/bknsti/references#REF39825), Telfer Telfer 1973a (/Species-Account/bna/species/bknsti/references#REF4436), Telfer 1975 (/Species-Account/bna/species/bknsti/references#REF44310), Telfer 1976 (/Species-Account/bna/species/bknsti/references#REF4437), Telfer and Burr Telfer and Burr 1978 (/Species-Account/bna/species/bknsti/references#REF39839), Telfer and Burr 1979 (/Species-Account/bna/species/bknsti/references#REF55414)).

Quantitative Analysis

From analysis of 80 stomachs from stilts in California, Utah, Florida, and Puerto Rico (details in Wetmore 1925b (/Species-Account/bna/species/bknsti/references#REF18618)): 35% true bugs (Hemiptera), 32.4% beetles, 9.7% flies, 7.9% snails, 3.3% caddisflies (Trichoptera), 3.2% fish, 2.7% miscellaneous animals (grasshoppers and crickets [Orthoptera] and a frog [Anura]), 2.9% dragonfly nymphs (Odonata), 1.3% mayflies (Ephemeroptera), 1.1% seeds and vegetative matter, 0.5% crawfish (by weight).

Food Selection and Storage

Information on food selection not available. Food storage not observed.

Nutrition and Energetics

Two cycles of fattening and loss occur each year: fattening periods are prebreeding and postbreeding (premigratory), and occur in both migrant and resident stilt populations (McNeil 1971 (/Species-Account/bna/species/bknsti/references#REF4413)).

Metabolism and Temperature Regulation

Under hot conditions, pants while incubating and wets belly to cool eggs (see Breeding: incubation, below).

Drinking, Pellet-Casting and Defecation

Hamilton (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)) did not observe stilts drinking in his thorough behavioral studies. Moved from aquatic feeding area to land to defecate in 73.8% of 62 cases (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)).

‹ **Distribution, Migration and Habitat (/Species-Account/bna/species/bknsti/distribution)**

Sounds and Vocal Behavior (/Species-Account/bna/species/bknsti/sounds) ›

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American Avocet (/Species-Account/bna/species/ameavo/demography/)

Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

Demography and Populations

Measures of Breeding Activity

Age At First Breeding; Intervals Between Breeding

Two males and one female bred at age 1 yr in s. California (James 1995b (/Species-Account/bna/species/bknsti/references#REF39817)). One of 51 banded stilt chicks returned and bred at age 2 yr in n. Utah (Sordahl 1984 (/Species-Account/bna/species/bknsti/references#REF38516)). One record of Hawaiian Stilt female breeding at age 1 yr (within 1 m of natal site) but probably more typical at age 2 yr (JMR).

Clutch

See Breeding: eggs, above.

Annual And Lifetime Reproductive Success

Appendix 2 (/Species-Account/bknsti/appendix/APP1002810) . At breeding sites potential reproduction is lost at both egg and chick stages, primarily due to predation and flooding. Nesting success (proportion of nests that hatched ≥1 egg) variable by location depending on whether nesting areas are on islands that protect nests from ground predators. In Tulare Basin, CA, nest success varied from 11.1% (*n* = 36 nests) to 100% (*n* = 47; mean across *n* = 14 sites with ≥30 nests each, 59.8% ± 26.8 SD; overall mean 59.7%, *n* = 1,706 nests, JPS). Success rates at sites where most nests are on islands are higher than at other sites (one-tailed *t* = 2.2, *df* = 12, *p* = 0.024, JPS). At Salton Sea, CA, 37.9% (*n* = 58; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). In n. Utah, mean of 1.3 eggs hatched/nest (*n* = 18 nests, 72 eggs), and 32% of eggs hatched, with majority of nest failures due to egg predation; for eggs that remained in nest long enough to hatch, egg viability 95.8% (*n* = 24; Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)). Downy broods averaged 3.06 chicks ± 1.03 SD (*n* = 17) and Juvenile-plumaged broods averaged 2.41 chicks ± 0.79 SD (*n* = 97), a significant decrease in brood size (1-tailed *t* = 2.06, *df* = 112, *p* <0.05, Cache Co., Utah; Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)).

Chicks hatched/nest for Hawaiian Stilts: 2.18 chicks ± 1.6 SD (*n* = 982; compiled by JMR from years of USFWS monitoring: Chang 1990 (/Species-Account/bna/species/bknsti/references#REF44304), Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403), Dougherty et al. 1978 (/Species-Account/bna/species/bknsti/references#REF39812), Ohashi and Telfer 1977 (/Species-Account/bna/species/bknsti/references#REF39825), Telfer Telfer 1972 (/Species-Account/bna/species/bknsti/references#REF39836), Telfer 1974 (/Species-Account/bna/species/bknsti/references#REF39837), Telfer 1983 (/Species-Account/bna/species/bknsti/references#REF4438), Telfer 1984a (/Species-Account/bna/species/bknsti/references#REF39838), Telfer 1985 (/Species-Account/bna/species/bknsti/references#REF32040), Telfer et al. Telfer et al. 1981 (/Species-Account/bna/species/bknsti/references#REF4439), Telfer et al. 1982 (/Species-Account/bna/species/bknsti/references#REF4440), Ueoka et al. 1976 (/Species-Account/bna/species/bknsti/references#REF39841), Ueoka and Telfer 1980 (/Species-Account/bna/species/bknsti/references#REF4442), Woodside 1979b (/Species-

Account/bna/species/bknsti/references#REF4445)). Hawaiian Stilt fledging success (number of fledglings per brood): 0.934 fledglings ± 0.431 SD (weighted mean across 4 yr, 1985-1988, range 0.125-1.355, *n* = 131); 0.887 fledglings ± 0.550 SD (simple mean of means, *n* = 4 yr, USFWS unpubl.).

No lifetime reproductive success data available for stilts.

Number Of Broods Normally Reared Per Season

One. A pair of Hawaiian Stilts fledged one brood and laid a second clutch, so two broods per year possible in Hawaiian Is. (M. Morin unpubl. data).

Proportion Of Total Females That Rear At Least One Brood To Nest-Leaving Or Independence

Estimate not available because of difficulty in estimating total number of females in breeding area. Available studies (1) only marked a portion of females and (2) observed significant movement of both marked and unmarked individuals into and out of study area during breeding season.

Life Span and Survivorship

Sufficient banding and long-term monitoring has not been conducted. However, based on records for *R. americana* and *R. avosetta* at least 10 yr would be expected (Robinson et al. 1997 (/Species-Account/bna/species/bknsti/references#REF39831)). In captivity, a Black-necked Stilt survived 19 yr (cited by Johnson 1987a (/Species-Account/bna/species/bknsti/references#REF39818)). Hawaiian Stilts alive in 1996 have survived 15 yr in captivity, and several wild stilts banded in 1978-1980 were still alive in 1995 (JMR).

Due to the length of the putative life span and the relatively recent emphasis on banding of adults, longitudinal life table analyses are not available. No systematic study of survivorship can yet be done, but may eventually become available from recoveries from extensive banding of this species in the 1990s.

From two Hawaiian Stilt cohorts, first year survival was 0.53 and 0.60; survival from first to second year for one cohort was 0.81 (Reed et al. 1998d (/Species-Account/bna/species/bknsti/references#REF44669)).

Disease and Body Parasites

Disease

Black-necked Stilts and American Avocets are the shorebird species most frequently stricken with botulism (caused by the bacterium *Clostridium botulinum* type C_a; see review by Rosen 1971 (/Species-Account/bna/species/bknsti/references#REF4425); also see discussion of botulism in Hawaiian Stilt, Morin 1996 (/Species-Account/bna/species/bknsti/references#REF4415)). Their diets, ranges, and habitat preferences all correspond to risk factors for the occurrence of botulism epidemics. In severe botulism outbreaks, number of stilt deaths would be sufficient to affect population dynamics (JAR). Large numbers of stilts are most likely to be affected in w. U.S. (especially California, Utah, and Nevada) in late summer and early fall, and in years when higher-than-normal precipitation produces an abundance of shallow, stagnant wetlands. Botulism toxin causes flaccid paralysis, evidenced by staggering and eventual loss of use of legs (Alcorn 1942 (/Species-Account/bna/species/bknsti/references#REF1819), Rosen 1971 (/Species-Account/bna/species/bknsti/references#REF4425)). In contrast to Black-necked Stilts, botulism uncommon in Hawaiian Stilts even when other waterbird species are dying in the same ponds (Brock and Breese 1953 (/Species-Account/bna/species/bknsti/references#REF60611)), possibly because they do not eat the maggots on morbid carcasses; outbreaks do occur, however, under certain conditions (Morin 1996 (/Species-Account/bna/species/bknsti/references#REF4415)).

Avian cholera (*Pasteurella multocida multocida*) has also been identified as a cause of death in wild stilts (Hirsch et al. 1990 (/Species-Account/bna/species/bknsti/references#REF32031)).

Parasites

Internal Parasites. Well categorized, including 6 species of trematodes, 9 species of cestodes, and 10 species of nematodes (review and checklist in Hinojos and Canaris 1988 (/Species-Account/bna/species/bknsti/references#REF39814)). When collected, usually infected with at least 1 species of helminth parasite (34 of 35 birds collected contained helminths, Hinojos and Canaris 1988 (/Species-Account/bna/species/bknsti/references#REF39814); also noted for Hawaiian Stilts by Perkins 1903 (/Species-Account/bna/species/bknsti/references#REF16433), Schwartz and Scwhartz 1951 (/Species-Account/bna/species/bknsti/references#REF32037)). A tapeworm (*Diplophallus polymorphus*) is the most common species observed. Although multiple tapeworms can be present in the small intestine early in infection, competition increases as the worms grow, and eventually only two large worms survive (Ahern and Schmidt 1976 (/Species-Account/bna/species/bknsti/references#REF55404), Burt 1980 (/Species-Account/bna/species/bknsti/references#REF39809), Hinojos and Canaris 1988 (/Species-Account/bna/species/bknsti/references#REF39814)).

External Parasites. Three of 35 (9%) collected by Hinojos and Canaris (Hinojos and Canaris 1988 (/Species-Account/bna/species/bknsti/references#REF39814)) were infected with nasal mites (*Rhinonyssus himantopus*; identified from Black-necked Stilts in Texas, Cuba, and Louisiana; Pence Pence 1972e (/Species-Account/bna/species/bknsti/references#REF11689), Pence 1975 (/Species-Account/bna/species/bknsti/references#REF32035) and op cit.). Malcomson (Malcolmson 1960 (/Species-Account/bna/species/bknsti/references#REF14048)) listed 2 species of lice (Mallophaga); augmented to 6 species by Hinojos and Canaris (Hinojos and Canaris 1988 (/Species-Account/bna/species/bknsti/references#REF39814)) with 63% (*n* = 35) of stilts infected with lice. Lice also noted on Hawaiian Stilts (Schwartz and Scwhartz 1951 (/Species-Account/bna/species/bknsti/references#REF32037), JMR). Hawaiian Stilt chicks commonly infested with feather mites (Acarina) and lice (25% heavily infested, *n* = 56 chicks 7-17 d old; JMR).

Nest Parasites. Louse flies (*Ornithomyia* spp.) in nest of *Himantopus* sp. (probably *H. himantopus*, Séguy 1935 in Hicks 1962 (/Species-Account/bna/species/bknsti/references#REF8184)).

Causes of Mortality

Adult mortality results from predation (see Behavior: predation, above) and botulism (see Diseases and body parasites, above). In addition to these factors, mortality of flightless young observed following unseasonable cold storms, after observed leg injury, and during movements from nest area to nursery (JAR and LWO); chick mortality also due to contaminants (see Conservation and management: effects of human activity, below). Eggs lost primarily to predation and flooding (Sordahl 1996a (/Species-Account/bna/species/bknsti/references#REF4435), JAR and LWO; Hawaiian Stilt: e.g., Ohashi and Telfer 1977 (/Species-Account/bna/species/bknsti/references#REF39825), Dougherty et al. 1978 (/Species-Account/bna/species/bknsti/references#REF39812), Woodside 1979a (/Species-Account/bna/species/bknsti/references#REF32042), Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Range

Initial Dispersal From Natal Site

No suitable sample available.

Fidelity To Breeding Site And Winter Home Range

In a banding study in s. California (4 yr, >12 adults, about 157 chicks banded), 22 birds were resighted during the nonbreeding season, 3 cases of natal philopatry, and 2 cases of adult breeding site fidelity (James 1995b (/Species-Account/bna/species/bknsti/references#REF39817)). Two of 9 (22%) adult stilts returned the next breeding season in n. Utah (Sordahl 1984 (/Species-Account/bna/species/bknsti/references#REF38516)).

Home Range

No information available.

Population Status

Numbers: Estimates Or Counts Of Density

Species ranked as highly vulnerable to habitat alteration relative to w. North American shorebirds as a whole (Page and Gill 1994 (/Species-Account/bna/species/bknsti/references#REF54678)). Population status of breeders is not known.

At least 25,000 *H. m. mexicanus* winter in North America west of the Rocky Mtns. and from Sinaloa, Mexico, north; these numbers are probably reduced relative to presettlement conditions due to wetland losses over the last 200 yr (Page and Gill 1994 (/Species-Account/bna/species/bknsti/references#REF54678)). Peak numbers of migrants approximately 2,000 in se. Oregon (Oregon Dept. of Fish and Wildlife unpubl.); 17,000 in Central Valley, CA (Shuford et al. 1994a (/Species-Account/bna/species/bknsti/references#REF9160)); 100,000 at Salton Sea, CA (Setmire et al. 1993 (/Species-Account/bna/species/bknsti/references#REF60607)); 1,700 in Lahontan Valley, NV (U.S. Fish and Wildlife Service 1995a (/Species-Account/bna/species/bknsti/references#REF39840)); 65,000 at Great Salt Lake, UT (Shuford et al. 1994b (/Species-Account/bna/species/bknsti/references#REF32038)).

Identification of important wintering areas is limited by survey data for Mexico. At least 1,000 stilts were counted in aerial surveys in 1992 of coastal nw. Mexico (Morrison et al. 1992 (/Species-Account/bna/species/bknsti/references#REF60365)). Approximately 6,000 counted in Dec 1993 and again in Feb 1994 at Ensenada Pabellones and Bahía Santa María, Sinaloa, Mexico. These counts considered minimal estimates of numbers there because stilts used winter habitat in vegetated estuarine areas and were extremely difficult to census (Engilis et al. 1998 (/Species-Account/bna/species/bknsti/references#REF13873)).

Due to habitat loss and hunting, Hawaiian Stilts declined to as few as 200 birds in 1944 (Munro 1960 (/Species-Account/bna/species/bknsti/references#REF59182)), but rebounded by 1949 after hunting them was banned (Schwartz and Schwartz 1949 (/Species-Account/bna/species/bknsti/references#REF13027)). Current population size is around 1,100-1,500 individuals (Banko 1988b (/Species-Account/bna/species/bknsti/references#REF32028), Hawaii Div. of Forestry and Wildlife unpubl.).

Trends

Breeding Bird Survey (BBS) data showed no significant trends 1966-1996 in the conterminous U.S., its regions, or the entire survey area (Sauer et al. 1997 (/Species-Account/bna/species/bknsti/references#REF38903)). A potentially significant decline was reported for Texas 1966-1979 (trend -13.7, *n* = 12, *p* = 0.08; Sauer et al. 1997 (/Species-Account/bna/species/bknsti/references#REF38903)). Consistent with recent expansions of breeding at the edges of the range (see Distribution: historical changes, above), BBS data suggest increases in populations in the U.S. (trend +3.3, *n* = 84, *p* = 0.08) and survey-wide (trend +3.0, *n* = 84, *p* = 0.09; Sauer et al. 1997 (/Species-Account/bna/species/bknsti/references#REF38903)). From 1980 to 1995 Hawaiian Stilt numbers appeared to be on a slow increase statewide, although the lack of good, long-term census records for Ni'ihau make this uncertain (Reed and Oring 1993b (/Species-Account/bna/species/bknsti/references#REF39829)).

Population Regulation

Although demographic data exist for some parameters (such as breeding biology), the structure and regulation mechanisms of Black-necked Stilt populations are not understood. Results from banding studies in ne. California have been limited by low adult return rates and marked pairs that breed there in some years and at unknown locations in other years (making inferences more difficult than for American Avocets banded in the same study). Hawaiian Stilts live in discrete local populations with quantifiable movement among wetlands and major islands (reviewed in Reed et al. 1994b (/Species-Account/bna/species/bknsti/references#REF39830)). Population modeling indicates that observed movements and colonization abilities should stabilize statewide population size (Reed et al. 1998d (/Species-Account/bna/species/bknsti/references#REF44669)). For both Black-necked Stilts and Hawaiian Stilts, the fate and success of such movements are unknown.

‹ **Breeding (/Species-Account/bna/species/bknsti/breeding)**

Conservation and Management (/Species-Account/bna/species/bknsti/conservation) ›

Tables and Appendices (/Species-Account/bna/species/bknsti/appendices)

References (/Species-Account/bna/species/bknsti/references)

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Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

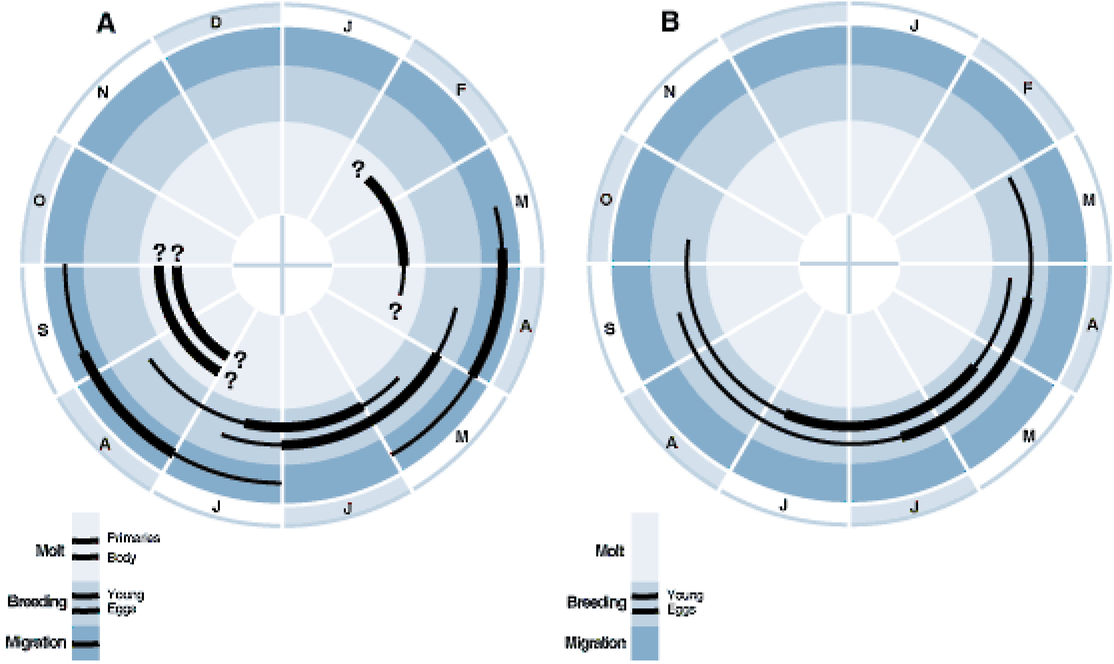
Breeding

(https://download.ams.birds.cornell.edu/api/v1/asset/24913111)

Downy young Black-necked Stilt, Louisiana, May

+ **Enlarge (https://download.ams.birds.cornell.edu/api/v1/asset/24913111)**

, May 30, 2005; photographer N. Smith



(https://download.ams.birds.cornell.edu/api/v1/asset/25022811)

Figure 5. Annual cycles of Black-necked and Hawaiian stilts.

+ Enlarge (https://download.ams.birds.cornell.edu/api/v1/asset/25022811)

A. Black-necked Stilt breeding (ne. California; JAR and LWO) and migration (central California to Sonora; JAR, LWO, and C. Marn), molt data approximate. B. Hawaiian Stilt (O‘ahu; Coleman 1981, Chang 1990).

(https://download.ams.birds.cornell.edu/api/v1/asset/24944701)

Black-necked Stilt nest and eggs; Salton Sea, CA, January.

➕ **Enlarge (https://download.ams.birds.cornell.edu/api/v1/asset/24944701)**

An open, ground-nesting species; generally on an alkali flat, dike or island.; photographer Rick and Nora Bowers

(https://download.ams.birds.cornell.edu/api/v1/asset/24931151)

Adult male and female Black-necked Stilts at their nest. Deerfield Beach, FL. June.

✚ Enlarge (https://download.ams.birds.cornell.edu/api/v1/asset/24931151)

The following link is to this contributor's Flickr stream or website. http://www.flickr.com/photos/39187618@N04/ (http://www.flickr.com/photos/39187618@N04/), Jun 22, 2007; photographer Amber Burnette

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Phenology

Pair Formation

Some pairs probably form on wintering grounds or during migration, but other individuals arrive at breeding sites unpaired (Sordahl 1984 (/Species-Account/bna/species/bknsti/references#REF38516), JAR and LWO). In Hawaiian Is., birds can appear to be paired at any time of the year, although less frequently in winter (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Nest-Building

Nest building completed immediately prior to egg-laying.

First/Only Brood Per Season

Figure 5 (https://download.ams.birds.cornell.edu/api/v1/asset/25022811) (ne. California and Hawaiian Is.); also see data for n. Utah in Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546) . At Salton Sea, CA: earliest egg-laying 2 Apr, median egg-laying 15 May, median hatching 14 Jun, latest active incubation 16 Aug (Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). At McKay Bay, Florida: adults arrive mid-Mar, with peak hatching during last week of May (Dinsmore 1977 (/Species-Account/bna/species/bknsti/references#REF4405)). At Cache Co., UT: arrival in late Mar, copulations 11 Apr–6 Jun, nests with eggs 23 Apr–10 Jul, hatching 20 May–6 Jul, latest clutch initiation 9 Jun, flightless young until 5 Aug (Sordahl 1981a (/Species-Account/bna/species/bknsti/references#REF14274)). In Great Salt Lake Valley, UT: arrival late Mar (Paton et al. 1992 (/Species-Account/bna/species/bknsti/references#REF56657)), nesting begins late Apr, latest clutches initiated mid-Jun (T. A. Sordahl pers. comm.). At Lassen Co., CA: arrival in late Mar, copulations begin mid-Apr, nests with eggs 18 Apr–19 Jul, hatching 14 May–20 Jul, latest clutch initiation 22 Jun, flightless young until 17 Aug (1992–1994; JAR and LWO). In ne. Venezuela (where birds are resident), breeds Apr (beginning of rainy season) through Jul (McNeil 1971 (/Species-Account/bna/species/bknsti/references#REF4413)). For Hawaiian Stilts, mid-Feb through late Aug with peak nesting varying among years (mid-May 1978, late Mar 1979, O‘ahu; Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Nest Site

Selection Process

Selected jointly by the pair.

Microhabitat

Appendix 1 (/Species-Account/bknsti/appendix/APP1001991) . Nest scrape in soft substrate of alkali flat, dike or island. Often over water on small islands or vegetation clumps (JAR and LWO; for Hawaiian Stilt, Telfer 1975 (/Species-Account/bna/species/bknsti/references#REF44310)). Although nests often completely in the open, at some sites nests surrounded by a mean of 56% vegetative cover (*n* = 47 nests), mostly glasswort and frakenia (*Frankenia grandifolia*; at Bolsa Chica, CA; James 1995b (/Species-Account/bna/species/bknsti/references#REF39817)). In tidal impoundments with 95% open water, flooded salt-meadow cordgrass (*Spartina patens*) and saltgrass (*Distichlis spicata,* in Delaware, north of the usual breeding range). Along water's edge of impoundments in clumps of barnyard grass (*Echinochloa crusgalli* var. *crusgalli*) or Bermuda grass (*Cynodon dactylon;* Texas; J. M. Cys pers. comm.). On dead remains of cattails protruding above the waterline (nw. Nevada; JAR). Short emergent vegetation stubble over water and on dikes, islands, or high spots with sparse vegetation, particularly glasswort and saltgrass (*Distichlis stricta*; Sordahl 1996a (/Species-Account/bna/species/bknsti/references#REF4435), unpubl. data).

Site Characteristics

Often slightly elevated (2–10 cm) from surrounding substrate. In Utah, 74% of nests in vegetation, others in the open (*n* = 23, Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)). Nests studied by Hamilton (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)) tended to be on the leeward side of the dike.

Islets are highly preferred for nesting (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403), JPS). In Tulare Lake Basin, CA, 100–150 nests found on each of several small (0.1 ha) islets (JPS). When wavebreak islands were removed at one agricultural evaporation pond in Tulare Lake Basin, nest attempts declined by 75% and nest predation increased 25-fold within two breeding seasons (JPS). No nests found by 8th postremoval breeding season (Harvey 1996 (/Species-Account/bna/species/bknsti/references#REF39815)).

For distances to water, see Appendix 1 (/Species-Account/bknsti/appendix/APP1001991) . Additional data: Salton Sea, CA, 15.9 m ± 21.6 SD (range 0–91.4, *n* = 128; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)); Salton Sea, CA, 13.6 m (*n* = 66; R. A. James, Jr., unpubl.); Ventura, CA, 18.1 m ± 22.5 SD (range 1.2–45.7, *n* = 5; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)); Bolsa Chica, CA, 1.1 m (*n* = 47; R. A. James, Jr., unpubl.). Distance to water in Hawaiian Is. (O'ahu), range of means for 4 sites 1.05–2.34 m (1.49–5.61, *n* = 319; Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

A dike or island used in one year may not be used in the next, even though conditions appear to be sim-ilar (JAR and LWO). Occasional nests constructed over water on floating algal mats (JAR and LWO), woven floating water hyssop (*Bacopa monnieria,* Hawaiian Stilt, Coleman 1978a (/Species-Account/bna/species/bknsti/references#REF32029)), or dead tules and marsh grasses (Wolfe 1931 (/Species-Account/bna/species/bknsti/references#REF14252)). Successful Hawaiian stilt nests built on floating wooden platforms (Morin 1994 (/Species-Account/bna/species/bknsti/references#REF12208)) and on bare lava rock next to an aquaculture facility (M. Morin unpubl. data).

Nest

Construction Process

Either sex scrapes with breast and feet while mate observes nearby; then tosses small pieces of lining materials over its back. Adds lining throughout incubation, particularly when mates switch incubating. If water rises, nests are built up by both sexes sticking pieces of dead vegetation beneath the nest lining. Mean height 1.2 cm ± 2.5 SD (*n* = 253; O'ahu; Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). In Waiwa, O'ahu, a nest was built up from an original height of 12 cm to a height of 25 cm in 2 d using dead saltwort (*Batis* sp.) twigs (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). Nests also built up using pieces of plastic trash (JMR). The process of adding materials to the nest can move the nest location horizontally up to 50 cm (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Structure And Composition Matter

Degree of lining varies from none to fully lined (see Appendix 1 (/Species-Account/bknsti/appendix/APP1001991)) with objects found nearby including grasses, other vegetation, pebbles, shells, feathers, mud chips and bones. Hawaiian Stilt nests also range from bare to fully lined with woven grass. Lining materials include pebbles, saltwort, *Brachiaria,* dry grass and snail shells (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403), JMR). Lining material used is that nearest nest; most lining material added during incubation (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082); Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Dimensions

Salton Sea, CA, diameter 132.0 mm ± 12.4 SD (range 100–160, *n* = 111); depth 25.6 mm ± 11.0 SD (range 0–51, *n* = 111; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). Salton Sea, CA, diameter 170.0 mm (*n* = 66; R. A. James, Jr., unpubl.). Ventura, CA, diameter 132.1 mm ± 11.1 SD (range 110–145, *n* = 7); depth 15.7 mm ± 15.1 SD (range 0–40, *n* = 7; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). Bolsa Chica, CA, diameter 120 mm (*n* = 470; R. A. James, Jr., unpubl.). McKay Bay, FL, diameter 214 mm (*n* = 5; Dinsmore 1977 (/Species-Account/bna/species/bknsti/references#REF4405)). Nuʻupia, Oʻahu, diameter 140 mm; depth 38–51 mm (*n* probably = 7; Saito 1975 (/Species-Account/bna/species/bknsti/references#REF32036)). James Campbell NWR, Oʻahu, diameter 190 mm ± 42 SD (*n* = 254); depth 30 mm ± 17 SD (*n* = 254; Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Microclimate

Mean air temperatures in nests with complete clutches, Salton Sea, CA: during day, 37.1°C ± 3.1 SD (*n* = 361); at night, 32.5°C ± 1.9 SD (*n* = 11; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). For incomplete clutches: during day, 36.9°C ± 3.0 SD (*n* = 47; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)).

Maintenance Or Re-Use Of Nests, Alternate Nests

Nests built earlier in season by American Avocets or Black-necked Stilts sometimes used later by another pair of avocets or stilts (JAR, JPS, LWO). Sequential use of nest cups most common on islands (JPS). In Hawaiian Is., same nest reused by different individuals in same year; nest cup also known to be used by the same individual in subsequent years (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Nonbreeding Nests

Scrapes without eggs are recorded regularly (JAR, LWO, JPS; Hawaiian Stilt, e.g., Ohashi and Telfer 1977 (/Species-Account/bna/species/bknsti/references#REF39825), Dougherty et al. 1978 (/Species-Account/bna/species/bknsti/references#REF39812)). Some pairs probably construct multiple scrapes during the nest site selection process (although this has not been documented for individually marked pairs). Other scrapes may represent nests that were depredated and abandoned before being found by researchers.

Eggs

Shape

Pyriform. Rarely oval. Four eggs of clutch fit snugly in nest cup with small ends together. Larger clutches (see below) do not fit well, and eggs often roll out of nest.

Size

Tulare Basin, CA: length 4.35 cm ± 0.18 SD (range 3.68–5.06); width 3.09 cm ± 0.11 SD (range 2.61–3.55); 1 randomly selected egg measured from each nest, and species confirmed by embryo examination (*n* = 270 nests; JPS). Nw. Nevada and ne. Cali-fornia, length 4.34 cm ± 0.13 SD (*n* = 33); width 3.04 cm ± 0.11 SD (*n* = 32; JAR and LWO). Salton Sea, CA, length 4.38 cm ± 0.17 SD (*n* = 222); width 3.05 cm ± 0.10 SD (*n* = 222); surface area 36.2 cm^2± 1.6 SD (*n* = 29; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)).

Runt eggs from central California measure 3.83 cm ± 0.02 SD × 2.78 cm ± 0.05 SD (*n* = 3). Both measurements differ significantly from measure-ments of normal eggs at the same site (length, $t = 4.93$, $p < 0.00001$; width, $t = 5.03$, $p < 0.00001$; $df = 271$ for both; JPS). Incidence of runt eggs 0.113% (6 of 5,302 eggs examined in 1988 and 1989, Tulare Basin, CA; JPS).

Mass

Fresh egg mass 21.0 g ± 1.4 SD (*n* = 29); volume 19.9 cm^3 ± 1.3 SD (*n* = 29); density 1.055 g/cm^3 ± 0.001 SD (*n* = 29; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)).

Color

All colors identified (and numbered) according to Smithe (Smithe 1975 (/Species-Account/bna/species/bknsti/references#REF61281)). Base color Tawny Olive (223D) to Light Drab (119C), occasionally as dark as Sayal Brown (223C) or as light as Drab Gray (119D). Surface speckled and mottled to varying degrees in 2 layers of intensity: underlying markings Army Brown (219B) to Natal Brown (219A); overlying markings Sepia (119) or Vandyke Brown (221). Occasionally, overlying markings are no darker than Dark Drab (119B), rarely they are nearly absent. Pattern of markings varies from blotching to spotting to irregular squiggles. Markings usually evenly distributed across egg, but rarely more dense at large end or around widest part.

For Hawaiian Stilt, Coleman (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)) noted that the initial base color was a dull mint green, which faded to tan 1 day after laying.

Surface Texture

Smooth without any gloss.

Eggshell Thickness

Churchill Co., NV (1991): 0.234 mm ± 0.022 SD (range 0.21–0.28, *n* = 18; JAR). Salton Sea, CA (1976): 0.224 mm ± 0.017 SD (*n* = 22; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)).

Clutch Size

Usually 4. Reported mean clutch sizes: Salton Sea, CA, 3.9 eggs ± 0.4 SD (range 2–5, *n* = 152; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)), 3.5 eggs ± 1.0 SD (range 1–4, *n* = 64; R. A. James, Jr., unpubl.); Ventura, CA, 3.8 eggs ± 0.4 SD (range 3–4, *n* = 9; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)), Bolsa Chica Reserve, CA, 3.2 eggs ± 1.0 SD (range 1–4, *n* = 38; R. A. James, Jr., unpubl.); Cache Co., UT, 3.9 eggs (range 3–4, *n* = 17, excluding single eggs and one 6-egg clutch; Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)); Stillwater NWR, Churchill Co., NV, 3.6 eggs ± 0.7 SD (range 2–4, *n* = 8; USFWS unpubl.); Churchill Co., NV, 3.4 eggs ± 0.96 SD (range 1–4, *n* = 13; JAR); Lassen Co., CA, 3.8 eggs ± 0.73 SD (range 1–6, *n* = 252; JAR and LWO). For Hawaiian Stilts, James Campbell NWR, Oʻahu, 3.6 eggs ± 0.9 SD (range 2–7, *n* = 366; Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)); Nuʻupia, Oʻahu, 3.8 eggs (*n* = 47; Ueoka et al. 1976 (/Species-Account/bna/species/bknsti/references#REF39841)).

Supernormal/supernumerary clutches (clutches of ≥6 eggs) can be found occasionally when 2 females lay in the same nest cup (Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546); Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)); 5-egg nests probably also involve ≥1 female. When ≥6 eggs are in a nest cup, 2 distinct patterns on eggs suggest laying by 2 females (Rohwer et al. 1979 (/Species-Account/bna/species/bknsti/references#REF4424), C. L. Gratto-Trevor unpubl., JAR, LWO). Incidence of supernumerary clutches: Churchill Co., NV, 0% (*n* = 16, 1991, JAR); Lassen Co., CA, 0.36% (annual range 00.93%, total *n* = 278 nests, 1992–1994, JAR and LWO). Incidence of 5-egg nests: Lassen Co., CA, 0.72% (annual range 0–2.5%, total *n* = 278 nests, 1992–1994, JAR and LWO). In Tulare Basin, CA, in-cidence of supernumerary clutches 0.23% and incidence of clutches with ≥5 eggs 0.73% (annual incidence range of all clutches with ≥5 eggs 0.7–1.1%, total *n* = 2,195 nests, 1987–1989; JPS).

On the northern edge of expanding range (see Distribution: historical changes, above), laying by 2 females appears to be more common than else-where; incidence in Brooks, s. Alberta, where breeding has only recently been documented, 2 of 8 nests (1995–1997; C. L. Gratto-Trevor unpubl.); incidence in Washington range expansion, 1 of 5 nests (1973 and 1977, Rohwer et al. 1979 (/Species-Account/bna/species/bknsti/references#REF4424)).

Rarely, supernormal clutches include both American Avocet and Black-necked Stilt eggs. In Lassen Co., CA, 2 cases (0.98%, *n* = 278 total stilt nests ob-served) each with 7–8 total eggs and 34 eggs per species; avocets incubated the clutch (JAR). In Tulare Basin, CA, 4 nests containing 1–2 avocet eggs in addition to Black-necked Stilt eggs (0.18%, *n* = 2,195 total stilt nests observed); all 4 were incubated by stilts (JPS).

Dropped eggs (single eggs laid on ground without evidence of scraping) also noted (Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546), JAR, JPS, LWO; Hawaiian Stilt, e.g., Ohashi and Telfer 1977 (/Species-Account/bna/species/bknsti/references#REF39825), Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Egg-Laying

Four eggs laid in 4–5 d. Time between laying third and fourth egg was 25 h 42 min for one female (Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)).

Incubation

Onset Of Broodiness And Incubation In Relation To Laying

Incubation may begin as soon as first egg is laid, but depends on local ambient temperatures (see below).

Incubation Patches

Developed by both sexes.

Incubation Period

When temperatures are moderate, incubation probably begins with penultimate egg (in Alameda Co., CA, eggs were cold until third or fourth egg was laid; Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). When ambient temperatures warm, first eggs begin developing immediately after being laid without parental incubation. When ambient temperatures hot, parental attention needed to cool eggs from the time first egg is laid. In hot conditions at Salton Sea, CA, eggs incubated from the time laid and for at least 10 h each day; first egg maintained near incubation temperatures for minimum of 30 h before 4th egg laid (Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). Days from known date first egg was laid to known date first egg hatched: Lassen Co., CA, mean 26.0 d ± 1.4 SD (range 24–29, median 26, *n* = 16; JAR and LWO); Tulare Basin, CA, 25.0 d ± 2.0 SD (range 21–30, median 25, *n* = 43; JPS). For comparison with intervals normally reported for shorebirds (from day clutch is complete to day first egg hatches) these data can be adjusted by subtracting 3 d for laying of first 3 eggs. Other reported incubation periods: Alameda Co., CA, range 22–27 d (*n* = 2, from day last egg laid to day last egg hatched in 4-egg clutches; Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)); Hawaiian Is.: 23–26 d (Berger 1967a (/Species-Account/bna/species/bknsti/references#REF59345), Ueoka et al. 1976 (/Species-Account/bna/species/bknsti/references#REF39841), Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

For fresh (confirmed by high intensity candling) stilt eggs artificially incubated at 37.5°C, mean time to pipping (small cracks in shell) 20.2 d ± 1.2 SD (median = 20, range 1822, *n* = 13); mean time to hatch 23.1 d ± 0.9 SD (median = 23, range 21–24, *n* = 20; JPS).

Parental Behavior

Both sexes take turns incubating day or night (Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160), Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546); Hawaiian Stilt, Woodside 1979b (/Species-Account/bna/species/bknsti/references#REF4445), Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). In very hot environments, incubation behaviors serve to cool eggs rather than to warm them. Parents soak belly feathers in water before sitting on nest to facilitate evaporative cooling and to maintain nest humidity, and periods off nest are reduced to minimum (not observed for Hawaiian Stilts, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). Due to belly soaking, eggs often become encrusted with salt and mud. Belly-soaking was most common during periods of high solar radiation loads (not high ambient temperatures), and egg temperature was not the proximate stimulus (Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). At Salton Sea, CA, no eggs were left uncovered for >1 min from 09:00 to 18:00 (Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). Incubating birds orient themselves to face into wind, pant and fluff feathers on back to regulate body temperature in hot environments (Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160); Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Male and female usually alternate throughout day; incubation bouts become shorter as shaded ambient temperature increases (Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). Sexes equally likely to be incubating at any time (James 1991b (/Species-Account/bna/species/bknsti/references#REF39816); Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). Mean incubation bout length: in Alameda Co., CA, male 64.6 min (*n* = 11), female 82.0 min (*n* = 10; Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)); at Salton Sea, CA, male 21.3 min (*n* = 199), female 19.4 min (*n* = 201; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)); Ventura, CA, male 37.6 min (*n* = 16), female 44.3 min (*n* = 16; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)); Bolsa Chica, CA, male 45.5 min (*n* = 15), female 41.4 min (*n* = 15; James 1991b (/Species-Account/bna/species/bknsti/references#REF39816)); Kaua‘i, Hawaiian Is., male 55 min (*n* = 34), female 51 min (*n* = 34; Stejneger 1887 (/Species-Account/bna/species/bknsti/references#REF11106)). Percent of time nest was incubated: 95.4% (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)), 95% (Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

During changover, relieving bird alights in water near nest and walks toward incubating individual. On approach of relieving bird, incubating bird stands and walks toward water. Occasionally departing bird tosses bits of material similar to nest lining over its back as it leaves the vicinity of nest (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082); Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Hardiness Of Eggs

Normal egg temperatures during incubation: at Salton Sea, CA, day 37.9°C ± 2.1 SD (*n* = 586, complete clutches) and 34.8°C ± 4.7 SD (*n* = 96, incomplete clutches); night 35.2°C ± 2.6 SD (*n* = 44, complete clutches); Ventura, CA, day 37.2°C ± 1.3 SD (*n* = 58, complete clutches; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). Egg temperature increases with ambient temperature (see Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160) for relationships between ambient temperature and incubated egg temperature). Eggs hardy to high ambient temperatures—hatched after reaching temperatures of up to 42.9°C for 15 min to 3 h, and a few minutes at 46°C; 47.7°C was lethal to embryo (Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). Eggs in early stages of development also hardy to cold temperatures. At Tulare Basin, CA, eggs at 3–5 d of incubation were refrigerated at 16°C for up to 36 h without any loss of viability upon subsequent artificial incubation (JPS).

Hatching

Preliminary Events And Vocalizations

Chicks begin to vocalize and small fractures appear at large end of egg approximately 1–3 d before hatching. Three vocalizations described for prehatch and young chicks: *Peep* Call, clicking sounds at 1–7 kHz, and "Whine Call" (sonograms in Sordahl 1980 (/Species-Account/bna/species/bknsti/references#REF38515)). Distinct hole (4–15 mm) appears in broad end of egg 1–2 d before hatching.

Shell Breaking And Emergence

Nestmates usually hatch within a 24–48 h interval: 46.2% of broods hatch within 1 d, 37.8% over 2 d, 14.2% over 3 d and 1.7% over 4 d (*n* = 119 broods; JAR and LWO). Hawaiian Stilts usually hatch within 24 h, occasionally to 36 h and rarely 48 h (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). Egg tooth on upper mandible and small egg tooth on lower mandible disappear approximately 24 h after hatch.

Parental Assistance And Disposal Of Eggshells

Shells are removed by parents immediately after hatching, and often sunk in nearby water (Sordahl 1994 (/Species-Account/bna/species/bknsti/references#REF55412)). If shells become crushed in nest and white insides are not visible, they are not removed.

Departure From Nest

Chicks stay in nest not >24 h after hatching of last chick. If nest disturbed, may move within hours of hatching of last chick. If nest is on an island, parents call chicks to swim to shore, which they do with difficulty. Broods are led to areas of shallow water with vegetation for cover. In general, either (1) vegetation shorter than adult, but taller than the chick with small openings to allow chicks to move freely, or (2) vegetation taller than the adult with unvegetated pathways that can be used by the chick.

Most broods move only once when they leave hatch site and go to brood territory. Straight-line distances between nest and brood territory: 80–950 m (*n* = 4; Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)), 10–20 m (Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)), several hundreds of meters (Hawaiian Stilt, JMR).

Young Birds

Condition At Hatching

Chicks precocial and downy; dry and able to leave nest within 1–2 h, but walk awkwardly for first day. Bill short.

Growth And Development

Crouches silently when parents give Alarm Call, usually in vegetation unless caught in the open; run when caught in the open; running only slightly more prevalent as chicks mature (Sordahl 1982 (/Species-Account/bna/species/bknsti/references#REF4433)). Measurements of known-aged chicks (T. A. Sordahl unpubl.): Age 1 d (≤24 h): mass 13.6 g ± 1.2 SD (range 12–15, *n* = 10), exposed culmen 11.4 mm ± 0.8 SD (range 10–12, *n* = 7), tarsometatarsus 28.4 mm ± 0.8 SD (range 27–29, *n* = 7), wing chord 14.7 mm ± 1.3 SD (range 13–17, *n* = 7);

age 3 d (*n* = 2): mass 17–18 g, exposed culmen 14–15 mm, tarsometatarsus 31–32 mm, wing chord 16–17 mm; age 4 d (*n* = 3): mass 21.7 g ± 2.1 SD (range 20–24), exposed culmen 16.3 mm ± 0.6 SD (range 16–17), tarsometatarsus 33.3 mm ± 1.5 SD (range 32–35), wing chord 17.3 mm ± 1.2 SD (range 16–18); age 5 d (*n* = 1): mass 28 g, exposed culmen 18 mm, tarsometatarsus 38 mm, wing chord 18 mm; age 17 d (*n* = 3): mass 68.7 g ± 3.05 SD (range 66–72), exposed culmen 29.3 mm ± 1.2 SD (range 28–30), tarsometatarsus 54.7 mm ± 3.8 SD (range 52–59).

Measurements of known-aged Hawaiian stilt chicks (Reed et al. 1999b (/Species-Account/bna/species/bknsti/references#REF55410)): Age 1 d (24 h): mass 15.6 g ± 1.1 SD (*n* = 33). Mass of older chicks, exposed culmen, tarsus length, and wing chord measurements presented graphically by Reed et al. 1999b (/Species-Account/bna/species/bknsti/references#REF55410) (in press).

Parental Care

Males more likely than females to be present with the chicks, although difference is not great (males present 86.4%, females 76.7%, $p = 0.01$). Parents significantly closer to chicks in first week than in third week posthatching, but males and females do not differ in proximity to chicks (James 1991b (/Species-Account/bna/species/bknsti/references#REF39816)).

Brooding

Only during first week except during overcast mornings or evenings (through 3 wk, James 1991b (/Species-Account/bna/species/bknsti/references#REF39816); Hawaiian Stilt, as late as 2 wk, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). Brooding prior to departure from the nest is similar to incubation. On land, parent rests on its tibiotarsi, and the young stand beneath. In cold weather, older chicks are sometimes brooded in shallow water. Parent stands with wings loosened, and young wade beneath. Coleman

(Hawaiian Stilt, 1981) also reported brooding during hot sunny periods, but this was not observed in California or Nevada (JAR and LWO; also see information on aggression toward foreign broods under Behavior: Agonistic behavior, above.)

Feeding

Feeding of young has never been observed in the wild, and young stilts survive in captivity with-out parents (M. Rubega pers. obs., JPS; Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). Lint (Lint 1959 (/Species-Account/bna/species/bknsti/references#REF4411)) reported chicks <1 wk old being fed exclusively by parents in a zoo setting, and parents becoming more tame with the presence of chicks.

Nest Sanitation

Not necessary because young do not remain in nest long after hatching and are mobile enough to defecate away from it.

Parental Carrying Of Young

None observed.

Cooperative Breeding

Association of nonbreeding adults with a breeding pair not observed (JAR and LWO).

Brood Parasitism

Eggs of Black-necked Stilts and American Avocets found in same nest twice in Lassen Co., CA; in both cases avocets incubated eggs and reared young (JAR and LWO). Although intraspecific nest parasitism and brood-mixing are fairly common in American Avocets (Hamilton 1975b (/Species-

Account/bna/species/bknsti/references#REF2082), JAR and LWO), the greater degree of nesting territoriality, brood territoriality, and aggression to foreign chicks usually prevents occurrence in stilts (JAR, LWO; Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403); see Eggs: clutch size, above). Hawaiian Stilt nests with up to 7 eggs reported; presumed to be from multiple females (Dougherty et al. 1978 (/Species-Account/bna/species/bknsti/references#REF39812)).

Fledgling Stage

Departure From Nest

Fledglings depart from nest 1–24 h after hatching of last chick. Short, hopping flights can begin at 22–23 d (JAR and LWO). Capable of sustained flight 27–31 d posthatching (Sordahl 1980 (/Species-Account/bna/species/bknsti/references#REF38515), JAR and LWO; Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Association With Parents Or Other Young

As noted by Wetmore (Wetmore 1925b (/Species-Account/bna/species/bknsti/references#REF18618)) family groups remain intact well beyond the time when young can fly. However, the degree of association appears to depend on location. In Utah, 100% (*n* = 9) of downy broods, but only 52% (*n* = 79) of juvenile broods were attended by both adults; in 87% (*n* = 38) of cases where only one parent was present, it was the male (Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)). In California, 39.2% of downy broods were attended by both adults (30.4% by male parent only, 17.4% by female parent only, 13.0% by neither, *n* = 23 marked broods; JAR and LWO). When first noted as flighted, groups of banded fledglings were accompanied by both parents 31.9% of the time (29.8% male parent only, 19.1% female parent only, 19.1% neither, *n* = 47 marked broods; JAR and LWO). In 75% of cases where brood was abandoned by one parent, the male remained (*n* = 16; JAR and LWO). Sibling Hawaiian Stilts observed in groups with 2 adults as late as Feb in the year after hatch (JMR).

Immature Stage

Juveniles congregate in small groups prior to departure from breeding areas. Siblings and/or family groups sometimes migrate together (Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)).

‹ **Behavior (/Species-Account/bna/species/bknsti/behavior)**

Demography and Populations (/Species-Account/bna/species/bknsti/demography) ›

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Whooping Crane (/Species-Account/bna/species/whocra/behavior/)

American Avocet (/Species-Account/bna/species/ameavo/behavior/)

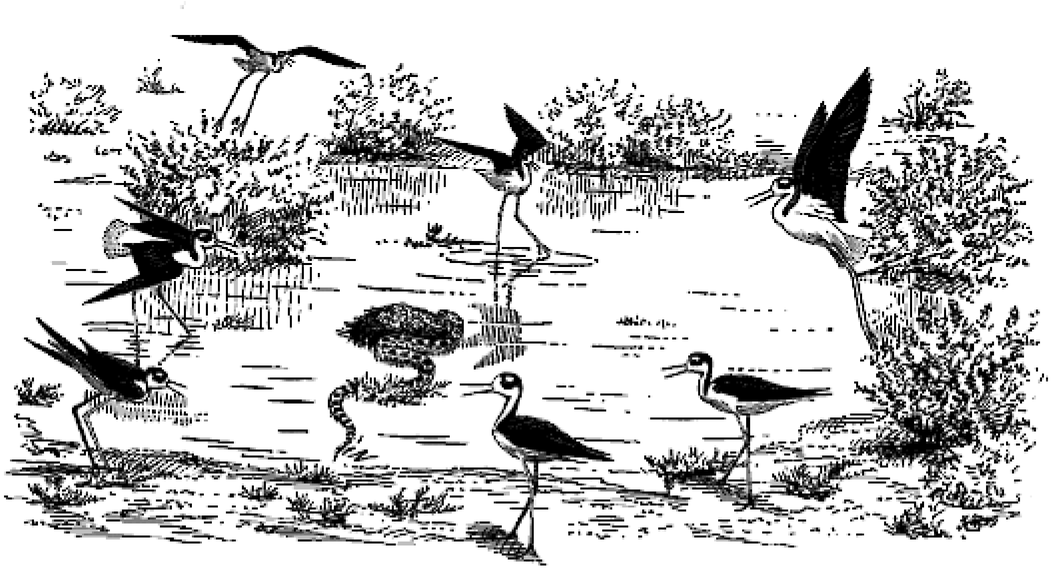
Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

Behavior



(https://download.ams.birds.cornell.edu/api/v1/asset/24995821)

Figure 4. Anti-predator display of nesting stilts. ✚ Enlarge (https://download.ams.birds.cornell.edu/api/v1/asset/24995821)

"Popcorn Display" performed by nesting stilts when they gather around a small ground predator such as a snake, or a wounded bird. Drawing by N. John Schmitt.

Locomotion

Walking, Hopping, Climbing, Etc

For short distances, normally walks or wades rather than flies. Shakes feet on exit from water to remove mud from feet (foot-shaking has been interpreted as a preincubation behavior; Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082), Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)). After flight, prefers to alight on land and walk into water. Runs during interactions with other individuals. In Hop-and-Flap behavior, individual hops a short distance to the side while simultaneously flapping wings several times; usually observed when resting birds are disturbed. Hop-and-Flap is also the basis for more intense response to ground predators; when performed in group, results in a Popcorn Display (Figure 4 (https://download.ams.birds.cornell.edu/api/v1/asset/24995821); see Predation, below).

Flight

Head and legs extended during flight. Often stoops slightly before take off then springs into the air. Sometimes, when disturbed in one-legged resting position, will fly and land with the other leg folded up against the breast. Rate 40.8 wing beats/min; wings move 60–150° (from vertical; Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). For flights used in sexual displays, see Sexual behavior, below. Butterfly Flight observed in territorial interactions and in response to predators (see Predation, below).

Swimming And Diving

Although Black-necked Stilts can swim and dive if necessary (Bent 1927 (/Species-Account/bna/species/bknsti/references#REF57779)), they do so awkwardly and avoid this except under duress (e.g., Mortimer 1890 (/Species-Account/bna/species/bknsti/references#REF39822)). Downy young swim from nest islands to nursery areas, and will dive to avoid capture, swimming up to 3 m under water (for Hawaiian Stilt, pre-fledging chicks of any age will dive to escape; JMR).

Self-Maintenance

Preening, Head-Scratching, Stretching, Bathing, Anting, Etc

Comfort movements studied by Hamilton (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). Preens with bill, often using nearby water (see description of preening as part of Precopulatory Display under Sexual behavior, below). Scratches head usually indirectly with foot, with wing drooped and leg raised over shoulder. After resting and prior to a period of flying, resting, or preening, sometimes performs a Two-wing Stretch. Two-wing Stretch more frequently performed by disturbed birds. This behavior primarily serves as a preflight intention movement; single wing and leg stretches are associated only with resting. Scratching and preening more common in undisturbed birds. Bathes by bending legs and lowering breast into the water, followed by a forward-to-back rocking motion; occurs as displacement movement in response to disturbance.

Sleeping, Roosting, Sunbathing

Sleeps with bill tucked under scapulars, but eyes not always closed when bird is in this position (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)), and may orient direction of tuck so as to observe a disturbance (Halkin 1983 (/Species-Account/bna/species/bknsti/references#REF4586)). Resting postures are (1) on 2 legs, (2) on 1 leg with the tibiotarsal joint of other leg drawn up against undertail-coverts, or (3) sitting on the tarsometatarsi. Sitting pose is most common during prolonged resting (62% of 26 observations; Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). Stilts rested on land in 88% of 48 observations (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). Roosting in small groups, rather than the large groups observed for American Avocets (Dinsmore 1977 (/Species-Account/bna/species/bknsti/references#REF4405)).

Daily Time Budget

For parents with flightless young, no significant difference in time-activity budget of males and females and no difference depending on age of the chicks (James 1991b (/Species-Account/bna/species/bknsti/references#REF39816)). Percentage of total time spent at each activity (James 1991b (/Species-Account/bna/species/bknsti/references#REF39816)): foraging, 35.8% male, 38.5% female; guarding chicks, 29.5% male, 29.7% female; resting, 17.9% male, 14.9% female; agonistic, 6.8% male, 8.2% female; walking, 3.9% male, 5.3% female; preening, 3% male, 1.7% female; brooding chicks, 3% male, 1.6% female. At the beginning of the breeding season (Hawaiian Stilt): 40% resting, 49% foraging, 4% preening and bathing, 3% vocalizing, 2% agonistic interaction, 2% flight (approximate for 13 h diurnal period; Allen and Lum 1972 (/Species-Account/bna/species/bknsti/references#REF32026)).

Agonistic Behavior

Physical Interactions

Postures for intraspecific interactions described by Hamilton (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). Upright Posture used to threaten both conspecifics and individuals of other species, generally adopted by both birds in an encounter. In Upright Posture, bird faces parallel to opponent with neck extended vertically; wings may be folded or extended. Giraffe Posture (back nearly vertical and feathers sleeked, appearing very tall and slim) is a threat by one bird to peck another. In Crouch-run, neck is retracted close to body, feathers of back are ruffled, tail is tipped slightly forward, and individual runs toward the opponent; used to chase or threaten another bird. Head-and-legs-down Flight used to hover above an opponent, sometimes striking with legs. When physical contact is made, wings, bill, and feet are used; encounter usually ends after one bird turns away and performs displacement pecking. Interactions with physical contact most common in late winter or early spring and tend to be associated with pairing.

After hatching, parent stilts are aggressive toward unrelated young and young of other species (particularly American Avocets). Observed pecking avocet chicks repeatedly, such that skin was completely removed from the crown, while parent avocets watched (JAR and LWO). Hawaiian Stilt will attack a chick not its own that has wandered too close, pecking the head and body, and stepping on the chick, pushing it under water (JMR). Even fledglings are chased by nonparental adults (JMR).

Communicative Interactions

Group interactions occur late winter to summer, with individuals calling while standing alert in shallow water, and others making short display flights and landing near the standing birds, forcing them to duck; accompanying vocalizations attract nearby birds (this interaction somewhat confusingly named Mob Display by Hamilton [Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)]). These interactions probably best interpreted as territorial or agonistic encounters. Response of nearby birds to agonistic interactions between Black-necked Stilts closely related to group responses to ground predators (see discussion of Popcorn Display under Predation, below).

Spacing

Territoriality

Strongly territorial during breeding and winter. Territoriality not quantified or systematically studied. Territories maintained near nests in Alameda Co., CA (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)), Lassen Co., CA, and Churchill Co., NV (JAR and LWO). Breeding-season territory defended from other Black-necked Stilts and to a lesser extent from other birds. See Behavior: social and interspecific behavior, below. Wintering Black-necked Stilts are also territorial (Engilis et al. 1998 (/Species-Account/bna/species/bknsti/references#REF13873)).

Individual Distance

Individual distance depends on behavior, season, and food resources. In breeding areas, minimum distances of 0.5 m are generally maintained. Nonbreeding Black-necked Stilts in flocks feed within 0.3 m of one another; in tight roosting flocks, individuals stand within cm of each other (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)).

Sexual Behavior

Mating System And Sex Ratio

Monogamous. Sex ratios not different from 1:1 (91 females, 113 males at Bolsa Chica, CA). Sex ratio at breeding site in ne. California (Lassen Co.) approximately equal (JAR and LWO). More male than female banded Black-necked Stilts seen at Tulare Basin, CA (7:2) suggests differential migration routes and not differences in sex ratio (Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)).

Pair Bond

Courtship Displays and Mate Guarding. A pair forms when female persistently associates with male and is eventually tolerated (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). Antipredator displays (see Predation, below) originally misinterpreted as courtship (e.g., Perry 1941 (/Species-Account/bna/species/bknsti/references#REF39827)).

Copulation; Pre- and Postcopulatory Displays. Copulation is a ritualized sequence of displays (described in detail by Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). Precopulatory Display is initiated by female Solicitation Posture or by male and female Sexual Preening. Female adopts stiff Solicitation Posture: neck extended horizontally forward and feet planted. Male performs Sexual Preening by standing 20 to 30 cm from female, extending his neck and preening his breast on the side facing the female. Water is used in Sexual Preening by shaking bill when placing it in the water and bringing water to the breast in the bill; intensity increases during the course of display, culminating in vigorous splashing immediately prior to mounting the female. Sometimes female also preens. As male Sexual Preening becomes more frenzied, male moves from one side of the female to the other 2–8 times (mean 4.55, *n* = 9; T. A. Sordahl unpubl.) while continuing vigorous preening and water splashing. Female may turn slightly to keep herself aligned parallel to direction of male. Behavior of Hawaiian Stilts similar (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

While female holds the Solicitation Posture, male mounts to copulate, resting his tarsometatarsi on her back. Male flutters wings to maintain balance, and cloacal contact is made. Female sometimes moves her head slowly from side to side during copulation.

After male slides off female, pair performs Post-copulatory Display: birds stand side to side with bills crossed and run forward 1.5–8 steps (mean 4.27, *n* = 13; T. A. Sordahl unpubl.). Male sometimes holds wing over back of female. According to Coleman (for Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)), the male's bill always crosses on top of the female's bill. The pair then separates. Total duration from first sexual preening to separation of the pair after postcopulatory display approximately 1 min (T. A. Sordahl unpubl.).

Duration and Maintenance of Pair Bond. Pair bonds maintained within the season. Records for 3 banded females and 6 banded males that renested within a season: 3 of 3 banded pairs renested together, 2 of 3 banded males probably retained unbanded mate when they renested; 1 banded male hatched eggs with an unbanded female and was later seen incubating a new nest with an unbanded female—a case either of sequential polygyny or of renesting following brood loss (JAR and LWO). If one parent abandons brood, it is usually the female (33 of 38 broods [Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)]; 12 of 16 broods [JAR and LWO]). Similarly, males more likely to be observed with chicks than females (percent time spent with chicks: 76.6% female, 86.4% male, reported *n* = 178 but may include the same pair in multiple observations; James 1991b (/Species-Account/bna/species/bknsti/references#REF39816)). James (James 1991b (/Species-Account/bna/species/bknsti/references#REF39816)) also noted two cases (of an unknown total number of pairs observed) where males raised young alone but he did not know if females had abandoned the nests or been killed. Grant (Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)) also reported a male incubating alone. At the northern end of the range, a polygynous trio observed (Rohwer et al. 1979 (/Species-Account/bna/species/bknsti/references#REF4424)).

Members of a pair often do not remain together after breeding season; a pair observed together at a fall migration stopover suggests pair bonds sometimes maintained after breeding season (Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)).

Little information on year to year repairings. Individuals may or may not mate with same bird in subsequent years (banded individuals that retained same mate: 1 of 3 females [1 female unknown], 1 of 6 males; JAR and LWO). In one of these cases of a male changing mates, his previous mate was seen alive at the breeding site (JAR and LWO).

Extra-Pair Copulations

No information available.

Social and Interspecific Behavior

Degree Of Sociality

Territories aggregated in suitable habitat. Some degree of semicoloniality noted, but whether this is because of joint participation in antipredator displays, or because nests are clumped in suitable habitat is unclear. Nests of Black-necked Stilts and American Avocets occur in same areas (except no avocets in Hawaiian Is.), although nests of stilts are more regularly distributed and less clumped than nests of avocets; majority of stilt nests >10 m from nearest nest (Appendix 1 (/Species-Account/bknsti/appendix/APP1001991)). Internest distance depends on location; closer nesting on islands than in other habitats (JAR and LWO). Degree of semicoloniality also varies in Hawaiian Stilts. At one extreme, 3 pairs with nests <5 m apart jointly defended the area around all 3 nests; at the other extreme, 38% of nests had no other active nests within 50 m (*n* = 366, Coleman 1981 (/Species-

Account/bna/species/bknsti/references#REF4403)). In California, avocet nests randomly distributed along dikes, and stilt nests regularly distributed along dikes (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)).

Distance to nearest nest, Appendix 1 (/Species-Account/bknsti/appendix/APP1001991) . Additional data: Alameda Co., CA, 21.9 m (range 2–42, *n* = 31, avocet and stilt nests; Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)); Salton Sea, CA, 46.2 m ± 52.9 SD (range 1.4–274.3, *n* = 60; Grant 1982a (/Species-Account/bna/species/bknsti/references#REF45160)). Internest distances for Hawaiian Stilts highly variable: Maui, 14.4 m (range 5.1–36.5, *n* = 69; Dougherty et al. 1978 (/Species-Account/bna/species/bknsti/references#REF39812)); O'ahu, 31 m (range 18–61, *n* = 69; Ohashi and Telfer 1977 (/Species-Account/bna/species/bknsti/references#REF39825)), 38 m (range 15.3–61, *n* = 24; Dougherty et al. 1978 (/Species-Account/bna/species/bknsti/references#REF39812)); range for means of 4 sites in 3 yr, 16–80 (*n* = 270, can be as little as 2 m apart; Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

In Tulare Basin, CA (JPS), evaporation ponds with islands supported mean nest density of 1.26 stilt nests/ha (range 0.44–1.78, *n* = 5 ponds), and ponds without islands supported mean nest density of 1.06 stilt nests/ha (range 0.40–1.83, *n* = 7 ponds). By comparison, mean avocet nest densities at ponds with and without islands showed distinct difference. Mean density with islands was 4.77 avocet nests/ha (range 0.74–8.64, *n* = 5 ponds) and without islands was 0.84 avocet nests/ha (range 0.40–1.65, *n* = 7 ponds). Without islands, stilts and avocets occur at comparable densities; on islands, avocets pack nests together more closely than do stilts. In areas without islands in Utah, nests more sparsely distributed than in California: nest densities 0.06 nests/ha (*n* = 12 nests) and 0.03 nests/ha (*n* = 7 nests) in 1977 and 1978, respectively (Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)).

Play

None observed.

Nonpredatory Interspecific Interactions

Neighboring breeders perform communal Mobbing and Distraction displays, with display intensity peaking away from the nest area (see Predation, below).

Parents are extremely aggressive toward stilt chicks of other broods and toward American Avocet chicks (JAR and LWO). Foreign chicks are pecked repeatedly on back of head. Normally stilt broods are kept separated by parents. When disturbance causes broods to scatter or mix, some chicks can be severely injured. Hawaiian Stilts also exhibit this aggressive behavior toward foreign young including chasing, head-pecking, and forcible immersion by striking with the feet (JMR; see Agonistic behavior, above).

Agonistic behaviors by breeding birds have been directed at most other species of wetland birds, e.g., Snowy Egret (*Egretta thula*), Turkey Vulture (*Cathartes aura*), American Avocet, Snowy Plover (*Charadrius nivosus*), Black-bellied Plover (*Pluvialis squatarola*), and Spotted Sandpiper (*Actitis macularia*). Hawaiian Stilts observed chasing Pacific Golden-Plover (*Pluvialis fulva*), Sanderling (*Calidris alba*), Wandering Tattler (*Heteroscleus incanus*), Ruddy Turnstone (*Arenaria interpres*), Osprey (*Pandion haliaetus*), Cattle Egret (*Bulbulcus ibis*) and others. Displaced by American Coot (*Fulica americana*) aggressive behavior at nesting territories and feeding territories (Ryder 1959 (/Species-Account/bna/species/bknsti/references#REF2279)).

Predation

Kinds Of Predators And Manner Of Predation

Predators on adults: Peregrine Falcon (*Falco peregrinus*; Porter and White 1973 (/Species-Account/bna/species/bknsti/references#REF46837)), Great Horned Owl (*Bubo virginianus*; Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546), JAR and LWO), Northern Harrier (*Circus cyaneus*; JPS), Great Blue Heron (*Ardea herodias*, white phase; Olsen and Johnson 1971 (/Species-Account/bna/species/bknsti/references#REF4418)), red fox (*Vulpes vulpes*; Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)). On young: Northern Harrier (JAR and LWO), mink (*Mustela vison*), kit fox (*Vulpes macrotis;* radio tag found near den; C. Marn pers. comm.). On eggs: Northern Harrier, California (*Larus californicus*) and Ring-billed (*L. delawarensis*) gulls, Common Raven (*Corvus corax*), Black-billed Magpie (*Pica pica;* Sordahl 1996b (/Species-Account/bna/species/bknsti/references#REF31546)), coyote (*Canis latrans*), gopher snakes (*Pituophis melanoleucus;* JAR, JPS and LWO, see description of Popcorn Display, below). Eggs are also trampled by grazing livestock (JAR and LWO).

Predators on Hawaiian Stilt adults: Short-eared Owl (*Asio flammeus*). Hawaiian Stilt young and eggs depredated by Black-crowned Night-Heron (*Nycticorax nycticorax*), Laughing Gull (*Leucophaeus atricilla*), Ruddy Turnstone, Cattle Egret, Common Mynah (*Acridotheres tristis*), small Indian mongoose (*Herpestes auropunctatus*), black rat (*Rattus rattus*), domestic cat (*Felis catus*), domestic dog (*Canis familiaris*), bullfrog (*Rana catesbeiana;* list compiled from Ueoka et al. 1976 (/Species-Account/bna/species/bknsti/references#REF39841), Woodside 1979b (/Species-Account/bna/species/bknsti/references#REF4445), Ueoka and Telfer 1980 (/Species-Account/bna/species/bknsti/references#REF4442), Andrews 1981 (/Species-Account/bna/species/bknsti/references#REF4396), Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403), JMR).

Porter and White (Porter and White 1973 (/Species-Account/bna/species/bknsti/references#REF46837)) compared Peregrine Falcon aerie with Prairie Falcon (*Falco mexicanus*) aerie along marshes of Great Salt Lake. Although both Ameri-can Avocets and Black-necked Stilts were abundant breeders in the marshes (Sordahl 1980 (/Species-Account/bna/species/bknsti/references#REF38515)), only a single stilt carcass was found in the Peregrine aerie (0.93% by biomass and 0.93% by frequency), and no stilt carcasses in the Prairie Falcon aerie. In contrast, avocets accounted for the greatest biomass of any prey type in the aerie (37.1% by weight, 20.6% by frequency).

Response To Predators

Adults. During breeding season, incubating birds tend to sit tight on the nest in response to aerial predators, and to get up and move from the nest on the approach of ground predators.

Nonincubating birds rise to mob approaching aerial predators (described by Sordahl 1986 (/Species-Account/bna/species/bknsti/references#REF4434); Hawaiian Stilt, Saito 1975 (/Species-Account/bna/species/bknsti/references#REF32036)). These mobs sometimes make contact with Northern Harriers (Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082)). Intensity of display increases through incubation; peak intensity reached 2–3 d before hatch. Adults will circle overhead or swoop at ground predators, calling loudly. Calls during antipredator displays indicate variable or graded vocal system; see Sordahl 1986 (/Species-Account/bna/species/bknsti/references#REF4434) for some sample sonograms.

Hawaiian Stilts are more aggressive against ground predators and regularly use legs to strike predators (including humans) from behind (JMR). While Black-necked Stilts rarely approach a human closer than 5 m (usually >10 m; JAR), Hawaiian Stilts routinely approach within <5 m (JMR). Black-necked Stilts breeding on islands might be more aggressive than on mainland; human observer brushed by wings of swooping birds on St. Croix and Hawaiian Is. (W. Knowles and M. Morin pers. comm.); human observer being struck by Hawaiian Stilts first noted by Munroe (Munro 1944a (/Species-Account/bna/species/bknsti/references#REF12316)).

All nearby nesting recurvirostrids perform distraction displays when threatened by ground predators. Distraction displays (described by Hamilton 1975b (/Species-Account/bna/species/bknsti/references#REF2082), studied by Dougherty et al. 1978 (/Species-Account/bna/species/bknsti/references#REF39812) b) include Wing-flagging Display (while both sitting and standing), False Incubation Display, Dihedral-Wing Flight Display (described below), Crouch-runs (see Agonistic behavior, above), and Popcorn Display. In Wing-flagging Display, wings are partly extended and raised up and down; often only one wing at a time is extended, and the individual may sit, stand, or alternate between sitting and standing while performing the display. In False Incubating Display, individuals crouch on the ground as if incubating eggs, then rise and move to another spot and sit again. In Dihedral-Wing Flight, bird flies in large circles with neck and legs angled downward, wings are held at a dihedral while alternating wing beats with gliding. Intensity of distraction peaks when predator is at some distance from the colony and declines as the predator gets closer to the colony.

Popcorn Display (Figure 4 (https://download.ams.birds.cornell.edu/api/v1/asset/24995821)) is an amalgamation of birds engaging in Hop-and-Flap behavior (see Locomotion, above) while encircling a ground predator. In general the display begins as ≥1 birds notice the predator and begin to perform Hop-and-Flap. Other birds are attracted to the commotion, fly over to the predator, and join the display. Popcorn Display observed to continue for several minutes while ground predator (a gopher snake) ate all the eggs in a nest and then dispersed as the snake departed (JAR and LWO).

Although groups of birds are attracted by the disturbance in response to a predator, the resulting group displays are not cooperative. Displays wane gradually after chicks have fledged or cease immediately when nesting fails.

The relative contributions of the sexes to antipredator displays is uncertain. Distracting males approached a human 17.6 m closer than their mates (male mean = 30.0 m, female mean = 47.6 m, $t = 4.8$, $df = 4$, $p < 0.01$; Sordahl 1990 (/Species-Account/bna/species/bknsti/references#REF2095)). Males swoop more often than females at nonhuman predators (Sordahl 1990 (/Species-Account/bna/species/bknsti/references#REF2095)). However, James (James 1991b (/Species-Account/bna/species/bknsti/references#REF39816)) noted that females tended to perform more distraction flights while males performed more dive-bombings and aerial chases; both sexes were equally likely to perform ground chases. Unfortunately, James's data do not distinguish encounters with potential predators from encounters with conspecifics or other nonpredators.

Forms of antipredator displays (at least toward humans) change across breeding season (Sordahl 1986 (/Species-Account/bna/species/bknsti/references#REF4434)). Crouch-run (see Agonistic behavior, above) most common early in incubation; dive-bombing occurs only just before and after hatching. Some individual stilts in Utah never dive-bombed an approaching human. False Incubation displays increase in frequency during incubation and brood-rearing, suggesting that the display might more properly be considered false-brooding (Sordahl 1986 (/Species-Account/bna/species/bknsti/references#REF4434)). Displays probably most effective at preventing predators from searching for nests or chicks, not at preventing nest depredation once nest has been found (Sordahl 1986 (/Species-Account/bna/species/bknsti/references#REF4434), Alberico 1993 (/Species-Account/bna/species/bknsti/references#REF2071)).

Young. When adults give Alarm Call, response by chicks depends on time of day and chick age. During day, young chicks (1–3 wk) tend to crouch on mud flats or near vegetation; at night they tend to crouch in open water. Older chicks (2–5 wk) were more likely to run (Sordahl 1982 (/Species-Account/bna/species/bknsti/references#REF4433)). Stilt chicks had a greater tendency to stay hidden in vegetation than did avocet chicks, were less likely to swim or dive, and were less likely to call when captured (Sordahl 1982 (/Species-Account/bna/species/bknsti/references#REF4433), JAR). When they do dive, chicks can swim up to 3 m under water (mean 2.2 m ± 0.8 SD [range 1.1–3.0, *n* = 6]; Sordahl 1982 (/Species-Account/bna/species/bknsti/references#REF4433)). When captured, only 39% of stilt chicks gave Alarm Calls (*n* = 89; Sordahl 1982 (/Species-Account/bna/species/bknsti/references#REF4433); see Sounds: vocalizations, above).

‹ **Sounds and Vocal Behavior (/Species-Account/bna/species/bknsti/sounds)**

Breeding (/Species-Account/bna/species/bknsti/breeding) ›

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Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

Sounds and Vocal Behavior

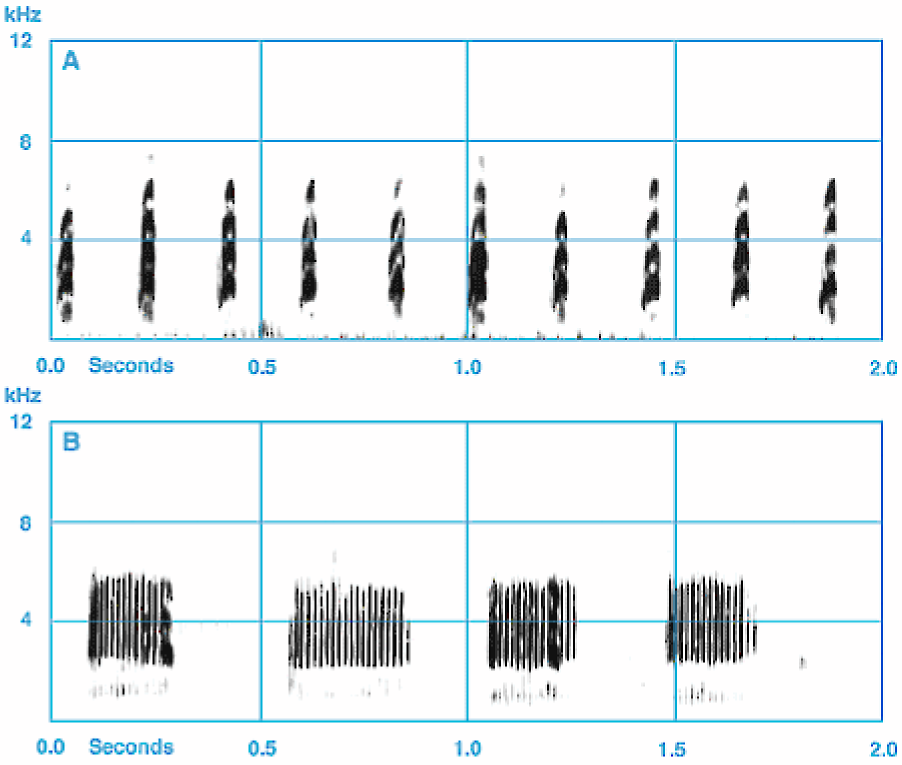

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Figure 3. Black-necked Stilt alarm calls.

➕ **Enlarge (https://download.ams.birds.cornell.edu/api/v1/asset/25000531)**

(A) Yap Call (BLB no. 12359) and (B) Rasp Call below (BLB no. 11523), Box Elder Co., Utah, 16 Jun 1973 and 26 Jun 1971, respectively. Sonograms prepared by the staff of the Borror Laboratory of Bioacoustics (BLB), The Ohio State University.

Vocalizations

Development

Young call in egg 2 d before hatch (JAR). Call while running to avoid capture and sometimes when captured (Sordahl 1982 (/Species-Account/bna/species/bknsti/references#REF4433)). Calling chicks rapidly repeat *chip-chip-chip* . Calls at night in absence of predators probably function for parental location or to encourage brooding (Sordahl 1982 (/Species-Account/bna/species/bknsti/references#REF4433)). Large juveniles on breeding grounds call with multiple *peep-peep-peep* in contrast to sharper Alarm Call of adults (below).

Vocal Array

Sonograms in Sordahl 1986 (/Species-Account/bna/species/bknsti/references#REF4434); also Figure 3 (https://download.ams.birds.cornell.edu/api/v1/asset/25000531) .

Alarm Calls. Dive-bombing and diversionary antipredator displays during breeding are accompanied by a range of vocalizations (see Behavior: predation, below). During Wing-flagging Display (see Behavior: predation, below), calls resemble a warble. *Yap* Call is a continuous "yapping," *yap yap yip yap,* while displaying to aerial or ground predators (Figure 3A (https://download.ams.birds.cornell.edu/api/v1/asset/25000531); also called *whuck, cleek, put* [Bent 1927 (/Species-Account/bna/species/bknsti/references#REF57779)], *pep* [Palmer 1967d (/Species-Account/bna/species/bknsti/references#REF4419)], *kwa* [Perry 1941 (/Species-Account/bna/species/bknsti/references#REF39827)], *kek, kek, kek, kek* [Paulson 1993 (/Species-Account/bna/species/bknsti/references#REF11385)], *kee-kee-kee* [Hawaiian Stilt, Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)], *kip-kip-kip* [Hawaiian Stilt, Pratt et al. 1987 (/Species-Account/bna/species/bknsti/references#REF58236)] see also sonograms Fig. 5–3, i, k in Sordahl 1986 (/Species-Account/bna/species/bknsti/references#REF4434)). Sometimes Yap Call grouped into 2–3 syllable sounds, as *k-ewick* or *kick-a-rick* (Palmer 1967d (/Species-Account/bna/species/bknsti/references#REF4419)). Distinct calls cannot be clearly attached to single antipredator behavior categories; instead, there is a graded transition between calls at different display intensities (as for other recurvirostrids; Wollemann and Olaszy 1977 (/Species-Account/bna/species/bknsti/references#REF38517)). Rasp Call (Figure 3B (https://download.ams.birds.cornell.edu/api/v1/asset/25000531), as named in Borror Laboratory records) is less shrill and longer in duration of each unit, resembles other calls recorded in antipredator contexts (Sordahl 1986 (/Species-Account/bna/species/bknsti/references#REF4434), Fig 5–3, j).

During nonbreeding season, groups of Hawaiian Stilts make a gull-like *Kwirk* Call, *kwirk-kwirk-kwirk* (Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403)).

Flight Calls. Calls resembling *Yap* and Rasp calls probably also used in flight or other contexts. Degree of differentiation in such calls unstudied.

Contact Calls. Similar to but quieter than other calls; heard in interactions among flocks or from parents calling young.

Phenology

All adult calls heard during both breeding and nonbreeding season, including Alarm Calls. Alarm Call much less common in winter relative to breeding season and even Contact Calls less common during migration and winter.

Daily Pattern Of Vocalizing

None detected. Continued giving of *Yap* Call throughout night is notable in breeding areas (JAR and LWO).

Places Of Vocalizing

Gives Alarm Calls from ground or in flight, depending on predator type or nearness to nest (see above). Gives Flight Calls in flight or before or after flock movements, Contact Calls in flight or at rest.

Social Context And Presumed Functions Of Vocalizations

See above.

Nonvocal Sounds

None known.

‹ **Diet and Foraging (/Species-Account/bna/species/bknsti/foodhabits)**

Behavior (/Species-Account/bna/species/bknsti/behavior) ›

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Whooping Crane (/Species-Account/bna/species/whocra/conservation/)

American Avocet (/Species-Account/bna/species/ameavo/conservation/)

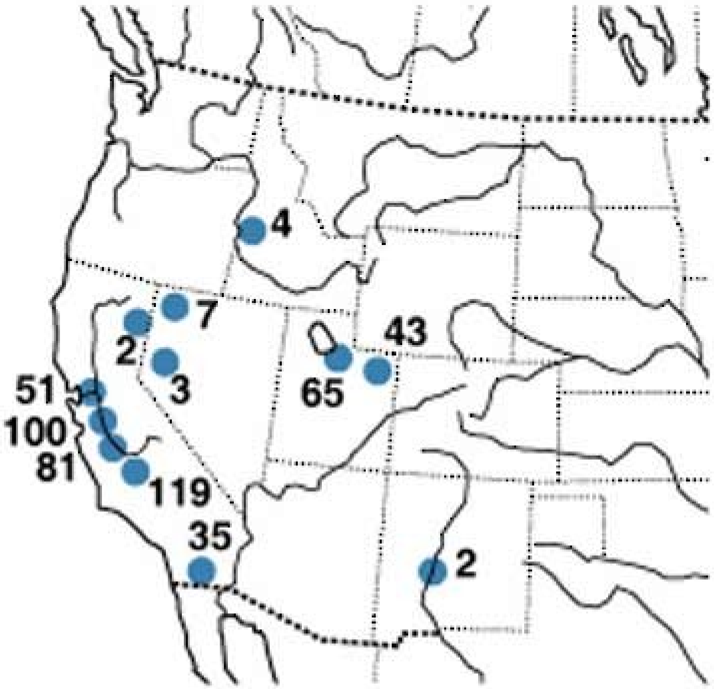
Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

Conservation and Management



(https://download.ams.birds.cornell.edu/api/v1/asset/25018511)

Figure 6. Selenium concentrations in Black-necked Stilt eggs. + Enlarge (https://download.ams.birds.cornell.edu/api/v1/asset/25018511)

Maximum concentrations of selenium (ppm, dry weight) detected in Black-necked Stilt eggs collected from 12 study areas in the w. U. S. (unpubl. data from U.S. Department of Interior, Environmental Contaminants Database Management system at Patuxent Environmental Science Center, San Francisco Bay Regional Water Quality Board, JAR, and JPS). Values ≥ 5 are abnormal and potentially toxic to embryos.

Effects of Human Activity

Shooting And Trapping

Shooting and trapping led to population declines and range retractions (particularly on Atlantic Coast) before 1840s (see Distribution: historical changes, above). Historically a minor game bird in California with small numbers sold in markets (Grinnell et al. 1918 (/Species-Account/bna/species/bknsti/references#REF21849)). Hawaiian Stilts were considered a game species until 1941, and this pressure severely impacted population sizes

(Schwartz and Schwartz 1949 (/Species-Account/bna/species/bknsti/references#REF13027), Shallenberger 1977a (/Species-Account/bna/species/bknsti/references#REF12258)). Probable hunting to extirpation on some islands, but now all islands of historic distribution recolonized (Bachman et al. 1982 (/Species-Account/bna/species/bknsti/references#REF4397)). All subspecies protected under Migratory Bird Treaty Act of 1918 (16 U.S.C. 703–712); illegal shooting and trapping now probably minor source of mortality.

Pesticides And Other Contaminants/Toxics

DDT and Its Metabolites. Elevated egg residues of DDT metabolites (particularly DDE) detected in California and New Mexico 1989–1990 (Ong et al. 1991 (/Species-Account/bna/species/bknsti/references#REF39826), Setmire et al. 1993 (/Species-Account/bna/species/bknsti/references#REF60607)). At Salton Sea, CA, eggs contain up to 12 ppm DDE (wet wt.) compared to presumptive adverse effects threshold of 3–8 ppm; 10% of eggs ≥8 ppm. Regression of eggshell thickness against DDE concentration for Salton Sea eggs not statistically significant (p = 0.25), but 7% eggshell thinning suggested at 12 ppm DDE. In San Joaquin Valley, CA, eggs collected near cotton fields treated with Dicofol (an organochlorine pesticide containing DDT as an impurity) contained up to 9.6 ppm DDE wet weight (mean = 2.79, n = 7) which exceeds toxic thresholds for eggs of other bird species (Clark et al. 1995a (/Species-Account/bna/species/bknsti/references#REF39810)). In Tulare Basin, CA, a maximum of 7 ppm DDE wet weight detected in eggs (JPS). DDE in Black-necked Stilt carcass wintering in lower Rio Grande Valley, TA, not of concern (3.30 ppm wet wt.; Gamble et al. 1988 (/Species-Account/bna/species/bknsti/references#REF39813)).

Selenium. Many wetlands used by Black-necked Stilts in w. U.S. have been contaminated as a result of irrigation and other human activities (U.S. Fish and Wildlife Service 1992a (/Species-Account/bna/species/bknsti/references#REF4441)). Black-necked Stilt an important indicator species in identifying effects of contaminants in irrigation drain water on wildlife. At Kesterson NWR, San Joaquin Valley, CA (Ohlendorf et al. Ohlendorf et al. 1986b (/Species-Account/bna/species/bknsti/references#REF59246), Ohlendorf et al. 1989a (/Species-Account/bna/species/bknsti/references#REF4417), Ohlendorf et al. 1990 (/Species-Account/bna/species/bknsti/references#REF2089)), irrigation drain water was diverted to the refuge for disposal; the project was viewed initially as a habitat replacement success. Like other waterbirds, Black-necked Stilts breeding at Kesterson failed to reproduce successfully (Williams et al. 1989 (/Species-Account/bna/species/bknsti/references#REF4444)) because drain water supplying the wetland was contaminated with selenium (Se) concentrated through soil-leaching and water recycling (Ohlendorf et al. 1986a (/Species-Account/bna/species/bknsti/references#REF16311)). Bioaccumulation of these toxicants resulted in reduced egg viability, dramatic developmental defects in embryos that survived to later stages of development (teratogenesis; Hoffman et al. 1988 (/Species-Account/bna/species/bknsti/references#REF2084)), and subsequent death of chicks that did hatch (Ohlendorf et al. Ohlendorf et al. 1986b (/Species-Account/bna/species/bknsti/references#REF59246), Ohlendorf et al. 1989a (/Species-Account/bna/species/bknsti/references#REF4417), Ohlendorf et al. 1990 (/Species-Account/bna/species/bknsti/references#REF2089), Williams et al. 1989 (/Species-Account/bna/species/bknsti/references#REF4444)). Kesterson has since been filled with uncontaminated soil in order to displace breeding birds to wetlands of better habitat quality, and habitat managers are monitoring potential bioaccumulation through the new terrestrial food chain (Wu et al. 1995 (/Species-Account/bna/species/bknsti/references#REF2099)).

Selenium (Se) pollution has since been documented as widespread problem associated with irrigated agriculture in w. U.S. (Seiler and Skorupa 1995 (/Species-Account/bna/species/bknsti/references#REF55411), Skorupa 1998 (/Species-Account/bna/species/bknsti/references#REF4431), JPS; see Figure 6 (https://download.ams.birds.cornell.edu/api/v1/asset/25018511)); stilts much more sensitive to Se poisoning than closely related American Avocet (Skorupa 1998 (/Species-Account/bna/species/bknsti/references#REF4431)). Normally, sets of eggs average <3 ppm Se (dry wt.); at contaminated sites average up to 97 ppm (Skorupa and Ohlendorf 1991 (/Species-Account/bna/species/bknsti/references#REF38514), JPS). Strong correlation between average waterborne Se (range 0.2–3,003 ppb) and average egg Se (range 1.4–97 ppm) for 36 breeding populations in Tulare Lake basin, CA ($r = 0.901$, $p < 0.1$; Skorupa 1998 (/Species-Account/bna/species/bknsti/references#REF4431)). Regression equation: log (egg Se [ppm]) = 0.44 + 0.434 log (water Se [ppb]). Kesterson Reservoir (California) and Salton Sea data fall on same regression line (Skorupa Skorupa 1994 (/Species-Account/bna/species/bknsti/references#REF39834), Skorupa 1998 (/Species-Account/bna/species/bknsti/references#REF4431)).

There is a dose-response relationship between egg Se concentrations and incidence of embryo deformity. Embryo deformity (teratogenesis) 50% effect concentration is 58 ppm Se (dry wt.; logistic regression anal-ysis, *n* = 608 randomly sampled Black-necked Stilt eggs from the San Joaquin Valley, CA), compared to 105 ppm for American Avocets (Skorupa 1998 (/Species-Account/bna/species/bknsti/references#REF4431)). Discernible depression in stilt egg viability begins at 6–7 ppm Se (Skorupa 1998 (/Species-Account/bna/species/bknsti/references#REF4431)). Selenium-induced embryo deformities in 5–60% of eggs at 5 California sites (Ohlendorf 1989 (/Species-Account/bna/species/bknsti/references#REF4416), Skorupa 1998 (/Species-Account/bna/species/bknsti/references#REF4431)). Background embryo deformity rate 0.15% (*n* = 654 embryos from Se-normal eggs; JPS). Recent agroforestry project (growing a series of salt tolerant crops as a disposal method for drainage water) also had unexpected side effects of pooling Se-contaminated water which led to 56.7% Black-necked Stilt embryo teratogenesis (*n* = 30; Skorupa 1998 (/Species-Account/bna/species/bknsti/references#REF4431)). Any time >10% of eggs in successful nests fail to hatch, possibility of Se poisoning warrants examination (JPS).

Significant Se-induced mortality of hatchlings at 2 California sites (Kesterson, Williams et al. 1989 (/Species-Account/bna/species/bknsti/references#REF4444); Tulare Basin, C. Marn pers. comm.). Combined embryo and hatchling poisoning can cause complete reproductive failure.

Se impacts on adults virtually unstudied. Although evaporation ponds theoretically could have positive impacts (by providing food-rich stopover areas) as well as negative impacts (through Se bioaccumulation) on migrants, adults might be more susceptible to Se poisoning during winter (as is the case with ducks; Heinz 1996 (/Species-Account/bna/species/bknsti/references#REF4408)). Selenium-contaminated evaporation ponds in Tulare Basin are used by Black-necked Stilts migrating from uncontaminated sites in w. U.S. (Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)). Some birds reside in these ponds for as long as 48 d (Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)), long enough for significant amounts of Se to accumulate in their bodies (Heinz et al. 1990 (/Species-Account/bna/species/bknsti/references#REF20954)).

Adult females at breeding sites in Tulare Lake Basin (California) had significantly lower body weight (–14%; controlled for week of collection and reproductive status) at high-Se pond compared to reference pond (JPS). Emaciation is a classic symptom of Se poisoning.

Potential for significant population level impact at Se-contaminated Salton Sea (California) where estimated 100,000 wintering stilts occur (Setmire et al. 1993 (/Species-Account/bna/species/bknsti/references#REF60607), Skorupa 1998 (/Species-Account/bna/species/bknsti/references#REF4431)). Potential exists for Se-poisoning in Mexico where high-Se Colorado River water also used for irrigated agriculture (Mora and Anderson 1995 (/Species-Account/bna/species/bknsti/references#REF6768)).

Other Trace Elements. Less studied than Se impacts, but studies of contaminants in irrigation drainage have documented trace element accumulation at levels that could produce detrimental effects. For example, the Carson River drainage of Nevada is contaminated with mercury from mid-1800s mining activity; bioaccumulation of mercury occurs in addition to any toxicants concentrated by irrigated agriculture. Juvenile stilt livers in Nevada exceeded effect criteria concentrations for boron, mercury, and Se; adult stilt livers exceeded effect concentrations for mercury and Se (Hoffman et al. 1990a (/Species-Account/bna/species/bknsti/references#REF4410)).

Other Contaminants. Nonnetted oil pits and gold-mining cyanide leach ponds probably attractive and lethal. Gizzard of Hawaiian Stilt contained ample grit, thus, ingestion of spent lead shot probable, but unconfirmed risk (Woodside 1979a (/Species-Account/bna/species/bknsti/references#REF32042)); potential problems unstudied in Hawaiian Stilts. Probable risk for Black-necked Stilts as well.

Degradation Of Habitat

Wetland losses and conversion in North America (Dahl 1990 (/Species-Account/bna/species/bknsti/references#REF61583)) probably have led to population declines of Black-necked Stilts (Page and Gill 1994 (/Species-Account/bna/species/bknsti/references#REF54678)); small habitat gains from construction of artificial ponds and extensions of range (see Distribution: historical changes, above) might offset some, but not all, of effect of habitat loss. Many traditional breeding areas dependent on vernal flooding, which is now rare because of agricultural diversion of in-stream flows and urban flood control projects. Rangewide loss of historic perennial wetlands and coastal intertidal wetlands also severe (Helmers 1992 (/Species-Account/bna/species/bknsti/references#REF4409)). Use of salt ponds, sewage ponds, agricultural evaporation ponds, and wet agricultural areas such as rice fields and flood-irrigated fields may counterbalance some of historic wetland losses. These surrogate habitats, however, are not as likely as natural habitats to include predator-safe islands for nesting, or to have suitable shallow habitats for juvenile foraging.

Extant breeding and wintering habitat, natural and surrogate, subject to widespread agricultural and industrial degradation of water quality (see above). Major breeding, staging, and wintering areas in Pacific Flyway such as San Francisco estuary, San Joaquin Valley, and Salton Sea, are already seriously polluted (Figure 6 (https://download.ams.birds.cornell.edu/api/v1/asset/25018511); Moore et al. 1990b (/Species-Account/bna/species/bknsti/references#REF55409), Harvey et al. 1992 (/Species-Account/bna/species/bknsti/references#REF55406)).

Increased salinization (human-caused increases in salt content of water) from agricultural drain water, surface flow, and subsurface flow is a problem in at least some inland wetlands in every western state in U.S. (U.S. Fish and Wildlife Service 1992a (/Species-Account/bna/species/bknsti/references#REF4441)). Because of multitude of ecosystem-level changes that salinization produces, salinization is likely to have significant impacts on populations of temperate-breeding shorebirds, including Black-necked Stilts (Rubega and Robinson 1996 (/Species-Account/bna/species/bknsti/references#REF39832)).

In Hawaiian Is., invasion of alien plants (in particular, California grass, water hyacinth [*Eichornia crassipes*], and mangrove [*Rhizophora mangle*]) poses a severe threat to the availability of suitable open water and mudflat habitat (U.S. Fish and Wildlife Service 1985d (/Species-Account/bna/species/bknsti/references#REF59346), Engilis and Reid 1995 (/Species-Account/bna/species/bknsti/references#REF4406)). Human encroachment by filling wetlands for development and agriculture has also greatly reduced availability of wetlands (Saito 1974 (/Species-Account/bna/species/bknsti/references#REF39833), Griffin et al. 1989 (/Species-

Account/bna/species/bknsti/references#REF7473)). In Hawaii, human encroachment is especially severe. Urbanization has impacts through both loss and degradation of habitat (Engilis and Reid 1995 (/Species-Account/bna/species/bknsti/references#REF4406)); it is possible that light pollution increases predation (JMR). Impact of scarcity of predator-safe nesting islands on reproductive success is exacerbated in Hawaii by human introduction of nonnative ground predators.

Disturbance At Nest And Roost Sites

At agricultural evaporation ponds, sewage ponds, and probably commercial salt ponds, routine grading of levees destroys many eggs (JPS). Loss measured for 1 season at 1 evaporation pond was 211 of 1,344 eggs (16%). Severe reproductive failure at another evaporation pond when about 125 chicks were trapped inside discarded motor vehicle tires placed at shoreline to stabilize earthen levees against wave erosion (JPS). In Hawaii, flooding taro fields can flood nests on embankments (JMR), human visitors also unknowingly disturb or step on nests and eggs (M. Morin unpubl. data).

Human/Research Impacts

Nests visited early—when only first egg present—have moderate probability of abandonment at some research areas but not others. No effect in Lassen Co., CA: 12.2% abandonment if found with 1 egg (n = 41), 12.1% if found with >1 egg (n = 224, p = 0.48; JAR and LWO). Possible effect in Tulare Basin, CA: 19.7% if found with 1 egg (n = 137), 3.7% otherwise (n = 1,064, $p < 0.0001$; JPS). Black-necked Stilt abandonment as a response to research activities is less prevalent than among American Avocets nesting in same area (36% if found with 1 egg and 9.5% if found with >1 egg in Lassen Co., CA [Robinson et al. 1997 (/Species-Account/bna/species/bknsti/references#REF39831)]; 31.7% if found with 1 egg and 3.3% if found with >1 egg in Tulare Basin, CA [n = 300 and 1,676 nests respectively, JPS]). However, both of these probabilities of abandonment must be considered maxima, because some 1-egg nests are abandoned before the researcher visit (JAR and LWO). When nest searching and/or monitoring occurs weekly, about 10% of nests contained 1 egg at first visit, thus, overall 1.9% rate of researcher-induced nest abandonment at Tulare Basin (JPS). In most cases, pairs probably renested.

At site where adults were captured for color-marking via nest-trapping, 33% of successful nests contained ≥1 inviable egg (Alberico 1995 (/Species-Account/bna/species/bknsti/references#REF4395)) compared to normal incidence of 5–10% at multiple sites without nest-trapping (JPS). This problem was avoided in subsequent years by use of wooden egg replacements during trapping (Robinson and Oring Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423), Robinson and Oring 1997 (/Species-Account/bna/species/bknsti/references#REF31545)).

Nest-trapping and banding probably influence movement behaviors of individuals. For example, 33.3% (3 of 9) of incubating birds disappeared from study area immediately after being captured (Robinson and Oring 1996 (/Species-Account/bna/species/bknsti/references#REF4423)) and were resighted at migration sites. Nest-trapping and banding probably affected dispersal distances in the year immediately after banding (as for American Avocets; Robinson and Oring 1997 (/Species-Account/bna/species/bknsti/references#REF31545)), and the lower return rates suggest that the effect might be greater for stilts than for avocets (JAR and LWO).

Hawaiian stilts collide with power lines along coastal highways (Fish and Wildlife Information Service 1996 (/Species-Account/bna/species/bknsti/references#REF4407)), but impact on populations probably are trivial.

Management

Conservation Status

Hawaiian Stilt listed as federal and state (Hawaii) Endangered Species. All subspecies protected from unregulated destruction under general wildlife laws such as federal Migratory Bird Treaty Act and state Fish and Game codes.

Measures Proposed And Taken

Hawaiian Stilt Recovery. A guiding sentiment for continued management for Hawaiian stilts was articulated by George C. Munro (Munro 1946 (/Species-Account/bna/species/bknsti/references#REF39823)), “[It is] a very fine endemic bird which should not be allowed to become extinct or even rare.” In the most recent recovery plan, Engilis and Reid (Engilis and Reid 1995 (/Species-Account/bna/species/bknsti/references#REF4406)) identify reduced habitat availability, primarily due to urban encroachment, as the most important reason for decline. This hypothesis was supported by viability modeling, which predicted that given predator control, this subspecies would increase to meet habitat availability (Reed et al. 1998d (/Species-Account/bna/species/bknsti/references#REF44669)). For Hawaiian Stilts, predator control and maintaining core areas of permanent wetlands, i.e., areas cleared of alien plants, are fundamental management activities for the continued existence of this subspecies (Ueoka et al. 1976 (/Species-Account/bna/species/bknsti/references#REF39841), Ohashi and Burr 1977 (/Species-Account/bna/species/bknsti/references#REF39824), Engilis 1988 (/Species-Account/bna/species/bknsti/references#REF33697), Engilis and Reid 1995 (/Species-Account/bna/species/bknsti/references#REF4406)).

In light of the importance of habitat availability, it is a concern that many of the wetlands currently used by Hawaiian Stilts are not secure over the long term. For example, none of the U.S. Fish and Wildlife Service refuges on O‘ahu are on land that is owned by the Fish and Wildlife Service. Measures proposed in recovery plans include: (1) securing specified habitats on five islands, (2) private lands protection easements, (3) water level, salinity, and predator management. Numerous recovery actions for Hawaiian Stilt accomplished or in progress. Most actions involve habitat preservation or restoration. Manipulation of nesting opportunities using water level management and pond contouring (Engilis and Reid 1995 (/Species-Account/bna/species/bknsti/references#REF4406)) likely to have positive impact. Efficacy of other activities such as artificial nest structures important in some wetlands (e.g., ‘Aimakapä), but not others; active research program evaluating management techniques and efficacy is ongoing (Fish and Wildlife Information Service 1996 (/Species-Account/bna/species/bknsti/references#REF4407)).

Currently, the recovery plan criterion for downlisting the Hawaiian Stilt is to observe population estimates of ≥2,000 individuals in 3 of 5 years of biennial censuses (U.S. Fish and Wildlife Service 1985d (/Species-Account/bna/species/bknsti/references#REF59346), Engilis and Reid 1995 (/Species-Account/bna/species/bknsti/references#REF4406)). Population viability analysis shows population persistence most sensitive to adult survival, a parameter for which no data exist (Reed et al. 1998d (/Species-Account/bna/species/bknsti/references#REF44669)). Until introduced threats (predators and wetland plants) are removed, constant management will be required for persistence.

Selenium Contamination. In California's Tulare Lake Basin, operators of selenium-contaminated evaporation ponds now required via Waste Discharge Permits to provide mitigation habitat targeted for breeding recurvirostrids (California State Water Resources Control Board 1995 (/Species-Account/bna/species/bknsti/references#REF55405)). In 1995, four operators provided 600 ha of mitigation wetlands of various designs which supported 1,723 stilt nests (overall density of 2.9 nests/ha; Central Valley Region, California Regional Water Quality Control Board unpubl. data).

Effectiveness Of Measures

Hawaiian Stilt Recovery. Total Hawaiian Stilt numbers stable at 1,100–1,1500 birds (Banko 1988b (/Species-Account/bna/species/bknsti/references#REF32028), Hawaii Div. of Forestry and Wildlife unpubl.)— still below minimum number (2,000) deemed adequate for delisting.

Selenium Contamination. The most attractive mitigation design was a 130 ha site with 2:1 ratio of shallow-water feeding areas (10–15 cm depth) to elevated nesting areas. Site arranged as 35 feeding lanes (each 20 m wide) alternating with 34 unvegetated and gradually sloping (12:1 slope) nesting lanes (each 10 m wide). All lanes 1.6 km long, and site perimeter bounded by electrified fence. Water managed as flow-through system. Site supported 1,303 stilt nests (density 10 nests/ha) with <1% nest predation (Tulare Lake Drainage District 1996 (/Species-Account/bna/species/bknsti/references#REF58953)). By comparison, the 1,200 ha of evaporation ponds being mitigated for in this case typically supported 550 stilt nests (density 0.5 nests/ha) with 15% nest predation (C. Marn pers. comm., JPS). Species response much more favorable than expected. Long-term sustainability of response unknown.

‹ Demography and Populations (/Species-Account/bna/species/bknsti/demography)

Priorities for Future Research (/Species-Account/bna/species/bknsti/priorities) ›

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Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

Priorities for Future Research

There are two major challenges to understanding the life histories of Black-necked Stilts. The first is their extreme mobility. Preliminary observations from banding studies suggest little site fidelity and distances of hundreds of kilometers between breeding sites. This has made it difficult to make even preliminary estimates of demographic parameters using banding data alone. In general, radio telemetry would be considered the field solution to this problem. However, banding data also suggest that the birds are sensitive to handling, and impacts of applying radio transmitters on stilt behavior might make it difficult to separate researcher-induced and natural behaviors. All studies of breeding Black-necked Stilts must keep a watchful eye on inadvertent researcher impacts.

Current demographic data reflects other data collection biases. For example, most of the studies of larger numbers of stilts have been done at concentrated breeding areas, especially salt ponds and managed wetlands. However, such areas are probably not representative of "typical" breeding conditions. Many of the Black-necked

Stilts in North America are breeding in lower densities at inaccessible coastal wetlands and small freshwater wetlands. To what extent does the social behavior and breeding biology differ for "dispersed" stilts? On a broader scale, possible range expansions and the mechanisms behind such movements are an important topic for study.

For Hawaiian Stilts, the most important demographic statistic that is unknown is adult survival data. Preliminary modeling (Reed et al. 1998d (/Species-Account/bna/species/bknsti/references#REF44669)) indicates that population growth patterns are most sensitive to adult survival rates; no data exist on this parameter. The most important management needs are developing effective predator control and efficient vegetation control. Experimental manipulation of different nest opportunities, using water level management and pond contouring (Engilis and Reid 1995 (/Species-Account/bna/species/bknsti/references#REF4406)), is important for testing the value of management efforts

Last but not least, the extensive treatment required here to discuss the taxonomic status of the entire genus *Himantopus* (see Systematics, above) illustrates the need for a detailed and worldwide systematic treatment.

‹ **Conservation and Management (/Species-Account/bna/species/bknsti/conservation)**

Acknowledgments (/Species-Account/bna/species/bknsti/acknowledgments) ›

Introduction (/Species-Account/bna/species/bknsti/introduction)

Appearance (/Species-Account/bna/species/bknsti/appearance)

Systematics (/Species-Account/bna/species/bknsti/systematics)

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Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

Sections

Tables and Appendices

Appendix 1

Black-necked Stilt nest characteristics (% and n) at laying in the w. Great Basin (JAR and LWO)(1). For quantitative categories, the median category is marked with an asterisk (*). Totals within years for each category vary because of missing data.

	Churchill Co., NV	**Lassen Co., CA**		
	1991	*1992*	*1993*	*1994*
	Distance to nearest nest			
<1 m(1)	50.0 (8)*	1.9 (2)		

	Churchill Co., NV	Lassen Co., CA		
1–4.9 m	31.2 (5)*	15.5 (16)	7.9 (6)	13.8 (11)
5–10 m	12.5 (2)	27.2 (28)	9.2 (7)	15.0 (12)
11–50 m	6.2 (1)	34.0 (35)*	65.8 (50)*	51.2 (41)*
>50 m		21.4 (22)	17.1 (13)	20.0 (16)
Microhabitat				
Island	71.4 (10)	84.6 (88)	41.0 (32)	51.9 (40)
Mainland	28.6 (4)	4.8 (5)	7.7 (6)	
Dike or peninsula		5.8 (6)	2.5 (2)	6.5 (5)
Flooded/floating vegetation(2)		4.8 (5)	48.7 (38)	41.6 (32)
Distance to water				
<1 m	100.0 (16)		76.6 (59)	66.3 (55)
1–4.9 m			10.4 (8)	22.9 (19)
5–10 m			3.9 (3)	8.4 (7)
11–50 m			9.1 (7)	2.4 (2)
>50 m				
Nest construction				
Bare scrape		8.6 (9)		

	Churchill Co., NV	Lassen Co., CA
Lined scrape	92.8 (13)	71.2 (74)
Partly-lined scrape	7.1 (1)	20.2 (21)

- (1)Including 2 cases of complete clutches in 1 nest cup in 1992.(2)Three nests in 1992 and 10 nests in 1993 were built on floating algal mats.

Appendix 2

Annual reproductive success parameters of Black-necked Stilts, w. Great Basin, 1991–1994 (JAR and LWO). Some sample sizes change in the table because of missing values.

	Churchill Co., NV	Lassen Co., CA			
Measure	**1991**	**1992**	**1993**	**1994**	**1992–1994 mean**
Nests initiated per female (banded females)(1)		1.071 (42)	1.000 (21)	1.000 (16)	1.024 (79)
Proportion of nests that hatched at least one egg (nests)	0.375 (16)	0.489 (96)	0.377 (69)	0.671 (82)	0.512 (278)

	Churchill Co., NV	**Lassen Co., CA**			
Eggs hatched per nest (nests)	1.312 (16)	1.539 (102)	1.221 (77)	2.217 (89)	1.684 (268)
Proportion of eggs laid that hatched (eggs laid, nests)	0.341 (44, 13)	0.426 (361, 94)	0.330 (285, 78)	0.627 (303, 80)	0.461 (949, 252)
Minimum proportion of chicks hatched that were seen fledged (minimum chicks hatched, number of broods)		0.560 (157, 47)	0.372 (94, 26)	0.314 (204, 56)	0.415 (455, 129)
Observed fledglings per brood (number of broods)	1.913 (46)	1.346 (26)	1.143 (56)	1.467 (128)	

- (1)Based on observations of banded females only.

Appendix 3

Linear measurements (mm) and mass (g) of live Black-necked Stilts from multiple study areas. Data shown as mean ± SD (range, n) t (1), p.

Location	**Lassen Co., CA and Churchill Co., NV**	**O‘ahu, HI**
Source	(JAR and LWO)	(Coleman 1981 (/Species-Account/bna/species/bknsti/references#REF4403))
		Bill length(2)
Male	63.8 ± 2.6 (57–69, 81)	74.1 ± 2.4 (n = 43)

Location	Lassen Co., CA and Churchill Co., NV			O‘ahu, HI		
Female	63.8 ± 2.6 (58–70, 71)	0.00	0.00	74.2 ± 2.9 (n = 45)	0.171	>0.05
Wing-chord						
Male	227.0 ± 6.3 (206–239, 73)			238.6 ± 11.3 (n = 43)		
Female	217.5 ± 6.4 (197–229, 64)	8.74	<0.0005	231.6 ± 10.3 (n = 45)	2.92	<0.005
Tarsus(3)						
Male	117.5 ± 4.9 (103–126, 79)			123.9 ± 6.1 (n = 43)		
Female	110.4 ± 5.3 (100–122, 70)	8.49	<0.0005	116.9 ± 5.9 (n = 45)	5.36	<0.001
Mass(4)						
Male	170.4 ± 11.5 (136–202, 76)			199.0 ± 13.8 (n = 42)		
Female	168.7 ± 11.0 (147–197, 69)	0.907	>0.10	206.2 ± 21.7 (n = 43)	1.84	>0.05

- (1)One-tailed.(2)Exposed culmen.(3)Includes tibiotarsal joint for Churchill and Lassen.(4)All masses from birds caught during breeding season; Lassen masses from birds incubating complete clutches; Hawaiian adults captured via spotlighting at start of breeding season, and female weights are probably biased high by those individuals carrying eggs.

Introduction (/Species-Account/bna/species/bknsti/introduction)

Appearance (/Species-Account/bna/species/bknsti/appearance)

Systematics (/Species-Account/bna/species/bknsti/systematics)

Distribution, Migration and Habitat (/Species-Account/bna/species/bknsti/distribution)

Diet and Foraging (/Species-Account/bna/species/bknsti/foodhabits)

Sounds and Vocal Behavior (/Species-Account/bna/species/bknsti/sounds)

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Breeding (/Species-Account/bna/species/bknsti/breeding)

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Conservation and Management (/Species-Account/bna/species/bknsti/conservation)

Priorities for Future Research (/Species-Account/bna/species/bknsti/priorities)

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Black-necked Stilt

Himantopus mexicanus

Order: CHARADRIIFORMES
Family: RECURVIROSTRIDAE

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About the Author(s)

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Himantopus mexicanus

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