

Order CHARADRIIFORMES

A large, diverse assemblage of small to medium-large (12–75 cm long) limicoline, pratincoline, aquatic or terrestrial birds. Cosmopolitan from Arctic to Antarctic regions; in all sorts of maritime, freshwater and open terrestrial habitats (including deserts) with a few (woodcocks and snipes) even using dense forests. Once known as Limicolae or Laro-limicolae (e.g. Mayr & Amadon 1951); colloquially, the assemblage (excluding alcids, skuas, gulls, terns and skimmers) is often referred to as waders (especially in Britain) or shorebirds (especially in North America).

About 350 species in 19 families, though taxonomic treatments vary. Following families recognized (mostly based on recent reviews of Order [Sibley *et al.* 1988; Sibley & Ahlquist 1990; Sibley & Monroe 1990]):

Thinocoridae	seedsnipes; four species, S. America.
Pedionomidae	Plains-wanderer; monotypic, Aust.
Scolopacidae	sandpipers, snipes and allies; c. 85 species, cosmopolitan.
Rostratulidae	painted snipes; two species, s. America and Old World.
Jacanidae	jacanas; seven species, pantropical.
Chionididae	sheathbills; two species, Antarctica and subantarctic islands.
Burhinidae	thick-knees, stone-curlews; nine species, widespread in Old World and two in Neotropics.
Haematopodidae	oystercatchers; c. 11 species, worldwide in tropics and temperate regions.
Recurvirostridae	avocets and stilts; about seven species, worldwide in tropical and temperate regions.
Ibidiorhynchidae	Ibisbill; monotypic, central Asia.
Charadriidae	plovers and lapwings; c. 60 species, cosmopolitan.
Pluvianellidae	Magellanic Plover; monotypic, S. America.
Dromadidae	Crab Plover; monotypic, Arabian region.
Glareolidae	pratincoles, coursers, and Egyptian Plover; c. 15 species, widespread in Old World.
Stercorariidae	skuas and jaegers; about seven species, mostly in Arctic and Antarctic regions.
Rhynchopidae	skimmers; three species, pantropical.
Laridae	gulls; c. 47 species, cosmopolitan.
Sternidae	terns; c. 42 species, cosmopolitan.
Alcidae	auks; c. 20 species, Arctic and temperate regions of n. hemisphere.

Apparently monophyletic. Pteroclididae (sandgrouse) probably sister-group of Charadriiformes (e.g. Fjeldså 1976, 1977; Sibley & Ahlquist 1990; BWP), though whether best placed within Charadriiformes or in separate order is debated. Flamingoes (Phoenicopteridae) and divers (Gaviidae) have also been treated as Charadriiformes (Olson & Feduccia 1981; Fjeldså 1976, 1977) but DNA–DNA hybridization studies (Sibley & Ahlquist 1990) inconsistent with these theories. Affinities to other orders still controversial; DNA–DNA hybridization has suggested closest links are to large waterbirds, such as storks, herons and allies, Pelicaniformes, Procellariiformes, penguins, grebes, divers (Gaviidae) and also Falconiformes. All these were combined in huge order Ciconiiformes by Sibley & Ahlquist (1990).

Taxonomy and relationships reviewed in Sibley & Ahlquist (1990), Christian *et al.* (1992) and BWP (and references therein). Recent reviews have included: patterning of downy young (Jehl 1968; Fjeldså 1976, 1977), osteology (Strauch 1978; Mickevitch & Parenti 1980; Olson & Steadman 1981), DNA–DNA hybridization (Sibley *et al.* 1988, Sibley & Ahlquist 1990) and electrophoresis of tissue proteins (Christian *et al.* 1992). The studies of allozymes, DNA–DNA hybridization and the most recent osteological study of the entire order (Strauch 1978) have agreed in finding two or three well-knit, monophyletic assemblages within the Charadriiformes: scolopacids and allies (Thinocoridae, Pedionomidae, Scolopacidae, Rostratulidae, Jacanidae) and charadriids and allies (Chionididae, Burhinidae, Haematopodidae, Recurvirostridae, Ibidiorhynchidae, Charadriidae, Pluvianellidae, Dromadidae, Glareolidae, Stercorariidae, Rhynchopidae, Laridae, Sternidae, Alcidae); Strauch (1978) treated Alcidae as separate lineage, but skeletons may be so highly modified for foot-propelled diving that they do not reflect relations well (Sibley & Ahlquist 1990); gulls and allies have also been regarded as a separate lineage (Christian *et al.* 1992) or as allied to charadriids (e.g. Sibley & Ahlquist 1990). Further relationships within the Order discussed in introductions to families.

Because the Order comprises so many species and adaptations are so diverse, few characters shared by all species; those that are shared are mostly anatomical features of the skull, e.g. most or all have schizorhinal nostrils, schizognathous palates, well-developed vomer, lachrymals fused with ectethemoid and pre-frontal bones, well-developed supra-orbital grooves; see Olson & Steadman (1981) for more information on osteological characters. Wings usually have 11 primaries, with p10 longest and p11 minute; 15–24 secondaries; diastataxic except in *Scolopax minor*, as far as is known. Usually 12 tail-feathers. Necks usually rather long with 15–16 cervical vertebrae. Oil-gland bilobed and tufted. Syrinx, tracheo-bronchial; two carotids (type A-1 of Glenny 1955); caeca present. Legs usually rather long; hind toe small or lacking in most but all toes greatly elongated in Jacanidae. Feathers with small thin afterfeathers. Normally two moults annually: complete post-

breeding and partial pre-breeding; some jacanas and alcids have flightless periods when moulting remiges. Young, downy, usually with intricate cryptic patterns on upperparts of three chief types: pebbly, spotted and striped, matching characters of habitat (Fjeldså 1976, 1977): precocial, nidifugous usually, self-feeding or not depending greatly on parents.

Thirteen families recorded in HANZAB region, with 54 species breeding, 41 occurring as regular non-breeding migrants and c. 38 as accidentals or probable accidentals. Scolopacidae, Stercorariidae, Laridae and Sternidae will be dealt with in Volume 3 of HANZAB.

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Family RECURVIROSTRIDAE stilts, avocets

Moderately large (35–48 cm) black-and-white waders with very slender, elongate bills, necks and legs. Seven species in three genera; almost worldwide in temperate and tropical regions. Four species with strongly upcurved bills referred to as avocets, all in genus *Recurvirostra*. Straight-billed species commonly called stilts; in two genera, *Himantopus* and *Cladorhynchus*. Former almost cosmopolitan and polytypic; has been split into as many as eight allospecies (e.g. Mayr & Short 1970; Sibley & Monroe 1990) but we follow Pierce (1984) and BWP in recognizing just two species, *H. himantopus* and *novaezelandiae*. *Cladorhynchus* endemic to Aust. and unusual in many respects; has been said to be intermediate between *Himantopus* and avocets (BWP). Similarities between *Cladorhynchus* and flamingos have also been stressed (Olson & Feduccia 1980) but are probably convergences related to similar diets, habitats and breeding biology; flamingos appear allied to storks, herons and the like (Sibley & Ahlquist 1990). Analyses of DNA–DNA hybridization (Sibley & Ahlquist 1990) and protein electrophoresis (Christian *et al.* 1990) confirm that *Cladorhynchus* is a recurvirostrid, the family being therefore monophyletic; these studies, downy young (Jehl 1968), osteology (Strauch 1978) and karyology (Christides 1990) agree in linking the Recurvirostridae with the Haematopodidae (probably the closest extant relatives), Burhinidae and Charadriidae. Ibisbill *Ibidorhyncha struthersii* of central Asian mountains has sometimes been combined with Recurvirostridae (e.g. Sibley & Monroe 1990) but reasons have not been adequately published and Ibisbills ought to be treated in monotypic family Ibidorhynchidae until more data available.

Bodies rather slim and graceful. Sexes similar but males larger than females; in three species of avocet, bill shorter and more steeply upcurved in females than males (not known if bill shape is dimorphic in *R. andina*). Head rather small in *Himantopus*; neck rather slender and long in all species; 15 cervical vertebrae. Wings, long and pointed with 11 primaries (p11 minute); 16–20 secondaries; no metacarpal spurs. Tails, short and square; 12 rectrices. Bills, long and very fine; straight and pointed in *Himantopus* with bulky adductor muscles (affecting shape of head) that facilitate rapid movement of jaws and firm grip on food taken from surface of water or below it. Bill of *Recurvirostra* specialized for filtering tiny food items from water or mud; strongly upcurved with complex lamellated structure; flattened at base; protractor and depressor muscles well-developed for frequent opening; tongue, broad and fleshy. *Cladorhynchus* has rather straight bill, superficially similar to *Himantopus* but slightly upcurved and with lamellation, basal flattening and enlarged tongue more similar to that of avocets. Scizorhinal. Supraorbital salt-glands present. No crop; caeca present. Tarsus and tibia, elongate and slender (especially in *Himantopus*); scaling, fine and reticulate. Toes, rather short with basal webbing between front three (strongly developed in avocets and *Cladorhynchus*); hallux, small and vestigial in avocets, absent in stilts.

Plumages, white with much black marking on upperparts and upperwings; *Recurvirostra americana* and *R. novaezelandiae* have reddish head and neck; *Cladorhynchus* has chestnut breast-band; and *Himantopus novaezeandiae* entirely black. Ventral plumage dense in all species. Bills and eyes, dark; legs, slaty-blue in avocets, pink to red in stilts. Two moults per cycle, though breeding and non-breeding plumages only markedly different in *Cladorhynchus* and *Recurvirostra americana*; post-breeding moults complete, primaries outwards. Young hatch in soft woolly down, mostly light grey or buff with simple pebble pattern; pure white and unmarked in *Cladorhynchus*, uniquely so among Charadriiformes. Juveniles paler versions of adults, somewhat scalloped above; immatures often separable. Adult plumage attained during first year. First breed at 2–3 years. Flight, swift and direct, with neck only slightly extended and legs projecting beyond tail. Walk briskly with long strides and neck somewhat hunched; often swim, (especially avocets and *Cladorhynchus*).

Frequent shallow wetlands of varying salinity; *Himantopus* more characteristic of freshwater wetlands, avocets of brackish or saline habitats; *Cladorhynchus* strongly prefers saltlakes. Black Stilt *H. novaezelandiae* and Andean Avocet *R. andina* appear mainly sedentary but most species move to some extent (often quite long distances) in response to drought or rainfall; *R. avosetta* and n. populations of *R. americana* and *H. himantopus* have seasonal migrations. Feed when wading or swimming, on small aquatic animals from the surface of water, submerged mud or floating vegetation.

Usually gregarious, forming flocks in non-breeding period that may number hundreds or even thousands of birds; often in single-species flocks or combined with other species of recurvirostrid. Most breed in dispersed colonies numbering scores of pairs; *Cladorhynchus* in tightly packed colonies with many thousand pairs. Monogamous; pair-bond may be formed annually (e.g. *Himantopus himantopus*) or persist till death of one partner (e.g. *Himantopus novaezelandiae*). Both sexes incubate and attend young; both (except in *Cladorhynchus*) defend nest aggressively with loud yelping calls. Other calls are generally simple repeated staccato notes.

Most breed seasonally; *Cladorhynchus* opportunistically in response to filling of inland saltlakes; other species may vary timing somewhat in response to erratic rainfall. Nests set on grass, sand or mud; either bare hollows sometimes lined with dead vegetation (avocets and *Cladorhynchus*) or more substantial (*Himantopus*). Laying interval, 24–48 h. Eggs, oval to pyriform, smooth with slight or no gloss, pale brownish (white in *Cladorhynchus*) blotched or spotted sepia. Clutch-size, usually three or four. Mostly single-brooded but may re-lay after failures and multiple broods probably characteristic of *Cladorhynchus* when water-levels allow. Incubation period 22–24 days. Young, precocial, nidifugous; active soon after hatching. Chicks swim well and feed themselves; usually remain with parents after fledging.

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Himantopus novaezelandiae **Black Stilt**

COLOUR PLATE FACING PAGE 745

Himantopus novaezelandiae Gould, 1841, *Proc. zool. Soc. Lond.* (1841): 8 — Port Nicholson, North Island, New Zealand.

Formerly the dominant, and probably only, stilt in New Zealand, hence the specific name.

MONOTYPIC

FIELD IDENTIFICATION Length 37–40 cm; wingspan 58 cm; weight c. 220 g. Endangered; medium-sized, extremely long-legged, entirely black wader with long fine bill. Slightly larger and plumper than Black-winged Stilt *H. himantopus*, with obviously shorter tarsi and rounded, not flat, back; also shorter neck; slightly longer bill, and longer wings and tail. Sexes similar. No seasonal variation. Juveniles and immatures separable. Hybridize with Black-winged Stilt, hybrids showing complete gradation in plumage and morphometrics between the two (see Plumages).

Description Adult Entirely black, with green gloss on much of head, neck and upperparts when fresh. When plumage worn, may show grey flecking around base of bill. Bill, black. Iris, red. Legs and feet, pink-red to pink. **Juvenile** Crown, sooty black with fine pale-brown scaling; rest of head, chin, throat and foreneck, mostly white, mottled grey on nape and in patch from

crown round eye; grey wash on ear-coverts. Hindneck and sides of neck, dark grey, mottled white. Mantle, light grey, mottled darker and scaled paler brown. Upper back and scapulars, grey-black, scaled light brown; lower back, rump and lateral upper tail-coverts, white, the latter smudged with black and brown; central upper tail-coverts, grey-black with narrow light-brown subterminal band and broad off-white tip. Outer tail-feathers, grey-black with slightly paler tips; inner feathers, white tinged grey with grey-black terminal band (sometimes fringed light-brown). Upperwing, black with diffuse white trailing-edge and light-brown scaling to forewing-coverts. Underparts, mostly white, with grey smudging at sides of breast and fine grey streaking on flanks and thighs when fresh. Underwing, black with some fine white scaling on coverts. Most pale scaling, fringing and mottling lost rapidly with wear. Bill, grey-black with reddish tinge at base. Iris, brown. Legs and

feet, pink. **First immature** Poorly known, with much individual variation; dark markings asymmetrical. Head and neck, white, with distinct dark-grey smudge round eye and some grey mottling on hindneck and, sometimes, crown. Mantle, white; rest of upperparts, unknown. Retain juvenile tail, or mixture of juvenile and adult rectrices. Upperwing, like juvenile but with white trailing-edge and scaling much reduced or absent and with black lesser coverts. Breast, belly and foreflanks, white; rest of underbody, black with white streaking; all show dark, sometimes broken, band extending from flank to flank, passing through cloacal area. Bare parts like juvenile but legs darker red. **Second immature** Attained gradually, with scattered greyish-black blotches on crown and hindneck at first, followed by darkening of area between blotches; pattern extends to foreneck, breast and then sides of breast. Head, neck, and body, mostly black like adult except for: scattered white spots and streaks on head; neck, not glossy; whitish patch at base of bill on some; scattered white feathers on underparts of some, especially on vent and under tail-coverts, but no large patches of white. Tail, usually like adult; sometimes with some worn juvenile rectrices. Juvenile remiges and greater coverts, retained; other coverts, black, as adult. Bare parts, as adult.

Similar species None as adult. Other ages most likely to be confused with subadult Black-winged Stilt and Black x Black-winged Stilt hybrids. Immature Black Stilt distinguished from juvenile and immature Black-winged Stilt by black on underparts. Juvenile Black Stilt, easily confused with **juvenile and immature Black-winged Stilt**, which are slightly smaller, more slender, with shorter tarsi, flat (not rounded) back, shorter more slender-based bill and longer neck; in flight, legs usually trail well beyond tip of tail, but tail falls short of knee (in Black Stilt, tail extends beyond knee); juvenile Black-winged has narrower dark terminal tail-band and pink-buff (not pink) legs; immature Black-winged Stilt has dull-pink legs. **Hybrid plumages** Separation of subadult Black Stilts from all ages and types of hybrids, problematical (see Plumages).

Endangered; restricted to braided rivers of Mackenzie Basin, central SI, though a few move to n. harbours and estuaries in winter. Seen singly, in pairs or in family groups. Rarely occur on nearby coasts. Confiding, rarely flying great distances. Feed in shallow riffles of rivers and their side channels, mainly by pecking and probing scythe in muddy areas. Yapping Alarm Calls like those of Black-winged Stilt but louder and higher-pitched.

HABITAT Usually associated with stable banks of shingle or gravel in wide braided channels of river beds and associated permanent tributaries and backwaters; occasionally on river-flats and lacustrine estuaries and deltas; also ponds, swamps and tarns with muddy bottoms and generally without weeds; lake shores and associated mudflats. Migratory birds may over-winter in harbours, usually on intertidal mudflats, or round coastal lagoons (Soper 1959, 1967; Pierce 1982, 1983, 1984a, 1986a,b; O'Donnell 1988; CSN 30; C.E.M. Reed).

Breed in intermontane basin round terrestrial wetlands, including small tributaries and backwaters of rivers with grasses and small plants on banks, small (<10 ha) swamps dominated by *Juncus* and *Carex*, permanent muddy-bottomed ponds near grasslands, and broad river beds with bare shingle banks in braided channels. Prefer to nest on dry banks or islets within these habitats (Soper 1967; Pierce 1982, 1983, 1986a,b; O'Donnell 1988). In Cass and Godley R. valleys (Pierce 1982), prefer stable permanent sidestreams (54% of nests observed, Cass R.; 67% Godley R.); also swamps (21%, 28%); ponds (21%, 0%); rivers (4%, 5%); mostly on stable shingle (48.1%); among grass (25.9%); on mud (11%); unstable shingle (7.4%); hummocks of sedge and

tussock (7.4%). Vegetation at breeding sites varies from none to total coverage on grassy banks, islets and in swamps (Soper 1967; Pierce 1982; O'Donnell 1988). Large plants (>0.5 m) avoided, except where they form base of nest (Pierce 1982). Tussocks, sedges and rushes provide cover for chicks (Pierce 1986b). Few records of breeding in paddocks (Soper 1967) and at artificial ponds (Pierce 1986b). Forage in range of freshwater habitats (Pierce 1982), including shallow (≤ 10 cm) flowing water of shingly or gravelly river beds and streams and river deltas; when these areas flood, use small weedless and muddy lagoons, swamps and ponds (Soper 1967; Pierce 1982, 1983, 1985, 1986b; CSN 30). During winter, some migratory birds may forage in harbours, on mudflats, estuaries and coastal saltmarsh (Pierce 1985; C.E.M. Reed). May wade up to belly when foraging in water (Pierce 1986b).

Birds in river valleys loaf on gravel banks; migratory birds roost in harbours on shell banks or dry saltmarsh and mudflats (C.E.M. Reed).

Continued survival threatened by changes in habitat (Pierce 1982, 1984a, 1986b; Reed 1986). Forced into marginal breeding habitat by drainage of preferred wetlands; artificial channelling of river beds, diversion and abstraction of water, have eliminated braided pattern of river beds; exotic grasses, weeds, shrubs and trees have choked former feeding and breeding areas, rendering them unsuitable, by building up large islands and forcing the river into deep fast-flowing channels, and providing extra cover for predators (Pierce 1986b; C.E.M. Reed). Prefer habitats little frequented by stock (Pierce 1986b). Has been recorded using artificial ponds (Pierce 1986b) and at airports (CSN 30).

DISTRIBUTION AND POPULATION Endemic to NZ. Endangered, with total population fewer than 50 birds. Formerly widespread but now virtually restricted to Mackenzie Basin, SI, where c. 90% of population sedentary. Small groups or singles occur elsewhere in winter: up to about ten birds leave Mackenzie Basin in winter. Up to eight recorded regularly at Kawhia Harbour; singles N of 38°S in harbours N to Rangaunu Harbour. Also at Manawatu R. estuary. In SI, occasionally winter at coastal lagoons such as L. Ellesmere and Wainono and Washdyke Lagoons; other scattered records of stragglers in coastal regions of Nelson and Marlborough, and occasionally inland Otago and Southland (Pierce 1982, 1984a, 1986b; C.E.M. Reed; CSN). **Breeding** Confined to Mackenzie Basin where, since 1977, has bred in valleys of Ahuriri, Hopkins, Dobson, Ohau, Tasman, Cass, Godley, Macaulay, Tekapo Rs. A pair probably also nested in Manuherikia R. in 1979 and 1980–81 (Pierce 1982, 1984a).

Populations and distribution in NZ have declined, from N to S. During late nineteenth century, widespread in NI and SI. **NI** Late last century, occurred in small numbers N to Parengarenga Harbour; very plentiful round lakes of Rotorua district and in Hawke's Bay; breeding recorded in both regions. Persisted round Hawke's Bay till at least 1900, by which time the species was rare in NI. Has not been recorded nesting in NI since then (Buller 1878, 1888; Hutchinson 1900; Pierce 1984a). Buller (1888) considered the species to be found mainly round Wellington district and in SI. **SI** Formerly, from Nelson, S to Otago, penetrating far inland and on both sides of Southern Alps. Between 1900 and 1910, populations in N. Canterbury, declined, but remained common in S. Canterbury. In 1928–30, estimated population density in lowland river beds in S. Canterbury was 1 bird/km; nesting recorded on upper and lower Rangitata, Waihi, Te Moana, Orari, Opihi, lower Waitaki, Marawhenua and Hakataramea Rs till 1940s, but during 1930s and early 1940s populations declined in lowlands. Persisted in Waitaki R. valley

till 1950s (Stead 1932; Pierce 1982, 1984a); last recorded nesting in lowlands on Orari R., S. Canterbury in 1957 (Child 1958). Extinct in Shotover R. since late 1940s but still nested at Naseby and Cromwell, and on Nevis, Arrow, Timaru, Dingleburn and Hunter Rs in central Otago till c. 1950. No nesting recorded there since except on Manuherikia R. (Pierce 1982, 1984a). Major decline of inland populations occurred in early 1950s, c. 20 years after lowland populations declined. By 1960s, confined to Mackenzie Basin, where number of valleys in which nesting recorded fell from at least 24 to c. 12. Since 1960s, rate of decline has slowed, and in that time only lower Waitaki and Hakataramea Rs have been abandoned as nesting sites (Pierce 1982, 1984a). However, since the 1970s the number of breeding pairs in Hopkins and Godley R. valleys have been alarmingly reduced (Pierce 1986b).

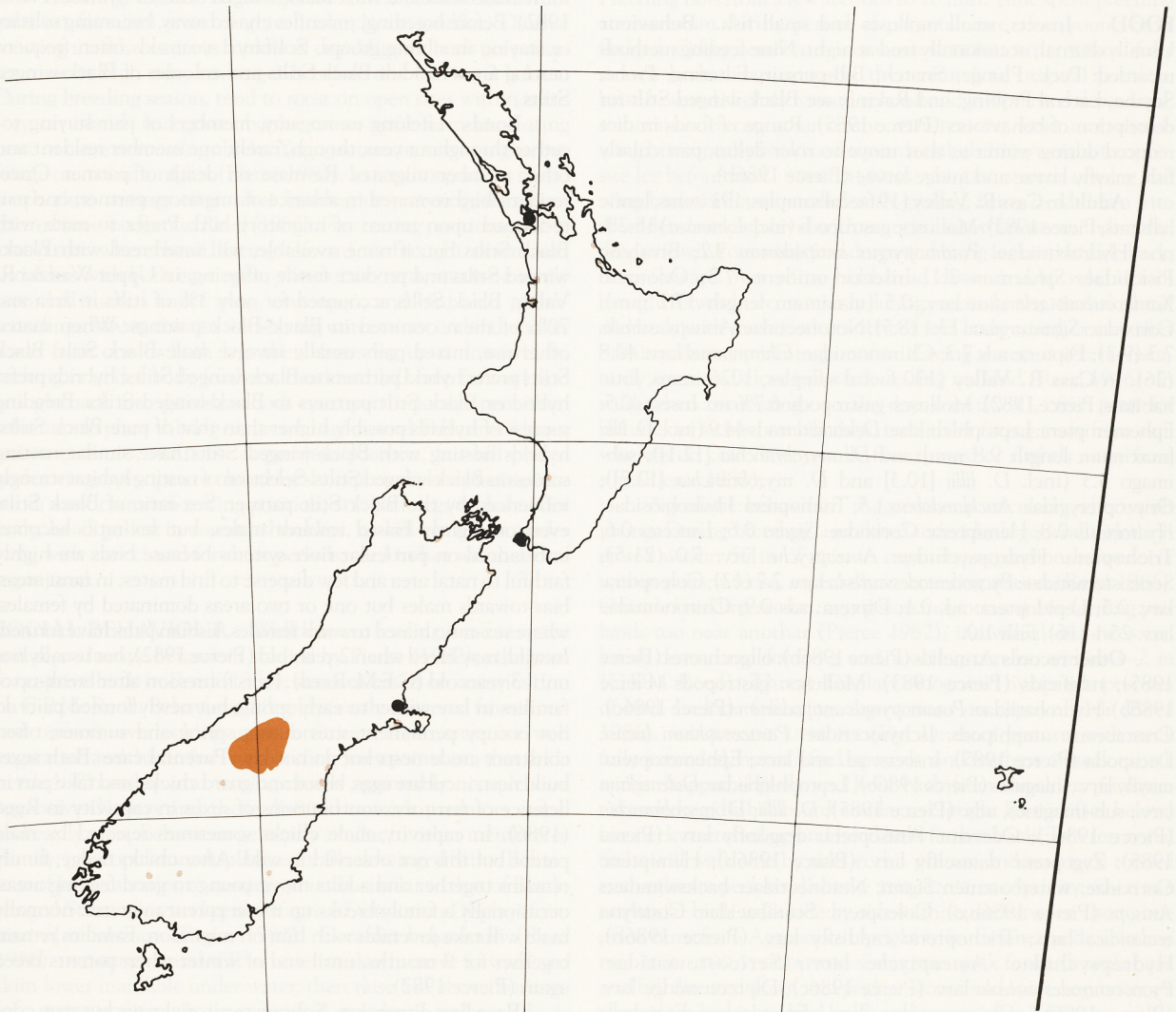
Hybrids Distribution of hybrid Black x Black-winged Stilts centred on Mackenzie Basin, but hybrids and mixed pairs may breed in central Otago and near Canterbury coast, e.g. L. Ellesmere (Pierce 1982, 1984b; O'Donnell 1988). Though most Black Stilts remain in Mackenzie Basin over winter, most hybrids follow movement patterns of Black-winged Stilts, and leave for n. har-

bours and estuaries, including Kawhia, Kaipara, Manukau, and Aotea Harbours, Firth of Thames and Manawatu R. estuary. Sometimes seen on passage in Nelson (CSN 35) and occur round coastal lagoons of SI (Pierce 1984b; CSN).

Status Endangered (IUCN 1979) through heavy predation by introduced species and loss of habitat through drainage and hydro-electric development (Collar & Andrew 1988). **Population** In 1940s, 500–1000 birds (Pierce 1984a); by 1962, 68 adults recorded in Waitaki R. system, and throughout 1960s, between 50 and 100 birds. Winter count (including NI sites) in 1972 recorded 67 adults; in 1975–79, 50–60 adults (Pierce 1982, 1984a, 1986b). In July 1986, total population was little more than 50 birds, including only about 12 breeding pairs (Pierce 1986b). Much predation by introduced species such as cats, ferrets and Brown Rats *Rattus norvegicus* (Pierce 1986b).

MOVEMENTS Sedentary within the Mackenzie Basin, with local movements (C.E.M. Reed). Move when rivers flood and to lower altitudes in bad weather, moving lower as severity of winter increases (Pierce 1982, 1983).

Generally at breeding grounds from late Aug. to Dec. or Jan.



After nesting, successful and unsuccessful pairs move to ponds on river deltas to forage, and gradually move to inland tarns, river deltas and lakeshores to winter, sometimes only hundreds of metres from breeding ground (Pierce 1982, 1983, 1986b; C.E.M. Reed). Families stay together until the end of winter, usually Aug. or Sept., when pairs return to breeding grounds (Pierce 1982, 1983; C.E.M. Reed).

A few birds, most of which are associated, and may be paired, with Black x Black-winged hybrids or Black-winged Stilts migrate to NI to winter (Falla *et al.* 1981; Pierce 1982; C.E.M. Reed). Leave Jan. and most return by July (C.E.M. Reed). Kawhia Harbour, NI, appears to be a traditional wintering ground (records go back to 1950s, B.D. Heather); counts in autumn–winter since 1971 have recorded 1–7 birds each year, most apparently hybrids; also occasionally recorded from other NI harbours (Pierce 1984a). Migrating birds return to same breeding area in the Mackenzie Basin each year and use same stop-over areas (C.E.M. Reed).

Banding Longest recovery in recent years was subadult at Manukau Harbour (Auckland) c. 1300 km N of banding site (C.E.M. Reed). Banding shows high fidelity to nest-site (Pierce 1982, 1986a). Natal fidelity high, juveniles remaining on river where raised (C.E.M. Reed). For banding recoveries of Black x Black-winged hybrids, see Movements of Black-winged Stilt.

FOOD Insects, small molluscs and small fish. **Behaviour** Usually diurnal; occasionally feed at night. Nine feeding methods recorded: Peck, Plunge, Snatch, Bill-pursuit, Filtering, Probe, Scythe, Lateral Probing, and Raking; see Black-winged Stilt for description of behaviours (Pierce 1985). Range of foods in diet reduced during winter as they move to river deltas, particularly fish, mayfly larvae and midge larvae (Pierce 1986b).

Adult In **Cass R. Valley** (19 faecal samples, 191 items, lentic habitats; Pierce 1982): Molluscs: gastropods (incl. *Lymnaea*) 16.2% no.: Hydrobatiidae: *Potamopyrgus antipodarum* 5.2; Bivalves: Pisidiidae: *Sphaerium* 2.1. Insects: unident. 7.3; Odonata: *Xanthocnemis zelandica* larv. 0.5 (maximum length 17.2 mm); Corixidae: *Sigara arguata* 13.1 (8.5); Notonectidae: *Anisops assimilis* 7.3 (9.2); Diptera: ads 7.3; Chironomidae: *Chironomus* larv. 40.8 (26). In **Cass R. Valley** (130 faecal samples, 1026 items, lotic habitats; Pierce 1982): Molluscs: gastropods: 6.7% no. Insects 0.5: Ephemeroptera: Leptophlebiidae: *Deleatidium* ads 44.9 (incl. *D. lillii* [maximum length 9.8 mm] and *D. myzobranchia* [12.1]), sub-imago 3.3 (incl. *D. lillii* [10.3] and *D. myzobranchia* [12.7]); Griptopterygidae: *Aucklandobius* 1.5; Trichoptera: Hydrobiosidae: *Hydrobiosis* 0.8; Hemiptera: Corixidae: *Sigara* 0.6; *Lancetes* 0.6; Trichoptera: Hydropsychidae: *Aoteapsyche* larv. 5.0 (21.5); Sericostomatidae: *Pycnocentodes aureola* larv. 7.7 (12); Coleoptera: larv. 0.5; Lepidoptera: ad. 0.1; Diptera: ads 0.9; Chironomidae larv. 25.1 (16). Fish 1.0.

Other records Annelids (Pierce 1986b): oligochaetes (Pierce 1985); tubificids (Pierce 1983). Molluscs: gastropods (Pierce 1986b): Hydrobatiidae: *Potamopyrgus antipodarum* (Pierce 1986c). Crustaceans: amphipods: Ischyroceridae: *Paracorophium lucasi*; Decapoda (Pierce 1985). Insects: ad. and larv.; Ephemeroptera: mayfly larv., imagines (Pierce 1986b); Leptophlebiidae: *Deleatidium* larv., sub-imagines, ads. (Pierce 1985); *D. lillii*; *D. myzobranchia* (Pierce 1986c); Odonata: Anisoptera: dragonfly larv. (Pierce 1985); Zygoptera: damselfly larv. (Pierce 1986b); Hemiptera: Corixidae: waterboatmen *Sigara*; Notonectidae: backswimmers *Anisops* (Pierce 1986b,c); Coleoptera: Scarabaeidae: *Costelytra zelandica* larv.; Trichoptera: caddisfly larv. (Pierce 1986b); Hydropsychidae: *Aoteapsyche* larv.; Sericostomatidae: *Pycnocentodes aureola* larv. (Pierce 1986c); Diptera: midge larv. (Pierce 1986b); Chironomidae: larv.; Ephydriidae: *Ephydrella*

(Pierce 1985). fish: small fish (Pierce 1985, 1986b); Salmoniformes: Galaxiidae (Pierce 1986b): *Galaxias* (Pierce 1986c); Gobiesociformes: Eleotrididae: bullies (Pierce 1986b).

Young Require still or slow-moving water. Rate of capture increases as chicks get older (C.E.M. Reed).

Intake Main prey, *Deleatidium*, is 90% water, 2.5% available carbohydrate, 0.9% dietary fibre and 5% protein. Each 1 m³ of wet sample contains: zinc 1.45 g, iron 14.9, sulphur 190, magnesium 91, sodium 23.3; calcium 18.5, phosphorus 178, copper 0.8, potassium 2340, manganese 0.6, and 17 amino acids (C.E.M. Reed).

SOCIAL ORGANIZATION Well known. Account based on contribution by C.E.M. Reed; major studies in Mackenzie Basin, SI (Pierce 1982, 1986), and in captivity (Reed 1986); detailed discussion of hybridization with Black-winged Stilt in Pierce (1982). Generally occur as territorial pairs that stay with young until onset of next breeding season. After breeding, solitary birds, including 1-year-olds and unmated adults, mingle with post-breeding flocks of Black-winged Stilts. Outside breeding season, pairs tend to avoid one another, though loose feeding and roosting associations can form between conspecifics, and, if alarmed, pairs may join groups of Black or Black-winged Stilts; some individuals associate with Black-winged Stilts or hybrids (Pierce 1982). Before breeding, juveniles chased away, becoming solitary or staying in sibling groups. Solitary 1-year-olds often frequent nesting areas of adult Black Stilts and colonies of Black-winged Stilts.

Bonds Lifelong monogamy, members of pair staying together throughout year, though, rarely, one member resident and other member migrates. Re-mate on death of partner. Once, resident bird re-mated in absence of migratory partner; one pair re-formed upon return of migratory bird. Prefer to mate with Black Stilts but, if none available, will interbreed with Black-winged Stilts and produce fertile offspring; in Upper Waitaki R. Valley, Black Stilts accounted for only 3% of stilts in area and 70% of them occurred in Black–Black pairings. When mated otherwise, mixed pairs usually involve male Black Stilt. Black Stilts prefer hybrid partners to Black-winged Stilts; hybrids prefer hybrid or Black Stilt partners to Black-winged Stilts. Breeding success of hybrids possibly higher than that of pure Black Stilts; hybrids nesting with Black-winged Stilts have similar nesting success as Black-winged Stilts. Selection of nesting habitat strongly influenced by the Black Stilt partner. Sex-ratio of Black Stilts even or slightly biased towards males, but sex-ratio becomes unbalanced on particular river systems because birds are highly faithful to natal area and few disperse to find mates; in most areas, bias towards males but one or two areas dominated by females; where sex-ratio biased towards females, lesbian pairs have formed. In wild, may breed when 2 years old (Pierce 1982), but usually not until 3 years old (C.E.M. Reed). Pairs form soon after break-up of families in late winter to early spring, but newly formed pairs do not occupy permanent sites during spring and summer; often construct crude nests but do not lay. **Parental care** Both sexes build nest, incubate eggs, brood and guard chicks, and take part in defence of territory; contributions of sexes in captivity in Reed (1986). In captivity, male chicks sometimes rejected by male parent but this not observed in wild. After chicks fledge, family remains together and adults move young to good feeding areas; occasionally a family breaks up if one parent migrates: normally male will take juveniles with him on migration. Families remain together for 9 months, until end of winter when parents breed again (Pierce 1982).

Breeding dispersion Solitary territorial pairs but may con-

concentrate in areas of suitable breeding habitat; sometimes many kilometres from nearest Stilts but occasionally within 100 m of other pairs (Pierce 1982). High fidelity to site. Recorded re-nesting in well-established colonies of Black-winged Stilts (Pierce 1982). **Territories** Centre on areas with plentiful food. Pairs territorial all year, but more so when nesting; exclude Black-winged Stilts, interspecific interactions being most intense in late winter, when territories occupied by Black Stilts often become smaller, and in late summer. Before incubation, often leave territories temporarily, typically for no longer than a few hours, but up to 9–10 days; on returning, chase out Black-winged Stilts, which have usually moved in. All activities during incubation and chick-rearing take place within territory, though sometimes after hatching families may move up to 2–3 km from nest-site (C.E.M. Reed); generally nest-site forms centre of feeding area of chicks; at first, chicks usually forage within general area of nest, but older chicks forage up to 200 m away (Pierce 1982). **Feeding territories** Outside breeding season, pairs spend most of day and night occupying areas with plentiful food; after breeding, may usurp feeding areas of Black-winged Stilts; sometimes leave territories, often to roost with other Black or Black-winged Stilts (Pierce 1982). Non-breeding territories observed in migratory birds (C.E.M. Reed).

Roosting Outside breeding season, tend to roost with other stilts on favoured areas of gravel, islands, or mudflat. Diurnal roosting mainly occurs in middle of day. Migrant birds on estuaries roost at high tide, arriving 2 h before and leaving 2 h later. During breeding season, tend to roost on open sites within territory, on islands and gravel banks; roosts apart from incubating mate or close to roosting chicks. Young return to nest at night, but forage on moonlit nights (Pierce 1982). In captivity, adults spend much time resting, often after bathing or preening; details of diurnal time-budgets in Reed (1986). Five resting positions: **STAND TWO LEGS**: where head, facing forward, is brought down into shoulders with both eyes open; **STAND TWO LEGS, HEAD IN**: rarely seen; bill tucked under wing, eyes open, and bird alert to surroundings; **STAND ONE LEG**: on leaving water to rest on land, shakes water from one or both legs then draws leg up to lower body, tucking it under body-feathers; head and bill face forward and brought back into shoulders; both eyes open or partly open; often reluctant to place this leg on ground again, and if disturbed hops; **STAND ONE LEG, HEAD IN**: as previous position, but bill placed under wing; eyes open or closed for short periods; body facing into wind; most common resting position; **SIT**: both legs folded under body, head pulled in toward shoulders, or bill tucked in under wing with eyes closed for short periods; used in hot weather or if leg injured.

SOCIAL BEHAVIOUR Well known; feeding, maintenance and reproductive behaviour studied by Pierce (1982); ethogram for captive birds in Reed (1986); account based on contribution by C.E.M. Reed. Behavioural displays easily observed from riverbed terraces overlooking most territories; some areas are well vegetated and have few surrounding viewpoints so that hide needed. Courtship and mating rituals reasonably conspicuous; aggressive displays and those directed towards predators, vocal and easily seen. Behaviour generally similar to other members of Family; pre-copulatory displays as for Black-winged Stilts. Behaviour of hybrids varies; at nesting grounds, similar to that of Black-winged Stilts, noisy and perform active Distraction Displays from start of incubation (Pierce 1982). **Comfort behaviour** (Reed 1986): **DRINKING**: stand still in water or slowly move forward and skim lower mandible under water, then raise bill above horizontal. **BATHING**: crouch in water 6–8 cm deep, and rock body

forward and backward, dipping head and bill rapidly in water so that droplets run over neck and back; wings closed, and, as head raised, give single Bathing Call; dip head and give call 4–8 times before bringing neck along back in sideways S-shaped movement, rubbing head over upper mantle. Dipping then resumed in forward rocking motion with wings spread; flap both wings up and down below water, and with sideways dip of body, immerse each wing alternately in water; intersperse flapping and sideways rocking with forward dipping and rubbing of head along mantle; vigorous side-dipping results in water being thrown over entire body. When bathing, occasionally dive. Complete bathing with upward spring into air, flapping both wings; shake body then tail. Bathing by one bird sometimes stimulates another to bathe. **PREENING**: occurs on land or in shallow water and often follows bathing or precedes resting. Stretch neck up, bring bill down and back towards chest, and give quick pecks with bill-tip at feathers of breast and edges of both wings. When preceded by bathing, rub tips of primaries on one wing continuously together with those on opposite wing; then hold one wing away from body with leading primary stretched downwards and uses bill to preen inside wing-feathers. Quickly peck feathers of breast, lower body and wings before rubbing side of head over lower back and uropygial gland; head rubbed over entire back and wings, spreading oil from gland. Preening lasts from a few seconds to 20 min. Time spent preening at maximum during period of parental care after young have fledged. Other comfort movements: **STRETCH BOTH WINGS**: fully stretch both wings upwards, then returns to original position; head lowered slightly toward ground and bill pointed downward; sometimes defecate at same time. **STRETCH ONE WING**: rare; stretch wing horizontally backward towards tail, shifting weight to opposite leg beforehand. **STRETCH WING AND LEG**: stretch one leg and wing backward and parallel with ground; bring head down into shoulders but keep level with mantle. **SCRATCH HEAD**: indirectly; drop one wing outwards and down and bring leg on that side back, then forward over wing; hold head down and to side as foot brought forward; occurs mainly during preening. **SHAKE**: shake head and body with most feathers of head and body raised; occurs after bathing, during preening, or after leaving water. **GAPE**: momentarily open and close bill while resting on land (Reed 1986). In wild, when incubating on calm days over 20 °C, often **PANT** for minutes at a time; on hot days, tend to sit facing away from sun, whereas on cold days, usually face toward or slightly away from sun (Pierce 1982).

Agonistic behaviour Aggressive, particularly when with young. During breeding, unrelated individuals generally not tolerated within 50 m of pair; in captivity, aggression between or within pairs intense, especially in breeding season (Reed 1986). Outside breeding season, aggression may occur if one feeding pair lands too near another (Pierce 1982); individual distances can break down, and foraging and roosting can be within 1–2 m (C.E.M. Reed). **Threat** Displays recognized by upright postures of bird. Include following observations on captive birds (Reed 1986). **AGGRESSIVE UPRIGHT** (Fig. 1): erect posture, with neck fully extended, breast lifted upwards, and feathers of neck raised; wings dropped slightly and held back from shoulder; primaries extended rigidly backward; similar to Upright Posture (see below) but neck stretched up and head held farther back. Two territorial Stilts will walk side by side in this posture and may turn toward each other to peck rival's body. **TUG FENCE**: in captivity, when two territorial birds walk side by side with fence between them, one often turns from Aggressive Upright towards fence and pecks and tugs at it. **TUG VEGETATION**: sometimes walk forwards with head and bill directed down and peck at stones and loose vegetation; if vegetation has roots, bird holds and tugs it; after letting go, either

drops material or throws it backward. **SIDE-THROW**: pick up vegetation with bill and throw it backwards with sideways flick of head, through 45–90°. **SQUAT**: bend knees, then lower body, chest first, toward ground though not always reaching it. Side-throwing observed after most Squats. If body lowered completely, Scraping follows. **SCRAPING** (Fig. 2): crouch with body on ground, then bring both legs behind body while carrying weight on breast; with feet, dig out gravel and vegetation with both tibia pointed upward at angle of 45–70° to ground, tarsi almost vertical, and wings directed upward. **AGGRESSIVE PURSUIT** (Fig. 3): chase in hunched posture, with head lowered to shoulder height and brought back into chest. Often seen at feeding sites, most commonly with Head

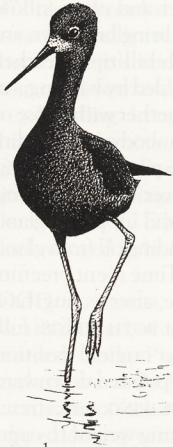


Figure 1
Aggressive Upright

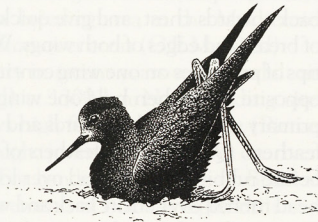


Figure 2 Scraping

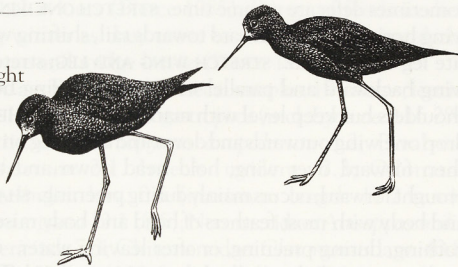


Figure 3 Aggressive Pursuit

Low, Run Sideways (see below). In wild, territorial pair (with male in front) walks, then runs at intruders (Pierce 1982). **INTENTION-PECK, PECK**: pursuing bird may lunge and sometimes peck at opponent. **FLY-AND-DROP**: (Fig. 4) in most intense attacks, bird springs into air and drops down on opponent crouching nearby; drops with both legs stretched down and wings held upward; physical contact often made; if in water, opponent submerges lower body. In captivity, repeated swoops made by one or both birds. In wild, when with young, normally male but often both parents will fly low and fast at intruding bird and prepare to land where intruder was standing (Pierce 1982). Aerial pursuit occurs until intruder driven away. **Appeasement** Female may go into soliciting posture to avoid attack (C.E.M. Reed). **HEAD-LOW, RUN-SIDEWAYS**: pursued subordinate runs with head lowered and turned toward pursuer and ends up running sideways rather than forward. In captivity, birds may also roost with head tucked under wing to avoid attack. Often seen at feeding sites, when subordinate birds chased off (Reed 1986). Black Stilts dominate Black-winged Stilts; will oust Black-winged Stilts from their own territories; particularly aggressive when with young. When Black-winged Stilt confronted Black Stilt after breeding, always involved physical contact with legs, feet, and wings, but not bill, and in all cases Black Stilts ousted Black-winged Stilts (Pierce 1982). **Alarm** Following postures or behaviours recorded in captivity (Reed

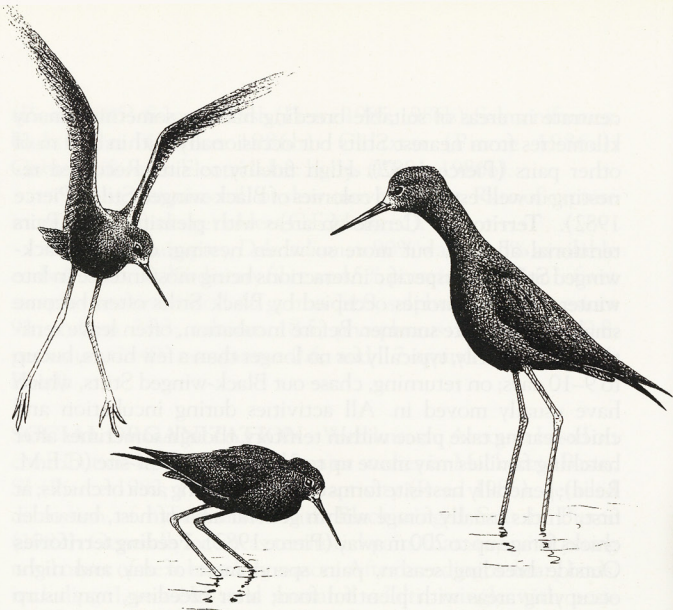


Figure 4 Fly-and-drop

Figure 5 Forward Posture

1986). **UPRIGHT POSTURE**: (see Aggressive Upright, Fig. 1) extend neck vertically, slightly forward of shoulders, keep both eyes open, turn head in direction of disturbance and give yapping Alarm Call until intruder leaves. **FORWARD POSTURE** (Fig. 5): similar to Upright Posture, except neck held farther forward; bill and head directed downward; feathers of breast raised, giving impression of broader chest, and feathers of nape and neck also raised; give Tip Call. **TILT HEAD**: in response to aerial predators, stretch neck and hold head at 30–40° angle to vertical so that one eye directed toward sky; move head and neck to follow flight of predator, while body remains stationary. **WALK FENCE**: in captivity, in response to disturbance on ground, walk or run backwards and forwards along fenceline facing disturbance. **HEAD-BOB**: when excited, often bob head, repeatedly extending neck a few centimetres; in captivity, seen near feeding sites and often accompanied by yapping Alarm Call. **INTENTION BOB TO FLY**: four times observed to run 2–3 m in semi-crouch, with knees bent and body forward; stopped and gave single bobbing movement with wings closed, and then moved off in semi-crouch again. **FLIGHT**: fly and give yapping Alarm Call; upon landing, continue yapping Alarm Call and assume alert Upright Posture and run until disturbance subsides. **RUN AND HIDE**: twice seen to run to cover and hide from Swamp Harrier *Circus approximans*.

Sexual behaviour Pair-formation occurs after c. 20 days of persistent association in same locality between members of pair (Pierce 1982). No pairing display. Pair-bond reinforced strongly by cooperation in territorial defence. **Greeting** Three different types of behaviour at change-over. (1) Incubating bird moved off nest while partner away from nest-area, though partner incubated fairly soon after; when change-over occurred during laying period, copulation common. (2) If sitting bird left because it had been disturbed, partner usually resumed incubation. (3) Partner approached incubating bird, and began to walk round nest, shaking legs to remove excess water; then stood near nest until sitting bird moved off; when incubating bird did not move, it was almost pushed off; as mate moved off, picked up and threw back nesting material. Before settling on nest, eggs may be turned with bill, and some scraping of nesting material may occur. To settle, bird lowers body breast-first, raising feathers of breast to expose brood-patch; then shuffles body sideways and settles (Reed 1986). **Copulation** In captivity, four types of social interactions observed before female adopts pre-copulatory position. (1) Male and female walk slowly past each other in Hunched Posture with heads upright but

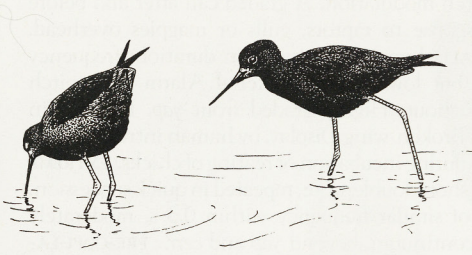


Figure 6a

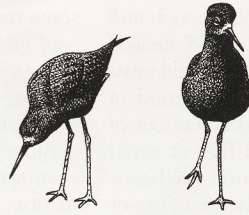


Figure 6b

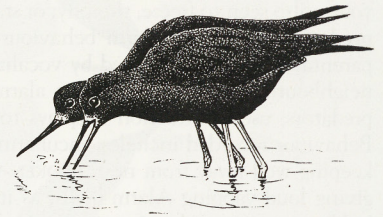


Figure 6c

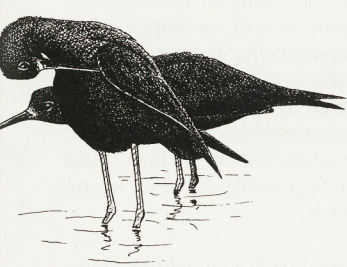


Figure 6d

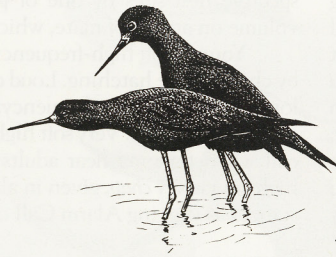


Figure 6e

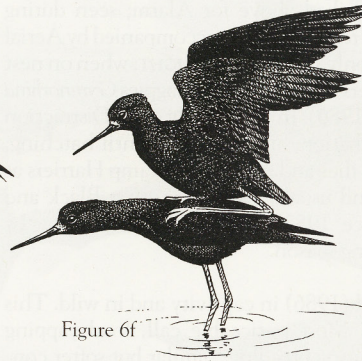


Figure 6f

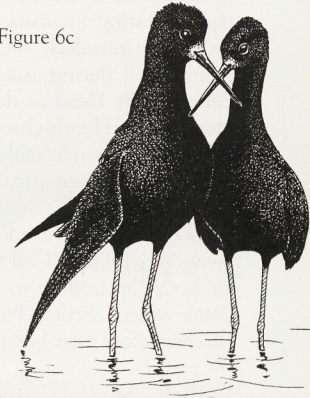


Figure 6g

Figure 6 Copulation

drawn in; as they neared each other, walked more slowly and lifted tarsi out of water. (2) Birds in adjoining aviaries spent much time interacting at fence and giving low staccato calls. (3) Two females stood next to one another, each manipulating nesting material. (4) One female aggressively pursued by male until she assumed pre-copulatory posture (Reed 1986). Observed copulations in wild always initiated during feeding bouts (Pierce 1982). Pre-copulatory behaviour begins with female walking in shallow water near mate with hunched body; she flicks water sideways with bill (Fig. 6a), then raises head and bill and holds in line with body at angle of 35–45° with water; continues dipping bill until approached by mate. Then, on land or in water, female adopts horizontal PRE-COPULATORY POSTURE (Fig. 6b), usually giving low soft call (Pierce 1982; Reed 1986). After this, responsive male performs SIDE-TO-SIDE WALK, following behind female in U-shaped path; as he comes shoulder to shoulder with female, he dips bill and splashes water upward (BILL-DIPPING) (Fig. 6c); often followed by flicking bill briefly under wing and feathers of upperbody, or by quickly preening feathers of breast (FALSE-PREENING) (Fig. 6d). Male resumes Side-to-side Walking, stopping to Bill-dip and False-preen on other side of female. As he becomes increasingly excited, he raises feathers of body and neck, Bill-dipping becomes exaggerated, and holds head high between Bill-dips (Fig. 6e). Copulate in shallow water, rarely on land. Male springs on to back of female, balancing by stretching wings up (Fig. 6f), then lowers them as cloacal contact made. During coition, female moves head rapidly from side to side. On dismounting, male and female cross bills with neck upstretched and male's wing over back of female, and female lowers wings (Fig. 6g); pair walks 3–5 m then separates. Bouts of copulation last on average 80 s (n=67) with 69 min (n=21) between bouts; in wild, maximum of seven copulations observed per pair per day (Pierce 1982). Copulation peaks before laying and stops 2–3 days after start of laying (Reed 1986) or until laying of last egg (Pierce 1982); resumed if re-laying (Reed 1986); in wild, copulation first

seen late July to Aug. Occasionally 1-year-olds and some adults copulate with inanimate objects during spring.

Relations within family group When selecting nest-site, bird approaches site in hunched posture with bill directed downward; holds bill, back, and tail at c. 45° to horizontal; when mate approaches, it adopts same posture and both give soft staccato calls. Then pair give SIDE-BY-SIDE GROUND-PECK display, picking up grass with bill and throwing it sideways at or near proposed nest-site. Performed at more than one site. For further details of nest-building, see Breeding. Chicks not recognized by parents for 4–5 days; this, and the ability of Black Stilts to re-lay, allows clutches to be cross-fostered as a management technique: clutches are fostered out to less endangered species of stilt to be incubated and raised; behavioural implications of such cross-fostering of eggs to Black-winged and Black x Black-winged hybrid Stilts discussed further in Reed (1986). Patterns of maintenance, comfort, and alarm behaviour of young resemble those of adults. Details of time-budgets of juveniles and of parents tending young, and age of first appearance of behaviours of young born in captivity, in Reed (1986). Parents brood and guard chicks until fledging. Brooded often in first week, particularly when cloudy or raining; chick approaches parent and flaps wings, flapping them in more exaggerated manner as parent crouches to face it; will continue pursuing parent and wing-flapping until brooded. Young able to swim (Pierce 1982; Reed 1986). Chicks not fed by parents, but learn to find best feeding areas from them. While chicks forage, adult gives loud contact calls and assumes semi-hunched posture; calls and posture not adopted when chicks rest; chicks give chip contact calls (C.E.M. Reed). In wild on Day 1, first foraging bouts have low success and last <5 min before chick returns to be brooded; in bad weather, prevented from foraging completely. In terms of foraging success, learning experience associated with foraging behaviour may continue up till first winter (Pierce 1982). Chick occasionally preens sitting sibling. In captivity, occasional intra-family aggression by adult males to male juveniles. **Anti-**

predator behaviour of young When 1–5 weeks old, crouch and freeze, sometimes after running; or run and hide. In wild, fledged young also seen to freeze, then fly; or stand alert. **Parental anti-predator strategies** Alarm behaviour peaks during period of parental care; can be caused by vocalizations and behaviour of neighbouring conspecifics. Gives alarm call and flies at aerial predators; uses Distraction Displays towards ground predators. Behaviour recorded includes: incubating bird False-brooding or keeping well away from nest; **BROKEN-WING DISPLAY**: bird runs, giving loud yapping Alarm Calls; as intruder nears nest, adult holds wings out with primaries lowered towards ground; occurs mainly during incubation, but also when with chicks. When diving at intruders, silent during approach but give yapping Alarm Call during ascent; most common reaction to people. Perform Tilt Head as described above for Alarm; seen during incubation and early chick-rearing; usually accompanied by Aerial Alarm Call given by male only. **AGGRESSIVE FLIGHT**: when on nest or with young, fly at intruders and Australian Magpies *Gymnorhina tibicen* (Pierce 1982; Reed 1986). In wild, rarely gives Distraction Displays until late in incubation, and often not until hatching; gives Aerial Alarm Call as flies and swoops at Swamp Harriers as far as 120 m from nest, and usually joined by other Black and Black-winged Stilts (Pierce 1982). Juveniles chased away by parents before next breeding season.

VOICE Studied by Reed (1986) in captivity and in wild. This account by C.E.M. Reed. Most noticeable call, loud yapping Alarm Call, particularly during breeding. Similar but softer contact call. Eleven adult calls identified. Male yaps higher-pitched than those of female, difference difficult to hear. Staccato calls of pair selecting nest-site overlap in time. Calls similar to those of Black-winged Stilt and of Black x Black-winged hybrids but longer and more highly pitched; in pitch and length, calls of hybrids intermediate between those of Black and Black-winged Stilts.

Adult BATHING CALL: soft *tw-ink* of one or two notes; fundamental frequency 2900 Hz, duration 23 ms. Given when raising head during bathing and repeated 2–7 times after Head-dips when bathing. **ALERT CALL**: short moderately loud *tip* of low frequency (555 Hz). Given in Alert Forward Posture. **DISTRESS CALL**: soft *ruh*; low frequency, moderately long (200 ms), repeated about twice per s. Given by captive adults under stress from human intrusion or capture. **PARENTAL CALL**: moderately loud *yark*; frequency 540–1000 Hz (higher at beginning, modulating at end), duration 120–160 ms. Contact call from adult to chick; given while guarding chicks. **CONTACT CALL**: *yak*; similar to Parental Call (*yark*) and Common Alarm Call (*yap*), but shorter and of lower frequency; lacks frequency modulation; quieter and not uttered as often. **ALARM CALL**: loud *yap*, frequency 770–1155 Hz (ascending then descending), duration 70–120 ms, with many harmonics (sonagram A). Given in response to predators and intruders. **AERIAL ALARM CALL**: *url*, frequency peaking early in call,

some terminal pitch modulation. A graded call after and before *yap*, given in response to raptors, gulls or magpies overhead. **HUMAN ALARM CALL**: Long *eerr*, varying in duration; frequency peaking at start, but lower than in Aerial Alarm Call; pitch modulation throughout. Highly graded from *yap*. Evoked, in conjunction with Broken-wing Display, by human intrusion onto nesting territories during incubation or rearing of chicks. **EXTREME ALARM CALL**: very short double-note, repeated in quick succession, often two notes of similar frequency within 0.3 s, moderately loud. Graded in continuum, beyond *yap* and *eerr*. **PRE-COPULATORY CALL**: very soft *pit*; short (8 ms), 3/s. By female; given as female adopts horizontal Pre-copulatory Position and dips bill in water. **NEST-SITE SELECTION CALL**: soft to loud staccato calls, varying in length from extremely short to 100 ms. Given over prospective nest-sites by one of pair, increasing in intensity and volume on arrival of mate, which joins in, calls overlapping.

Young Soft high-frequency piping; 60 ms in duration; given by chick before hatching. Loud double-note *yip-yip* call; first note longer and of higher frequency; given as contact call by chicks away from parents. Very soft high-frequency *chip*, given as contact call when foraging near adults or when following them. Loud high-frequency *chap*, given in alarm by juveniles in same circumstances as yapping Alarm Call of adult.

BREEDING Well known. Detailed studies in wild by Pierce (1982, 1984b, 1986a) and in captivity by Reed (1986). Account based on contribution by C.E.M. Reed. Breed in simple pairs, solitarily, sometimes in colonies of Black-winged Stilts, with which it hybridizes.

Season First clutches laid Sept. to mid-Oct., a few early nests in Aug.; replacement clutches from mid-Oct. to Dec., occasionally Jan.; mean fledging date, 19–24 Jan. (Pierce 1982). Laying often delayed during floods or cold weather in spring (Pierce 1982; C.E.M. Reed).

Site Prefer streams, swamps or ponds, less often rivers; one recorded in a wet field; on stable shingle, grassy banks, mudflats, hummocks of sedge or tussock, or in loose sedge or rushes, sometimes between two stones, on or beside plants, including *Juncus effusus* and *Holcus lanatus*, but individual stems were widely spaced, not in dense vegetation where visibility impaired; usually on banks (52%) or islands (22%), preferring mounds of small vegetation, close to shallow feeding areas (Child 1958; Soper 1967; Pierce 1982; C.E.M. Reed). Two nests within 100 m; occasionally near colonies of Black-winged Stilts; one nest c. 27 m from Black-winged x Black Stilt pair, another within 50 m of Swamp Harrier (Soper 1967; Pierce 1982). **MEASUREMENTS** (cm): height of nests above water, 16–48; distance from water, 75–450 (n=27; Pierce 1982). High site-fidelity: usually re-nest at same site but may move >10 km (Pierce 1982). Will nest with Black-fronted Terns *Sterna albobriata* and Black-winged Stilts (Soper 1959). Both sexes select site; one pair lined three sites before choosing third (Pierce 1982).

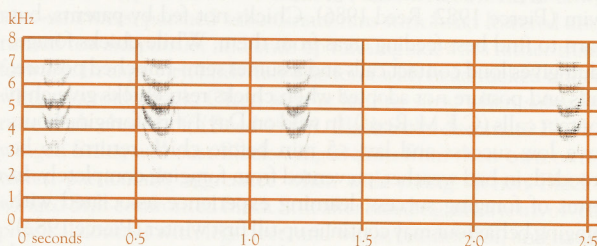


Plate 59

Red-necked Avocet *Recurvirostra novaehollandiae* (page 790)
 1 Adult male; 2 Adult female; 3 Downy young
 4 Juvenile, in fresh plumage; 5 Adult; 6 Adult

Banded Stilt *Cladorhynchus leucocephalus* (page 780)
 7 Adult breeding (alternate); 8 Adult non-breeding (basic)
 9 Downy young; 10 Juvenile; 11 Adult breeding (alternate)

Nest, Materials Shallow scrape in gravel, lined with grass, leaves, roots or other vegetation, whatever is available round nest. Both sexes occasionally sit on nest and form bowl by wriggling breast and drawing lining in to body (Pierce 1982); Nest-scraping identical in form to Scraping (see Agonistic Behaviour, Fig. 2) (Reed 1986). Both sexes collect material; lining gathered in bill within 2 m of nest and thrown backwards over shoulder towards site, where other bird arranges it. Build during day, taking 1–2 weeks to complete. Continue improvement of nest during incubation. Inspect up to three sites before laying. Usually build new nest for each clutch. **MEASUREMENTS** (cm): diameter, c. 15–20; depth, 3–5.

Eggs Oval; smooth; light green or brownish olive, occasionally ground-colour, fawn-clay with dark-brown streaks and moderate to small blotches (Pierce 1982); pale fawnish, with dark-brown blotches superimposed on pale-purplish spots and blotches (Child 1958). **MEASUREMENTS**: 44.0 (1.14; 42.6–45.2; 4) x 31.8 (0.36; 31.5–32.3) (Child 1958); 45.0 (0.94; 32) x 32.0±0.71 (Pierce 1982).

Clutch-size Usually four eggs per clutch; C/3 x 2, C/4 x 51, C/6 x 1; both clutches of three eggs were replacements; clutches of six and eight probably laid by paired females without males (Pierce 1982).

Laying Eggs laid at c. 24-h intervals, sometimes a 48-h break after second or third egg. For a clutch of four: three eggs laid between 15:20 and 18:40, last egg between 19:00 and 09:00 (Pierce 1982). A trio involving two females laid up to eight eggs for each of five seasons. Replacement clutches laid after 8–37 days (Pierce 1982); in captivity, 9–13 days (Reed 1986). Will not re-nest after loss of young (Pierce 1982), though said to re-nest if young lost in first few days of rearing (C.E.M. Reed). Do not raise two broods in a season.

Incubation By both sexes, beginning with third egg or when clutch complete; male does most incubating in first 5 days from beginning of laying (Reed 1986). Hatching largely synchronic, within 1–2 days (C.E.M. Reed). Stints of incubation average 56.5 min (26–129) for both sexes, with 11–19 change-overs per day; longer at night, with usually one, sometimes two change-overs (Pierce 1982). Parents not able to recognize own eggs from dummies; have deserted eggs with no pigmentation. **INCUBATION PERIOD**: 25.5 days (24.5–26; 4) (Pierce 1982). Will sit on addled eggs for 2 months (Pierce 1982). Remove egg-shells after hatching.

Young Precocial, nidifugous. At hatching: down, buff, grey and fawn with black splotches all over (C.E.M. Reed); mottled fawn with darker brownish-black markings on head and forming two lines down back; underparts, pale greyish-white; bill, slaty black; iris, hazel-brown; legs, fawnish pink; toes, pink (Child 1958). Acquire full covering of contour-feathers at c. 5 weeks (Pierce 1982). **Growth** Weight at hatching, 15–20 g; at fledging, 125–175 g, about half to two-thirds of adult weight. From growth curves in Pierce (1982), at 20, 30 and 40 days respectively:

weight, 40, 85 and 118 g; wing, 27.5, 52.5 and 107.5 mm; tarsus, 38.5, 45 and 52 mm. **Parental care, Role of sexes** Brooded most in first week, decreasing until stops at c. 5 weeks (Pierce 1982). Guarded until fledged. Remain in nest for 13–38 h after hatching, leaving to forage within a few metres of nest, and returning to nest at night only; able to feed themselves and not shown food by parents (Pierce 1982). On moonlit nights, chicks forage up to 100 m apart and sometimes over 150 m from guarding parent (Pierce 1986a). Downy chicks freeze when adults gave Alarm Call, older chicks ran for up to 250 m before hiding beside or under vegetation, debris or stones (Pierce 1982). Adults distract predators by dive-bombing, feigning injury and False-brooding (Pierce 1986a). **FLEDGING PERIOD**: 47 days (41–55; 12); for hybrids, 39 days (35–43; 3) (Pierce 1984b).

Fledging to maturity Family group moves out of nesting area after chicks fly, by Jan.; with parents for 9 months after fledging; remain near parents throughout period of dependence but may forage up to 500 m away at 6–9 months. Able to breed at 2 years but generally do not do so until 3 years old. Return to breed at 2 years (Pierce 1982).

Success Between 1977 and 1980, for nests with no management protection: from 108 eggs, 33 (31%) hatched, two (2%) fledged; 19 (70%) of the 27 nests failed, of which 11 (41%) were taken by predators, one (4%) was flooded and seven (26%) for other reasons, including desertion, damage by stock, wind and unknown causes (Pierce 1986a). For nests protected by traps set for predators: from 92 eggs, 40 (43%) hatched, 13 (14%) young fledged; 12 (52%) of the 23 nests failed, of which five (22%) were taken by predators, three (13%) were flooded and four (17%) for other reasons (Pierce 1986a). Of 15 young fledged, one survived to breed (Pierce 1982). After predator-proof fence erected round nesting site in 1980, success rate increased from nil between 1977 and 1979, to 67% in 1980 and 83% in 1981 (Pierce 1982). Between 1981 and 1989, with active management: from 373 eggs, 260 (70%) hatched, 104 (28%) fledged; annual variation for hatching 50–86%, for fledging 18–42% (C.E.M. Reed). Success rate of hybrid pairs: hybrid and Black-winged Stilt pairs: from 64 eggs, 11 (17%) fledged young; hybrids and Black Stilt pairs: from 32 eggs, three (11%) young fledged (Pierce 1984b). For ten colour-banded juveniles, four survived to 3 years old, one to 4 years old (Pierce 1986a). Of 72 juveniles colour-banded from 1981 to 1986, 32 survived to 1 year, 24 to 2 years or older (C.E.M. Reed). A female still alive and nesting at 12+ years old (Pierce 1986a). Eggs taken by rats, cats, ferrets and Swamp Harriers; chicks by feral cats and ferrets (Pierce 1986a); eggs and young also taken by stoats and Kelp Gulls *Larus dominicanus* (C.E.M. Reed).

PLUMAGES Prepared by D.J. James. Hatch in natal down. Begin pre-juvenile moult in third week. Partial post-juvenile moult introduces first immature plumage, followed by partial pre-breeding moult introducing second immature plumage; immature plumages vary individually, showing broad range between pied juvenile and all-black adult-like plumages. Thereafter, complete post-breeding and partial pre-breeding moults each cycle produce alternating non-breeding and breeding plumages without seasonal variation in appearance. Sexes, similar. First breed in second or third year (Pierce 1982). Interbreeds with Black-winged Stilt, and hybrids show complete variation in plumage and morphometrics between the two species; separation of immature Black Stilts from all ages of hybrids requires caution.

Adult (Definitive basic and alternate). First attained in summer of second year at 14–17 months (cf. Pierce 1982). Plumage entirely black. Large off-white bases of contour feathers normally concealed but sometimes exposed on underparts when

Plate 60

Grey Plover *Pluvialis squatarola* (page 811)

1 Adult breeding; 2 Adult non-breeding; 3 Juvenile
4, 5 Adults, non-breeding plumage

Pacific Golden Plover *Pluvialis fulva* (page 800)

6 Adult breeding; 7 Adult non-breeding; 8 Juvenile
9, 10 Adult non-breeding

ruffled. **Head and neck** Crown nape, chin, throat and neck, black with green gloss. Forehead, lores and ear-coverts, dull black. Often some dark-grey grizzling round base of bill, but no white on head. **Upperparts** Black, with strong greenish gloss, most prominent on scapulars; reduced but not lost with wear. **Underparts** Black, with only slight gloss, to black-brown (119). Some birds retain some indistinct mottling on vent and belly when this plumage first attained (i.e. second basic), but lost with subsequent pre-breeding moult. **Tail** Glossy black. Shafts of rectrices, brown (27) on underside. **Upperwing** Glossy black. **Underwing** Remiges, dark brown (219) to black-brown (119). Coverts, dull black.

Downy young **Head and neck** Top of head, light brown (123C), speckled and blotched black. Short black stripe on lores, not reaching bill. Lower ear-coverts, chin and throat, off-white. Hindneck, light grey-brown (119C) mottled brownish grey (80). **Upperparts** Speckled light brown (123C) and black with light grey-brown (119C) tinge at tip of some down; and with larger blackish blotches. **Underparts** White, except for dark-grey patch on thigh. **Tail** Black, with light-brown (123D) tips to down. **Wings** Light brown (123D), speckled light grey-brown (119C) and black. Similar to Black-winged Stilt but upperparts browner and dark-grey thigh-patch larger (Pierce 1982).

Juvenile **Head and neck** Forehead, lores, chin and throat, white. Feathers of crown, sooty black (c82) with thin light-brown (223D) fringes at tips and white edges at base, forming pale scaling when fresh; dark crown does not form defined cap; when fresh, more scaled and less streaked than juvenile Black-winged Stilt but, with wear, fringes lost quickly and white edges become more obvious, giving mottled appearance. Varied grey (84) or dark-grey (83) mottling of white feathers extends from crown, vertically down to and round bottom of eye; small dark-grey to grey-black (c82) smudge round eye on some. Ear-coverts, white, faintly washed grey. Nape, white, mottled grey by grey-black (82) smudging at tips of feathers; becomes cleaner white with wear. Side of neck and hindneck, dark grey (83) with irregular white tips (reduced by wear) giving mottled appearance. **Upperparts** Mantle, light grey (85), mottled (almost spotted) dark grey (83) and faintly scaled pale brown (223D); feathers, light grey (85) basally, white along edges and grey-black (82) distally with thin light-brown (223D) fringe at tip; fringes wear away quickly and generally lost before fledging (Pierce 1982); when fresh, slightly paler than fresh juvenile Black-winged Stilt. Scapulars and upper back, grey-black (82), with conspicuous light-brown (223D) fringes at tips; fringes, irregular, streaked with grey-black; wear away quickly. Subscapulars, as scapulars but with additional small light-brown (223D) spot near tip of inner web. Lower back and rump, white, with very faint light-brown (223D) speckling near tip of some feathers. Central upper tail-coverts, grey-black (82) basally, with narrow light-brown (223D) subterminal band, which usually grades into off-white distal quarter or so of feathers. Lateral upper tail-coverts, white, tending to be smudged grey-black (82) with narrow light-brown (223D) subterminal band and narrow black tip. **Underparts** Mostly white. Sparse grey (c84) smudging on tips of feathers at sides of breast; some fine grey (c84) streaks down rear flanks and thighs; these markings reduced or lost with wear. Axillaries, grey-black (82) with small white tips. **Tail** Outer three or four rectrices, grey-black (82) with smeary grey (83–84) tip to outer web, which is faintly tinged light brown (223D). Inner rectrices, white smeared dark grey (83) with poorly defined grey-black (82) subterminal band and narrow tip tinged light brown (223D); tinge at tip quickly lost with wear. Tend to be darker, especially at base, than juvenile Black-winged Stilt. **Upperwing** Primaries and secondaries, black, with poorly defined

narrow white fringes at tips; fringes quickly lost from outer four or so primaries. Greater coverts and alula, black. Median and lesser secondary coverts, black with faint light-brown (223D) fringes at tips, which are streaky, like those on scapulars but less conspicuous; fringes lost with wear. Tertiaries, black with light-brown (223D) subterminal spot on each web and streaky fringe at tip. **Underwing** Remiges and greater coverts, grey-black (82). Median and lesser coverts, black with thin white fringes at tips. Subhumeral, as axillaries.

First immature (First basic). Vary individually. **Head and neck** Mostly white. Dark greyish above, behind and narrowly round eye. Some feathers of hindneck and sometimes crown have grey tips, giving lightly mottled appearance. **Upperparts** Mantle, white. Scapulars, black with green gloss. Details of rest of upperparts, unknown. **Underparts** Mostly white anteriorly, black posteriorly. Breast, belly and anterior flanks, white; two of ten birds studied by Pierce (1984b) had small greyish-black marking on breast. Under tail-coverts, vent and flanks from about level of legs to rear, black, irregularly streaked or mottled white; generally more white towards midline; always have dark broken band from flank to flank through region of cloaca; markings generally asymmetrical. **Tail** Most juvenile rectrices, retained; usually worn and contrast of pattern reduced and tip lost. Any new rectrices, like adult. **Upperwing** Juvenile primaries, secondaries and greater and median coverts, retained, rather worn; whitish fringe at tips still visible on some inner primaries and secondaries; fringes lost from coverts. Some tertiaries sometimes retained, faded blackish-brown (c119) with fringes reduced and faded or lost; sometimes replaced and black like adult. Lesser coverts, black as adult. **Underwing** Details of coverts, unknown.

Second immature (First alternate). Acquired at 10–14 months (Pierce 1982). **Head and neck** As adult, but with some scattered white tips and edges showing on feathers, mainly on throat, lores and nape; do not have neat white face (cf. some hybrids) but, during moult, may show untidy whitish area at base of bill. Neck lacks gloss of adults. **Upperparts** Glossy black, as adult. **Underparts** Mostly black; some have few scattered white feathers with or without blackish tips but varied, irregular, and usually asymmetrical; most white occurs on vent and under tail-coverts, but no large patches of white feathering (Pierce 1984b). **Tail** Rectrices, usually new, black like adult, but sometimes some worn juvenile rectrices may be retained. **Upperwing** Juvenile primaries, secondaries and greater coverts, retained, rather worn; some trace of whitish fringe at tips still visible on some inner primaries and secondaries. Tertiaries and rest of coverts, black as adult. **Underwing** As adult except for retained juvenile remiges.

Hybrid plumages Based on work of Pierce (1982; 1984b), who described range of variation of adult hybrids, categorizing them into ten types ('nodes') from pure Black Stilt (type J) to pure Black-winged Stilt (type A) (Fig. 7). Type I: trace of hybridization first evident as white mottling on vent, which is usually more clearly defined than in first adult Black Stilt. Types H, G: characterized by increasing white on vent, extending to posterior flanks and under tail-coverts, and small neat patch of white on face round base of bill (on forehead, lores and chin). Type F: white on underparts increased to form irregular belly-patch, with scattered black streaking; and white on face expanded but retaining neat circular pattern round base of bill. Type E: intermediate state; head and neck mostly white except for black hindneck and band across base of foreneck, which is continuous with black mantle and large black U-shaped bib on breast; the belly, vent and under tail-coverts show varying black markings, especially smudged bar from posterior flank on each side, meeting at vent in V pointing to rear. Types D, C: black mantle still continuous with hindneck;

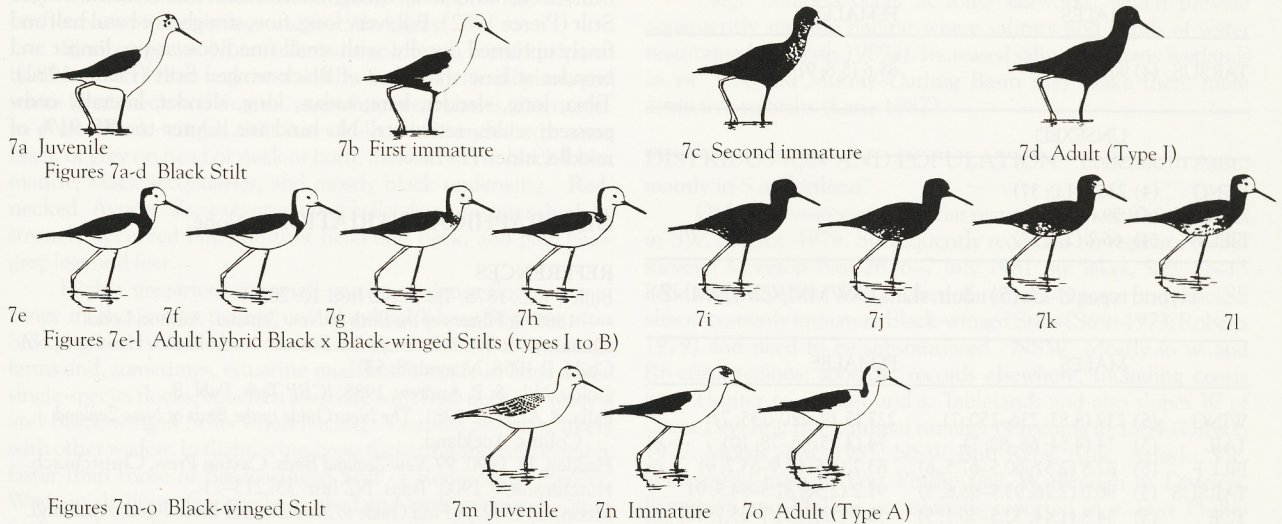


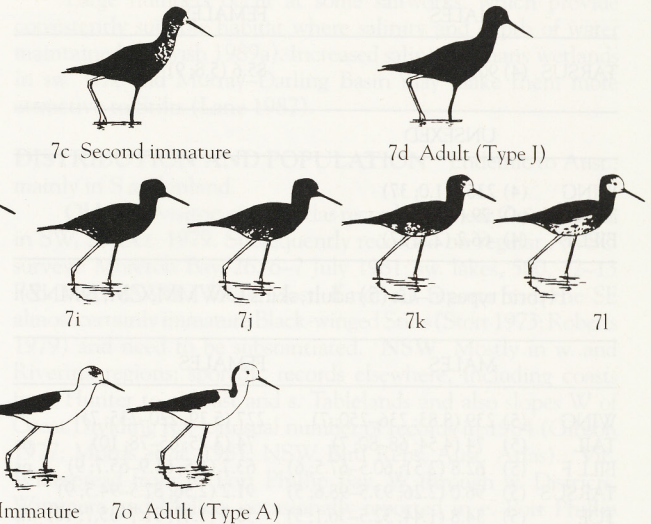
Figure 7 Ages of Black Stilt and Black-winged Stilt and variation in adult hybrid Black x Black-winged Stilts.

and underparts, white except for black or mottled black band across base of foreneck. Type B: very similar to Black-winged Stilt but with black at base of hindneck continuing as black mottling on to mantle and sides of lower neck. Pure-strain Black-winged Stilts of subspecies *leucocephalus* (q.v.), type A, always have cleanly defined black hindneck with no mottling on mantle or lower side of neck; apparently rare in NZ.

Second-immature hybrids can mostly be recognized by criteria similar to those used for adults. First immatures are problematical (see Pierce 1982, 1984b). Plumages of hybrids mostly intermediate between those of their parents; throwbacks rare or absent; indicates system under control of several genes. F1 hybrids approximate type E birds. Back-crosses between Black and types E or F hybrids produce progeny of types G, H or I. Back-crosses between Black-winged Stilt and types E to C produce progeny intermediate between parents or similar to hybrid parent.

BARE PARTS Based on photos (Moon & Lockley 1982; Pierce 1986b; Chambers 1989; Hadden 1990; Moon 1992; NZRD; DOC Slide Library; R.J. Pierce). **Adult** Bill, dull black to grey-black (82). Orbital ring, dark grey (c83) to grey-black (c82), inconspicuous. Iris, red (c12). Legs, pink-red (c10) to pink (c108C). **Downy young** Bill, grey-black (c82). Iris, brown. Legs, light grey-pink. **Juvenile** Bill, grey-black (c82) with reddish tinge to small area at base. Iris, brown. Legs, pink (c108C). **First immature** As juvenile, except legs darker like adult. **Second immature** Similar to adult.

MOULTS Based on Pierce (1982), supplemented by examination of c. 30 skins (AM, AWMM, CM, NMNZ). **Adult post-breeding** (Pre-basic). Complete. Primaries, outwards; usually two active at a time. Secondaries, inwards from several centres, including s11 (outer tertial). Rectrices, centrifugal. Spans from mid-Dec. to early Apr.; begin primary-moult when young first fly or just before, about mid-Jan.; delayed by up to 1 month in late nesters. **Adult pre-breeding** (Pre-alternate). Partial moult of head, body and tertials; details of wing-coverts, unknown. Moulting birds seen in field, July–Sept. with peak in Aug. **Pre-juvenile** One skin 18 days old had pins of remiges just emerging, as first sign of moult. Fledge at c. 47 days (41–55; 12) (Pierce 1982) with moult continuing for short while after. A captive bird, 2.5 months old, had almost finished but over three primaries still in sheath



(NMNZ). **Post-juvenile** (First pre-basic). Partial moult of head, body and some wing-coverts; sometimes replace central pair of rectrices. From late Dec. to late Apr, though time of onset varies between individuals; juveniles generally begin slightly after their parents begin post-breeding moult; moult of individual lasts 8–14 weeks. **Immature pre-breeding** (First pre-alternate). Partial moult of head, body, tertials, tail and some wing-coverts. Tail may moult outwards from t2 without replacing first-basic central pair. Moulting birds seen in field, late June to late Oct., though time of onset varies between individuals, even within clutch; moult of individual lasts 8–12 weeks.

MEASUREMENTS Types J and I: (1) adults, skins; sexing based on labels (AM, AWMM, CM, NMNZ).

	MALES	FEMALES
WING	(1) 237	234 (7.07; 225–242; 4)
TAIL	(1) 82	77.8 (3.27; 74–82; 5)
BILL F	(1) 63	64.4 (3.03; 60.4–67.0; 4)
TARSUS	(1) 90.2	83.3 (5.09; 76.7–87.5; 5)
TOE	(1) 36.5	31.6, 33.7, 35.0

Types J and I: skins, unsexed (AM, AWMM, CM, NMNZ); (2) adults; (3) juveniles and immatures.

	UNSEXED
WING	(2) 238 (6.37; 225–248; 11) (3) 224 (11.3; 213–250; 13)
8TH P	(2) 155 (4.34; 152–162; 5)
TAIL	(2) 79 (2.73; 74–82; 12) (3) 74 (5.43; 66–83; 16)
BILL F	(2) 65.5 (3.07; 60.4–70.8; 9) (3) 64.1 (4.20; 58.6–70.7; 9)
TARSUS	(2) 85.7 (4.19; 76.7–90.7; 12) (3) 87.7 (7.2; 77.0–99.7; 15)
TOE	(2) 33.7 (1.28; 31.6–35.6; 9) (3) 33.7 (1.25; 31.4–36.2; 14)

Immatures significantly shorter than adults in wing ($P < 0.05$). (4) Skins (from Pierce 1982: AWMM, BMNH, CM, NMNZ, OM).

	MALES	FEMALES
TARSUS	(4) 90.8 (2.3; 4)	85.6 (5.8; 9)
UNSEXED		
WING	(4) 236 (11.0; 37)	
TAIL	(4) 79 (4.3; 33)	
BILL F	(4) 66.2 (2.5; 27)	

Hybrid types C–G: (5) adult, skins (AWMM, CM, NMNZ).

	MALES	FEMALES	
WING	(5) 239 (8.83; 236–250; 7)	227 (5.29; 220–235; 7)	*
TAIL	(5) 74 (4.54; 68–80; 7)	74 (3.75; 65–78; 10)	ns
BILL F	(5) 62.8 (2.51; 60.5–67.5; 6)	63.7 (1.5; 61.9–65.7; 9)	ns
TARSUS	(5) 96.0 (2.26; 93.5–98.6; 5)	91.2 (2.56; 87.5–94.5; 9)	*
TOE	(5) 34.8 (1.44; 32.5–36.1; 5)	33.5 (1.47; 31.7–35.7; 10)	ns

Hybrid females shorter in wing and longer in tarsus than Black Stilt but differences not significant in samples.

WEIGHTS Three adult females: 135, 147, 190; juvenile male 2.5 months old: 150 (NMNZ). Four live unsexed birds in Mackenzie Basin, SI, mean 223 g (Pierce 1982). Three chicks at hatching, 13.3, 14.0 and 14.8 g (CM); at 19 days, female, 40 g (NMNZ); reach 100 g by c. 5 weeks (Pierce 1982).

STRUCTURE Wing, medium to long, narrow, pointed. Eleven primaries; p10 longest; p9 3–9 mm shorter, p8 13–22, p7 29–43, p6 43–57, p5 57–73, p4 73–88, p3 83–99, p2 95–113, p1 102–122, p11 minute. Fourteen secondaries including about four tertials; tips of longest tertials fall between p5 and p6 on folded wing. Tail, square; 12 rectrices. Body plumper than Black-winged

Stilt; neck, rather long, though shorter than that of Black-winged Stilt (Pierce 1982). Bill, very long, fine, straight for basal half and finely upturned distally, with small fine hook at tip; longer and broader at base than that of Black-winged Stilt (Pierce 1982). Tibia, long, slender, bare; tarsus, long, slender, laterally compressed; scales, reticulate. No hind toe. Outer toe 85–91% of middle, inner 71–78%.

GEOGRAPHICAL VARIATION None.

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Sponsors: Mrs M & Mr P McLauchlan



Volume 2, Plate 58

Black Stilt *Himantopus novaezelandiae* (page 769)
 1 Adult; 2 Downy young; 3 Juvenile; 4 First immature; 5 Adult

Black-winged Stilt *Himantopus himantopus* (subspecies *leucocephalus*) (page 758)
 6 Adult; 7 Downy young; 8 Juvenile; 9 First immature; 10 Adult; 11 Adult