Population estimates of North American shorebirds, 2006

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This paper provides updates on population estimates for 52 species of shorebirds, involving 75 taxa, occurring in North America. New information resulting in a changed estimate is available for 39 of the 75 taxa (52%), involving 24 increases and 15 decreases. The preponderance of increased estimates is likely the result of improved estimates rather than actual increases in numbers. Many shorebird species/taxa are considered to be declining: current information on trends indicates negative trends outnumbered increasing trends by 42 to 2, with unknown or stable trends for 31 taxa.

INTRODUCTION

It is now some five years since the publication of the first compilation of all available information to assess population sizes of all shorebirds in North America (Morrison *et al.* 2000, 2001b). This exercise was stimulated by the need to determine population status of shorebirds during the preparation of national shorebird conservation plans in Canada (Donaldson *et al.* 2000) and the United States (Brown *et al.* 2001), and in most cases population numbers were regarded as minimum estimates. Information on population sizes serves a number of purposes. It is required by a variety of conservation initiatives in which the data are used to identify wetlands of key importance for waterbirds. These include the Ramsar Convention (Ramsar Convention Bureau 2005), the Important Bird Areas program of BirdLife International (BirdLife International 2004), the East Asian Australasian Shorebird Site Network (Environment Australia and Wetlands International – Oceania 2002), and the Western Hemisphere Shorebird Reserve Network (WHSRN 2005), all of which have adopted the convention that a wetland is considered of international importance if it supports 1% of a biogeo-

graphical population of a waterbird species (Morrison *et al.* 2005b). Clearly, knowledge of the population size of the species is required to determine the 1% criterion. For endangered species, information on population size is needed to assess the status of the species, as well as to set recovery targets, and to judge the success of recovery programs. For species that are declining, knowledge of population numbers is needed to determine status and assess whether the species is reaching a level below which recovery will be difficult. The United States Shorebird Conservation Plan included population targets for all species of shorebirds in North America against which to judge the success of conservation efforts. Many shorebird populations in North America are thought to be declining (Bart *et al.* 2007, Morrison *et al.* 2001a) and obtaining up-to-date information on their status and size is thus of particular importance for determining conservation requirements.

Shorebird and other waterbird populations are dynamic and constantly changing, so that regular updating and revision of population estimates is needed to keep information used to identify key areas up-to-date and relevant. Shorebirds visit many countries in the course of their travels and it is

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therefore important to have an internationally agreed set of population figures that may be used in determining the importance of the habitats they use. The Ramsar Convention, through the triennial meetings of its Conference of the Contracting Parties, has determined that global waterbird population estimates should be updated every three years, and that major reassessment of 1% criteria should be undertaken at every third meeting. Information on global waterbird populations is collected by Wetlands International and published at three-year intervals in its Waterbird Population Estimates (WPE) publications. The present paper updates estimates for North American shorebird populations to spring 2006; it will form the basis for updating the Third Edition of Waterbird Population Estimates ("WPE3", Wetlands International 2002) scheduled to appear as the Fourth Edition (WPE4, Wetlands International 2006). The next major reassessment of 1% population levels is scheduled for 2008.

METHODS

The species accounts and previous estimates of shorebird population size in Morrison *et al.* (2001b) are taken as the starting point for the addition of new information presented in the present report. The new information has come from a variety of sources, including published papers, unpublished reports, conference abstracts, and expert opinion based on unpublished work. Information on current population trends has been added to the species accounts and tables, where available, and is also based on published and unpublished material, as well as the expert opinion review undertaken for reassessing priority species under the United States Shorebird Conservation Plan (USSCP). Throughout this document, WPE3 is used to refer to the Third Edition of Waterbird Population Estimates that was compiled and edited by Simon Delaney and Derek Scott and published by Wetlands International in 2002 (Wetlands International 2002). CSCP and USSCP are used to refer to the Canadian Shorebird Conservation Plan (Donaldson *et al.* 2000) and United States Shorebird Conservation Plan (Brown *et al.* 2001), respectively. Nomenclature and systematics for species are based principally on the *Check-list of North American Birds*, seventh edition, and subsequent Supplements (American Ornithologists' Union 1998); further division of species into subspecific or biogeographic populations may follow recent literature or WPE3 to facilitate consistency with global estimates.

RESULTS

Results are presented in the form of Species Accounts, which indicate new sources of information on which population estimates have been based. Population estimates, trends, and comparisons with previous estimates, as well as a rating of the accuracy of the estimates, are presented in Table 1.

Black-bellied Plover *Pluvialis squatarola*

New information lacking and we therefore suggest retaining current estimates of 150,000 for *P. s. cynosurae* and 50,000 for *P. s. squatarola*.

Eastern populations (*P. s. cynosurae*) migrating through Atlantic Canada and the United States are thought to be declining (Bart *et al.* 2007, Morrison & Hicklin 2001); trend

information is not available for *P. s. squatarola* (Brown *et al.* 2001).

American Golden-Plover *Pluvialis dominica*

Like the Pacific Golden-Plover (see below), estimates of world population sizes have varied considerably, from 150,000+ (Morrison *et al.* 2001b) to 2.5 million breeding pairs (Byrkjedal & Thompson 1998). The former estimate is likely low, the latter high (Johnson 2003). Little new information is available on population size, though a report of 42,000–84,000 passing through west-central Indiana (Braile 1999) on migration is notable and would represent a substantial proportion of the likely North American population (Johnson 2003). These observations are separate from those tallied in Morrison *et al.* (2001b), so that a revised total for North America/Canada could be some 200,000 birds, based on observations of spring migrants.

The species appears to be declining in eastern North America (Bart *et al.* 2007, USSCP 2004).

Pacific Golden-Plover *Pluvialis fulva*

Estimates for the world population of Pacific Golden-Plovers have varied widely (Johnson 2003), from 125,000 (with 16,000 in North America, involving fall counts likely to involve many juveniles in Alaska; Morrison *et al.* 2001b) to 2.6 million breeding pairs (Byrkjedal & Thompson 1998). The former estimate is likely low, the latter high (Johnson 2003). The previous Alaskan estimate was based solely on totals counted at three post-breeding sites in Alaska, the majority (14,000) of which involved juvenile birds at Shishmaref. Given that Shishmaref is north of much of the Pacific Golden-Plover's breeding range in Alaska and many of the birds could have been from Siberia, 16,000 is unlikely to represent a satisfactory estimate for the Alaskan population. Preliminary surveys in 2002 suggested the Alaskan population was likely to exceed 16,000 (C. Wightman in Johnson 2003). Estimates from wintering areas have included 74,000 from the main Hawaiian islands in 1949 and 15,173 from Oahu in 1968 (Johnson 2003, Johnson & Connors 1996), though the proportion of these birds that would be from Alaska is unknown and the estimates are now considerably out of date. Given these uncertainties, a new estimate of 35,000–50,000 is suggested for the North American (Alaskan) population (O. Johnson, pers. comm.).

Harris (1995) reported that Pacific Golden-Plovers declined by 72% at numerous wintering sites in Australia.

Snowy Plover *Charadrius alexandrinus*

Charadrius alexandrinus nivosus (Pacific Coast)

In 2005, 1,845 Snowy Plovers were counted on the Pacific coast of the United States, which resulted in an extrapolated total of 2,394 (previous estimate in 1989 was 1,900 extrapolated in a similar manner from a counted total of 1,464) (GWP unpubl. data). The estimate for the Pacific coast of the Baja California peninsula in Mexico is currently based on surveys conducted in 1991–92, which resulted in a total of 1,900 extrapolated from a survey total of 1,344 adults. The total for the Pacific coast of North America would thus be 2,394 + 1,900 = 4,294, which we round to 4,300.

Table 1. Estimated population sizes of North American shorebirds, 2006. Estimates shown for comparison include those in Morrison *et al.* (2001b), those in WPE3 (Wetlands International 2002), and the updated, current estimate. Trend estimates shown for comparison include those appearing in North American shorebird conservation plans (Canadian Shorebird Conservation Plan (CSCP), Donaldson *et al.* 2000; United States Shorebird Conservation Plan (USSCP), Brown *et al.* 2001), in WPE3, and the current perceived trend. Shaded rows indicate species at risk.

Accuracy ratings are as follows: **1** (Poor): A population estimate based on an educated guess. Score 1 also given to Eskimo Curlew, which has not been reliably seen in recent years. **2** (Low): A population estimate based on broad-scale surveys where estimated population size is likely to be in the right order of magnitude. **3** (Moderate): A population estimate based on a special survey or on broad-scale surveys of a narrowly distributed species whose populations tend to concentrate to a high degree either a) in a restricted habitat or b) at a small number of favoured sites. Estimate thought to be within 50% of the true number. **4** (Good): A calculated estimate based on broad-scale mark:recapture ratios or other systematic estimating effort resulting in estimates on which confidence limits can be placed. **5** (High): Number obtained from a dedicated census effort and thought to be accurate and precise. The ratio between the new and old North American estimates is shown to indicate magnitude of change.

No.	Common name	Species/subspecies (population)	previous North American[a]	WPE3[b]	updated	Accuracy rating[c]	Comments (population size)	Conservation plan trends[d]	Trend WPE[e]	current trend	ratio (new/old)
			Estimates							Estimates	
1	Black-bellied Plover	*Pluvialis s. squatarola* (breeds Alaska)	50,000	50,000	50,000	2		(3)	DEC	DEC	1.00
1	Black-bellied Plover	*Pluvialis s. cynosurae* (breeds Northern Canada)	150,000	150,000	150,000	2		5	DEC	DEC	1.00
2	American Golden-Plover	*Pluvialis dominica*	150,000	150,000	200,000	2	Additional spring records from Indiana. (Braile 1999, Johnson 2003)	4	DEC	DEC	1.33
3	Pacific Golden-Plover	*Pluvialis fulva*	16,000	166,000–216,000	35,000–50,000	2	North American population estimate (Alaskan breeders) estimated as 35,000–50,000; WPE3 estimate includes all birds breeding outside North America	3		DEC	2.66
4	Snowy Plover	*Charadrius alexandrinus nivosus* (Pacific Coast)	2,000	2,000	4,300	4	Revised total of 4,300 based on surveys coordinated by GWP	5	DEC	DEC	1.25
4	Snowy Plover	*Charadrius a. nivosus* (Interior)	13,200	13,200	12,400	3	Based on extrapolations, some recently revised; accuracy rating 3 (moderate)?	(4)	DEC	DEC	1.00
4	Snowy Plover	*Charadrius a. tenuirostris* (Gulf of Mexico & Caribbean)	500	2,200–2,800	1,500	4	Revised counts for Mississippi, Alabama, Texas sectors of Gulf Coast	5	DEC	DEC	5.00
4	Snowy Plover	*Charadrius alexandrinus* (North America, all populations)	16,000	17,700	18,200	3	4,300 + 12,400 + 1,500 = 18,200	5	DEC	(DEC)	(1.14)
5	Wilson's Plover	*Charadrius wilsonia*	6,000	6,000	6,000	2	Retain current 6,000 (range 5,000–6,000)	3	STA	STA	1.00
6	Common Ringed Plover	*Charadrius h. hiaticula*	(10,000)	190,000	(10,000)	1	Estimate for Canada only	3	DEC?	STA?	1.00
7	Semipalmated Plover	*Charadrius semipalmatus*	150,000	150,000	150,000	2	Breeding ground estimate from densities/range compatible with previous estimate	3		STA?	1.00
8	Piping Plover	*Charadrius m. melodus* (Atlantic)	2,581	2,920	2,920	5	2001 Piping Plover census	5	INC	INC	1.13
8	Piping Plover	*Charadrius m. circumcinctus* (Great Lakes)	48	72	110	5	110 birds found during 2004 survey; 72 during complete census in 2001	5	STA	INC	2.29
8	Piping Plover	*Charadrius m. circumcinctus* (Great Plains)	3,284	2,953	2,953	5	2001 Piping Plover census	5	DEC	DEC	0.90
8	Piping Plover	*Charadrius melodus* (all populations)	5,913	5,945	5,945	5	Retain 5,945 total until next international census in 2006	5		(STA)	(1.01)
9	Killdeer	*Charadrius v. vociferus*	1,000,000	>1,000,000	1,000,000	2	Population declining (Sanzenbacher & Haig 2001)	5	STA	DEC	1.00
10	Mountain Plover	*Charadrius montanus*	9,000	8,000–9,000	12,500	4	Midpoint of updated estimate, range 11,000–14,000 (Plumb *et al.* 2005)	5	DEC	DEC	1.39
11	American Oystercatcher	*Haematopus p. palliatus*	8,850	8,500	11,000	4	10,700–11,300; Brown *et al.* (2005) range-wide survey; previously 8,850	3		STA	1.24
12	Black Oystercatcher	*Haematopus bachmani*	8,900	6,900–10,800	10,000	3	Additional birds from Middleton Island, Alaska	3	STA	STA	1.12
13	Black-necked Stilt	*Himantopus m. mexicanus*	150,000	D (100K to 1 M)	175,000	2	Range 150,000–200,000, midpoint 175,000, suggested from counts in Morrison *et al.* 2001b) and Robinson *et al.* (1999) (and Breeding Bird Survey extrapolation)	3	INC	STA?	1.17

Charadrius alexandrinus nivosus (Interior)

The previous estimate of 13,200 was produced using counts and extrapolations, some of which have been updated. Current estimates for interior populations in California, Oregon, and Nevada are 6,100 and in interior Utah 4,189 (P.W.C. Paton pers. comm.), to which may be added a total of 2,105 from states in the Great Plains (Colorado, Kansas, Oklahoma, Texas, New Mexico), for an overall total for the interior population of 12,394, which we round to 12,400 (GWP unpubl. data).

Charadrius alexandrinus tenuirostris (Gulf of Mexico and Caribbean coasts)

Estimates of the breeding population along the coast of the Gulf of Mexico and Caribbean reported by Gorman & Haig (2002) included 200 pairs from Florida to Alabama, 500–700 pairs in Texas, 27 pairs on Puerto Rico, and 17+ pairs in Cuba, for a total of 744–977 pairs. WPE3 used a multiplication factor of 3 on this range to arrive at a population estimate of 2,232–2,832 birds. Winter totals for the area reported by Gorman & Haig (2002) were 2,370+, with a more recent count of 1,083 (Elliott-Smith *et al.* 2004). More recent counts in Texas in 2004 and Mississippi and Alabama in 2005 produced totals of 962 and 34, respectively (GWP unpubl. data). Using these recent counts with the estimate of 400 for Florida, and above estimates for Puerto Rico (54 individuals) and Cuba (34+ individuals), the total for the Gulf and Caribbean population of *C. a. tenuirostris* would come to 1,484 individuals, which we round to 1,500 birds.

The above estimates bring the North American total to 1,500 (*C. a. tenuirostris* [Gulf of Mexico and Caribbean]) plus 4,300 (*C. a. nivosus* [Pacific]) plus 12,400 (*C. a. nivosus* [Interior]) = 18,200.

Population trend for Snowy Plovers is listed as **5** (declining) by USSCP (2004).

Wilson's Plover *Charadrius wilsonia*

No new data were presented in the species account in *The Birds of North America* (Corbat & Bergstrom 2000), and we suggest retaining the present estimate of 6,000 (5,000–6,000, Morrison *et al.* 2001b).

No information on population trend; scored as **3** (unknown) in USSCP (2004).

Common Ringed Plover *Charadrius hiaticula*

The estimate for the proportion of the overall population of this species (190,000, WPE3) breeding in Canada remains at 10,000 birds.

Semipalmated Plover *Charadrius semipalmatus*

Nol & Blanken (1999) suggested a population of 13,000–120,000 breeding pairs, based on densities on the breeding grounds and range of the species. This would imply a population of 26,000–240,000 adults, the midpoint of the range being 133,000. This is broadly compatible with the previous estimate of 150,000, which we suggest retaining.

Population trend probably stable (Bart *et al.* 2007, Morrison & Hicklin 2001, USSCP 2004).

Piping Plover *Charadrius melodus*

The 2001 international census produced a total of 5,945 individuals (Haig & Elliott-Smith 2004), with 2,953 in the Prairie Canada/US Northern Great Plains region (*C. m. circumcinctus*), 2,920 in the Atlantic region (*C. m. melodus*), and 72 in the Great Lakes area (also *C. m. circumcinctus*). In 2004, 110 birds were found in the Great Lakes area, though numbers are not currently available for other regions and the next international census will be held in 2006. We suggest using the total from the 2001 census as the best current population estimate; using the higher total in the Great Lakes area from 2004 would bring the total to 5,983.

In the 2001 census, numbers had increased in the Atlantic and Great Lakes populations but decreased in the Prairie Canada/US Northern Great Plains populations (Haig *et al.* 2005). However, preliminary data from 2006 now show increases in the western population (CLG-T, unpubl. data).

Killdeer *Charadrius vociferus*

No update for previous estimate of 1 million. As discussed in Morrison *et al.* (2001b), the real population size might be much larger, on the basis of state estimates from various parts of the breeding range (L. Igl in litt.). New information comes from a survey of the Prairie Pothole Region in 2002–2003, which produced estimates of 109,716±16,925 (SE) and 208,766±37,777 (SE) Killdeer for May 2002 and 2003, respectively, and 260,322±47,715 (SE) Killdeer in late-summer 2002 (SKS unpubl. data). Based on the mean spring total of 153,536±21,990 (SE), the total passing through the area would be 468,285 assuming a residency period of ten days: if it is further assumed that the true number lies 1 SE below the mean, then with turnover the total passing through the area would be 401,000 (SKS unpubl. data).

The species appears to be declining in North America (Sanzenbacher & Haig 2001), though the declines are only significant in some parts of the range (Sauer *et al.* 2005).

Mountain Plover *Charadrius montanus*

The previous estimate of 9,000 (midpoint of range of 8,000–10,000, Knopf 1996) may be revised to 11,000–14,000 birds (midpoint 12,500), based on population estimates in Wyoming (Plumb *et al.* 2005). Nearly all the population breeds in the United States; Knapton *et al.* (2006) indicated that the species only occurs peripherally in Canada and is probably not a regular breeder at present.

The species is listed as declining (population trend **5**) by USSCP (2004).

American Oystercatcher *Haematopus palliatus*

A recent survey of American Oystercatchers in eastern North America by Brown *et al.* (2005) resulted in an estimate of some 11,000 (10,700–11,300), which substantially increases the previous estimate of 7,500.

Listed as stable (population trend **3**) by USSCP (2004).

Black Oystercatcher *Haematopus bachmani*

Although new work is being carried out on Black Oyster-

Table 1 continued.

No.	Common name	Species/subspecies (population)	Estimates previous North American[a]	WPE3[b]	updated	Accuracy rating[c]	Comments (population size)	Conservation plan trends[d]	Trend WPE[e]	current trend	ratio (new/old)
13a	Hawaiian Stilt	*Himantopus m. knudseni* (Hawaii)	1,600	1,200–1,600	1,400	5	WPE3 estimate appears more recent than 1,100–1,300 given in Robinson *et al.* (1999)	3	STA	STA	0.88
14	American Avocet	*Recurvirostra americana*	450,000	450,000	450,000	3		3	STA	STA	1.00
15	Greater Yellowlegs	*Tringa melanoleuca*	100,000	100,000	100,000	2		3		STA?	1.00
16	Lesser Yellowlegs	*Tringa flavipes*	500,000	300,000–800,000	400,000	2	Reassessment of wintering data (T. L. Tibbitts); spring migration data from north-central USA	3	DEC	DEC	0.80
17	Solitary Sandpiper	*Tringa s. solitara*	21,000	<150,000	100,000	1	See text	3(U)	STA	DEC	4.76
17	Solitary Sandpiper	*Tringa s. cinnamomea*	4,000	4,000	50,000	1	See text	3(U)		DEC?	12.5
17	Solitary Sandpiper	*Tringa solitara* (both subspecies)	25,000		150,000	1	See text	3(U)	STA	(DEC)	(6.00)
18	Willet	*Tringa s. semipalmatus*	90,000	90,000	90,000	2		3		STA?	1.00
18	Willet	*Tringa s. inornatus*	160,000	160,000	160,000	2		3		STA?	1.00
19	Wandering Tattler	*Heteroscelus incanus*	10,000	B (10–25K)	10,000–25,000	1	Global estimate 10–25K, 90% in North America	3	STA	STA	1.75
20	Spotted Sandpiper	*Actitis macularius*	150,000	<250,000	150,000	1		3	STA	STA?	1.00
21	Upland Sandpiper	*Bartramia longicauda*	350,000	350,000	350,000	2		2(5)	DEC	DEC	1.00
22	Eskimo Curlew	*Numenius borealis*	<50	<50	<50	1		5	EXT?	EXT?	1.00
23	Whimbrel	*Numenius p. hudsonicus*	18,000	18,000	40,000	2	Derived from spring counts	5		DEC?	2.22
23	Whimbrel	*Numenius p. rufiventris*	39,000	39,000	26,000	2	Mid point of high and low estimates	3(U)	STA	STA	0.67
23	Whimbrel	*Numenius phaeopus* (both subspecies)	57,000	57,000	66,000	2		5		(DEC)	(1.16)
24	Bristle-thighed Curlew	*Numenius tahitiensis*	10,000	10,000	10,000	4		3	DEC	STA?	1.00
25	Long-billed Curlew	*Numenius americanus*	20,000	20,000	55,000–123,500	3	Range reflects expert opinion (lower) to statistically based surveys (upper)	5	DEC	DEC	6.18
26	Hudsonian Godwit	*Limosa haemastica* (Alaska)	14,000	14,000	14,000	3		3(U)	STA	STA	1.00
26	Hudsonian Godwit	*Limosa haemastica* (Hudson Bay)	36,000	36,000	56,000	3		3	STA	STA	1.56
26	Hudsonian Godwit	*Limosa haemastica* (both populations)	50,000	50,000	70,000	3		3	STA	(STA)	(1.40)
27	Bar-tailed Godwit	*Limosa lapponica baueri*	100,000	170,000	90,000	3	Revision of numbers from breeding and wintering areas	3	STA	DEC	0.90
28	Marbled Godwit	*Limosa f. fedoa* (Plains)	168,000	140,000–200,000	170,000	3		4	DEC	DEC	1.01
28	Marbled Godwit	*Limosa f. fedoa* (Hudson Bay)	1,500	1,000–2,000	1,500	3		4	DEC	DEC	1.00
28	Marbled Godwit	*Limosa f. beringiae*	2,000	1,000–3,000	2,000	3		3		U	1.00
29	Ruddy Turnstone	*Arenaria i. interpres* (Canada)	35,000	94,000	45,000	3	New figure for Canada based on breeding ground estimates; overall winter population estimate 105,000	3(U)	INC	U	1.29
29	Ruddy Turnstone	*Arenaria i. interpres* (Alaska)	20,000	none	20,000	3	Includes Siberian breeders; 31K in Asia/Oceania	3(U)		U	1.00
29	Ruddy Turnstone	*Arenaria i. morinella*	180,000	200,000	180,000	3		4	INC	DEC	1.00
30	Black Turnstone	*Arenaria melanocephala*	80,000	61,000–99,000	95,000	4	Additional breeders in Alaska added	3		STA?	1.19
31	Surfbird	*Aphriza virgata*	70,000	70,000	70,000	3		4	DEC	DEC	1.00
32	Red Knot	*Calidris canutus rufa*	170,000	60,000	20,000	4	Large declines in 2000–2003 and 2004–2005 in population wintering in Tierra del Fuego/Patagonia; total possibly 20,000 or less; surveys cover all major wintering areas	5	DEC	DEC	0.12
32	Red Knot	*Calidris c. islandica*	80,000	450,000	80,000	3	Canadian *islandica* population estimated as 80,000	3(U)	DEC	DEC	1.00
32	Red Knot	*Calidris c. roselaari*	150,000	20,000	20,000	3	Reassessment of wintering numbers in Florida/SE USA, Maranhão, N coast of S. America, Panama, and Pacific coast of the Americas. Taxonomic status of these groups uncertain, and likely to consist of distinct biogeographic populations; see text	3(U)		DEC	0.13

catchers, little is directed specifically towards refining the current population estimate of 8,900. The previously undocumented population of 800–900 on Middleton Island, AK (Guzzetti *et al.* 2006, R. Lanctot pers. comm.) may be added to the total, giving a revised population of about 9,700–9,800. We suggest rounding this to 10,000.

Listed as stable (population trend **3**) by USSCP (2004).

Black-necked Stilt *Himantopus mexicanus mexicanus*

Counts given in Robinson *et al.* (1999) for sites in North America total 210,700, though it is not clear to what extent "double counting" may have occurred with sites in the interior of the continent. We suggest adopting a range of 150,000–200,000, with a midpoint of 175,000, which is the total suggested by extrapolation of BBS data (Morrison *et al.* 2001b).

USSCP (2004) indicates the trend as **3** (stable or unknown).

Hawaiian Stilt *Himantopus mexicanus knudseni*

WPE3 gives a range of 1,200–1,600 (midpoint 1,400; USFWS 2002) which should be used to update the previous North American estimate in Morrison *et al.* (2001b). This would appear to be a more recent estimate than the 1,100–1,500 referred to in Robinson *et al.* (1999).

USSCP (2004) indicates the trend as **3** (stable or unknown).

American Avocet *Recurvirostra americana*

No new information on population size (currently 450,000).

USSCP (2004) indicates the trend as **3** (stable or unknown).

Greater Yellowlegs *Tringa melanoleuca*

No new information on population size (currently 100,000).

USSCP (2004) indicates the trend as **3** (stable or unknown).

Lesser Yellowlegs *Tringa flavipes*

A reassessment of wintering data (T.L. Tibbitts pers. comm.) suggested that a range of 200,000–400,000 would be a better estimate than the current WPE3 estimate of 300,000–800,000 (listed as 500,000 by Morrison *et al.* 2001b). Morrison *et al.* (2001b) pointed out that sites listed in five countries in South America by Scott & Carbonell (1986) totaled 296,700 birds, so that the overall total is likely to be at least 300,000. A two-year survey of the Prairie Pothole Region in 2002–2003 produced an average of 128,101±34,693 (SE) birds in the study area during northward migration and 283,578±63,956 (SE) birds during southward migration. Assuming a residency period of seven days for each season, these estimates imply that 558,200 and 567,200 birds passed through the area in spring and fall, respectively (SKS unpubl. data). Using a conservative approach, if it is assumed that the true number lies 1 SE below the mean, then with turnover the total passing through the area in spring and fall would be 407,000 and 439,200, respectively. These estimates are consistent with the

range suggested by T.L. Tibbitts (pers. comm.). Numbers passing through the east coast of North America in spring are fairly small (20,100, Morrison *et al.* 2001b). We therefore suggest using a total of 400,000 (range 300,000–500,000). This information updates that in Morrison *et al.* (2001b) and Tibbitts & Moskoff (1999).

The species appears to be declining in eastern North America (Bart *et al.* 2007, USSCP 2004).

Solitary Sandpiper *Tringa solitaria*

Two subspecies of Solitary Sandpipers are generally recognized (Moskoff 1995). *T. s. solitaria* breeds from eastern Canada to the southern part of the Prairie Provinces and eastern British Columbia; the wintering range extends from the southern U.S., through Central America and South America south to Argentina. *T. s. cinnamomea* breeds from central Alaska and the Northwest Territories to northern British Columbia, southern Yukon, and northeastern Manitoba; it winters south to central Argentina. Brown *et al.* (2001) list figures of 4,000 for *T. s. cinnamomea* and 21,000 for *T. s. solitaria*, and the corresponding numbers in WPE3 are 4,000 and <150,000, respectively; Morrison *et al.* (2001b) suggested a range of 25,000–150,000, listing the lower figure in their Table. Population estimates using Breeding Bird Survey data (Morrison *et al.* 2001b) were rather higher (188,000), though this method may not be ideal for the species owing to its breeding in remote areas and its low detectability (Moskoff 1995, L. Oring pers. comm.). These same features, however, suggest that such estimates are likely to be conservative, and may help explain the relatively low population estimate compared with other species (Morrison *et al.* 2001b).

Survey results on the Yukon-Kuskokwim Delta (YKD; surveys covering some 3,000 km^2 of suitable riparian habitat) accounted for at least 580 birds (assuming 100% detectability), which would extrapolate to a population of nearly 100,000 birds over suitable habitat in western Alaska (Bird Conservation Region 4; BMcC unpubl. data). Detection frequency on the YKD was considered to be higher than recorded elsewhere and habitat probably better than average, suggesting the extrapolation would produce too high a figure; on the other hand, detection was unlikely to have been 100%. The evidence thus suggests that there are at least several tens of thousands of *T. s. cinnamonmea*, and it is likely there would be more of the nominate race, given its more extensive range. Thus, an estimate of 150,000 is not unreasonable for the global population of both subspecies. There is little basis for assigning a population figure to the two subspecies. On the basis of their distributions, an approximate ratio of 2:1 for *T. s. solitaria*:*T. s. cinnamomea* could be suggested.

The population trend for Solitary Sandpipers is listed as **4** (thought to be declining) by USSCP (2004), and a significant negative trend was found for the species in eastern North America by Bart *et al.* (2007).

Willet *Tringa semipalmatus*

In the absence of new information, we suggest retaining the current estimate based on Morrison *et al.* (2001b) and Lowther *et al.* (2001) of 90,000 for *T. s. semipalmatus* and 160,000 for *T. s. inornatus*.

USSCP (2004) indicates the trend as **3** (stable or unknown).

Table 1 continued.

No.	Common name	Species/subspecies (population)	Estimates			Accuracy rating[c]	Comments (population size)	Conservation plan trends[d]	Trend WPE[e]	Estimates	
			previous North American[a]	WPE3[b]	updated					current trend	ratio (new/old)
33	Sanderling	*Calidris alba*	300,000	300,000	300,000	2		5	DEC	DEC	1.00
34	Semipalmated Sandpiper	*Calidris pusilla*	3,500,000	3,500,000	2,000,000	2	Consistent declines noted in many areas; new estimate based on 5% annual decline over 15 years for Bay of Fundy (Canada) migrant population (comprising 75% of North American population)	5	DEC	DEC	0.57
35	Western Sandpiper	*Calidris mauri*	3,500,000	3,500,000	3,500,000	4	Apparent declines thought to have occurred on Pacific coast of Canada may be partly caused by increased predation risk from falcons and shorter stopover times rather than population decline	3(5)	DEC	DEC?	1.00
36	Least Sandpiper	*Calidris minutilla*	600,000	600,000	700,000	2	New data from interior USA	5	DEC	DEC	1.17
37	White-rumped Sandpiper	*Calidris fuscicollis*	400,000	400,000	1,120,000	3	Based on spring surveys in USA Prairie Pothole region, extrapolated, using mean–1SE value and allowing for turnover	3	STA	DEC	2.80
38	Baird's Sandpiper	*Calidris bairdii*	300,000	300,000	300,000	3		3	STA	STA?	1.00
39	Pectoral Sandpiper	*Calidris melanotos*	400,000	C (25–100K)	500,000	2	New spring data from north-central USA suggests population may be larger	3	STA	DEC	1.25
40	Sharp-tailed Sandpiper	*Calidris acuminata*	166,000	160,000	160,000	1	30,000 estimated in North America, 1000 in Canada			STA?	0.96
41	Purple Sandpiper	*Calidris m. maritima*	10,000?	15,000	10,000?	3	Estimates are for *belcheri* + *maritima* wintering in North America	2(3(U))	INC	STA?	1.00
41	Purple Sandpiper	*Calidris m. belcheri*	15,000	<15,000	15,000	3		(3)		STA?	1.00
42	Rock Sandpiper	*Calidris p. ptilocnemis*	25,000	25,000	25,000	2	No new information; estimate acceptable	3(4)	DEC	DEC	1.00
42	Rock Sandpiper	*Calidris p. tschuktschorum*	50,000	60,000–70,000	50,000	2	No new information; estimate acceptable	3	STA	STA?	1.00
42	Rock Sandpiper	*Calidris p. cousei*	75,000	75,000	75,000	2	No new information; estimate acceptable	3	STA	STA?	1.00
43	Dunlin	*Calidris alpina pacifica*	550,000	500,000–600,000	550,000	2		4	DEC	DEC	1.00
43	Dunlin	*Calidris a. arcticola*	750,000	750,000	750,000	2	Recent surveys suggest lower total	5	DEC	DEC	1.00
43	Dunlin	*Calidris a. hudsonia*	225,000	150,000–300,000	225,000	2		4		DEC	1.00
44	Stilt Sandpiper	*Calidris himantopus*	200,000	200,000	820,000	2	Based on spring surveys in USA Prairie Pothole region, extrapolated, using mean–1SE value and allowing for turnover	3	STA	STA?	4.10
45	Buff-breasted Sandpiper	*Tryngites subruficollis*	15,000	15,000	30,000	2	Surveys in Midwestern USA and Gulf Coastal Plain suggest 16,000–32,000, and 28,000–84,000, respectively	4	DEC	DEC	2.00
46	Short-billed Dowitcher	*Limnodromus g. griseus*	110,000	110,000		2		5	DEC	DEC	0.46
46	Short-billed Dowitcher	*Limnodromus g. hendersoni*	60,000	60,000		2		4	DEC	DEC	0.46
46	Short-billed Dowitcher	*Limnodromus g. griseus* and *hendersoni* combined			78,000	2		5	DEC	(DEC)	–
46	Short-billed Dowitcher	*Limnodromus griseus caurinus*	150,000	150,000	75,000	2		3(U)		U	0.50
46	Short-billed Dowitcher	*Limnodromus griseus* (all populations)	320,000	320,000	153,000	2	Range 150,000–175,000	5		(DEC)	0.48
47	Long-billed Dowitcher	*Limnodromus scolopaceus*	500,000	500,000	400,000	1	Lower than previous, based on Birds of North America account	2		STA?	0.80
48	Wilson's Snipe	*Gallinago delicata*	2,000,000 (range 1–3 million)	1–3,000,000	2,000,000	1		5	DEC	DEC	1.00
49	American Woodcock	*Scolopax minor*	5,000,000	5,000,000	3,500,000	2	Declines, population somewhat less than previous? Range 3–4 million	5	DEC	DEC	0.70
50	Wilson's Phalarope	*Phalaropus tricolor*	1,500,000	1,500,000	1,500,000	2		4(5)	DEC	DEC	1.00
51	Red-necked Phalarope	*Phalaropus lobatus*	2,500,000	2,500,000	2,500,000	1	Includes Greenland in WPE; 2.5 million estimated for North America	4		DEC	1.00
52	Red Phalarope	*Phalaropus fulicarius*	1,000,000	1,000,000	1,250,000	1	Range 1–1.5 million suggested by data in Tracy *et al.* (2002)	4(5)		DEC	1.25

[a]Morrison *et al.* 2001b (also USSCP, CSCP) [b]Wetlands International 2002 [c]Morrison *et al.* 2001b [d]CSCP (or USSCP if different) [e]Wetlands International 2002

Wandering Tattler *Heteroscelus incanus*

Gill *et al.* (2002a) report an estimated global population range of 10,000–25,000, of which over 90% occurs in North America. We suggest reporting this range, rather than the previously reported minimum estimate of 10,000 (Morrison *et al.* (2001b). Further resolution of this estimate is needed. USSCP (2004) indicates the trend as **3** (stable or unknown).

Spotted Sandpiper *Actitis macularius*

No new information on population size; the current estimate is 150,000.

USSCP (2004) indicates the trend as **3** (stable or unknown).

Upland Sandpiper *Bartramia longicauda*

No new information on population size; the current estimate is 350,000.

Population declines were noted by Houston & Bowen (2001) and by Bart *et al.* (2007) for eastern North America. Breeding bird survey analyses indicated some increases up to 1980, but decreases since then (Morrison 2001). The population trend is listed as **5** (decreasing) by USSCP (2004).

Eskimo Curlew *Numenius borealis*

No new information on population size (currently less than 50). Lack of recent reports of sightings suggest the designation of possibly extinct (EXT?) in WPE3 is appropriate.

Whimbrel *Numenius phaeopus*

Little new information is available for Whimbrel, but a reassessment of the previously reported North American total of 57,000 (Morrison *et al.* 2001b) may be in order. This total includes two subspecies: *N. p. hudsonicus* breeding west and south of Hudson Bay, and *N. p. rufiventris* breeding from north to southwest Alaska and east to the Melville Hills, Nunavut (Skeel & Mallory 1996, Morrison *et al.* 2001b, REG unpubl. data). Little mixing probably occurs between the two populations (Skeel & Mallory 1996).

The previous estimate for *N. p. rufiventris* in Morrison *et al.* (2001b) and WPE3 of 39,000 was based primarily on a figure of 36,000 derived from an estimated proportion of 3% of some 1.2 million shorebirds on the entire north Yukon River delta in Alaska (Morrison *et al.* 2001b). Much uncertainty must be attached to this number, since it was derived from a range of density values and percent species composition extrapolated over a very large area. Given that no other Alaskan staging areas are known to support more than several thousand Whimbrels, this figure is probably an overestimate. Winter counts of Whimbrels totaled some 31,000 (very similar to the spring total of 32,000); based on geographical distribution, Morrison *et al.* (2001b) derived a figure of 18,000 for *N. p. hudsonicus* from these counts, which would leave some 13,000 as *N. p. rufiventris*. This number is considered low, and since the previous estimate of 39,000 is considered high, we suggest taking a midpoint of 26,000 as the best current estimate: this would appear consistent with spring counts from western North America of 25,000 (GWP unpubl. data in Morrison *et al.* 2001b).

Further information is available on *N. p. hudsonicus* from counts conducted during spring migration 1994–1996 on Virginia barrier islands by B. Watts and B. Truitt (B. Truitt pers. comm., Chincoteague Natural History Association 1996). Highest counts on aerial transects reached 13,000, with peak estimated numbers based on habitats present in the study area exceeding 40,000 (B. Truitt pers. comm., Chincoteague Natural History Association 1996, Clark and Niles 2000). This would indicate the previous estimate for *N. p. hudsonicus* should be increased to at least 40,000, bringing the total for the two subspecies for North America to 66,000.

Population trend score revised from **5** (declining; Brown *et al.* 2001) to **4** (possibly declining; USSCP 2004). Trend estimates have been variable (Morrison *et al.* 2001a), though negative overall in eastern North America (Bart *et al.* 2007).

Bristle-thighed Curlew *Numenius tahitiensis*

The present estimate remains at 10,000, based on references and unpublished data quoted in Morrison *et al.* 2001b (see also Marks *et al.* 2002).

The population trend for the species is listed as **3** (apparently stable or unknown) by USSCP (2004).

Long-billed Curlew *Numenius americanus*

Recent work has suggested that there are considerably more Long-billed Curlews than the previous estimate of 20,000 (Morrison *et al.* 2001b). A compilation of estimates of numbers of Long-billed Curlews in 16 states and three provinces in the United States and Canada, based mostly on expert opinion, suggested a total of some 55,000 (54,873, range 32,700–62,500; SLJ unpubl. data), though most survey results were considered to be of poor or unreliable accuracy. Even these numbers may be low, as indicated by new work involving a recent two-year survey of Long-billed Curlew in 16 western states in the United States, which resulted in estimates of 164,515±42,047 (SE) in 2004 and 109,533 ±31,060 (SE) in 2005 (Stanley & Skagen 2005). A more conservative estimate is given by subtracting 1 SE from the mean, which yields 122,468 and 78,473 birds in 2004 and 2005, respectively. An even more conservative estimate represented by the lower bound of the 95% confidence limit gives figures of 82,103 and 48,656, respectively, closer to the estimates based on expert opinion. In Canada, the population has been estimated by summing minimum estimates from the three provinces in which the species occurs (Saskatchewan 4,000 birds, Alberta ≥19,000 birds (also from roadside surveys, involving the mean minus 1SE, Saunders 2001), and British Columbia 500 birds) to produce a total of a minimum of 23,500 mature birds (COSEWIC 2002). If the United States population is taken as the midpoint of the conservative estimates (mean minus 1SE) at approximately 100,000, this would produce a minimum total for North America of 123,500 Long-billed Curlews. The higher numbers derived from breeding ground surveys are at present the best attempt to derive a statistically defensible estimate of the Long-billed Curlew population in the United States.

It has been suggested that winter surveys would be the most appropriate approach for determining the global population, since the birds are aggregated and relatively immobile (Oring 2006); current opinion places winter numbers in the range of 30,000–40,000 with an outside estimate of 50,000–60,000 (L. Oring pers. comm.).

In summary, it appears that there are considerably more Long-billed Curlews than previously thought, with a likely range in the order of 50,000–150,000: we suggest reporting a range of 55,000–123,500, based on the recent assessments, noting the upper value reflects the results from statistically based surveys.

Population trend listed as **5** (declining) by USSCP (2004).

Hudsonian Godwit *Limosa haemastica*

The previous estimate of 50,000 should be increased somewhat. Counts on the main wintering grounds in Tierra del Fuego (Chile and Argentina) between 2000 and 2006 ranged between 31,100 and 66,800, averaging 45,000 (RIGM & R.K. Ross, unpubl. data), compared to 31,132 during the 1980s (Morrison & Ross 1989). During CWS Shorebird Atlas surveys in the 1980s, a further 1,580 Hudsonian Godwits were seen on the Atlantic coasts of Argentina and Uruguay and 12,813 on the Pacific coast of South America, most of which (12,642) were in Chiloe (Morrison & Ross 1989). In 2006, further aerial surveys in the Chiloe area produced a total of 13,009 birds (RIGM, R.K. Ross & L. Espinosa), close to the total from the 1980s, and also similar to the long-term mean of approximately 12,000 obtained from ground surveys conducted between 1993 and 2005 (Espinosa *et al.* 2005).

In the United States, a two-year survey of the Prairie Pothole Region in 2002–2003 produced a mean spring total of 16,229±6,974 for the area, which could imply that a total of 70,170 birds passed through the area assuming a residency period of seven days (SKS, unpubl. data). Using a conservative approach, if it is assumed that the true number lies 1 SE below the mean, then with turnover the total passing through the area would be 40,300. Maximum estimates in both Tierra del Fuego and on the Prairies during northward migration approach 70,000, and we suggest that this would be an appropriate total for the entire population. With recent surveys (see above) indicating no major changes in numbers in the Chiloe/Pacific population, we suggest leaving the current estimate for this population at 14,000 (Brown *et al.* 2001), and increasing the Tierra del Fuego population to 56,000, a figure mid-way between the average and maximum aerial survey counts (also see Elphick & Klima 2002).

The data on the wintering grounds in Tierra del Fuego indicate the population is stable. Counts in eastern coast of North America appear to have declined in recent years (Bart *et al.* 2007).

Bar-tailed Godwit *Limosa lapponica*

The previous estimate of 100,000 for *L. l. baueri* by Morrison *et al.* (2001b) was based on counts in Alaska (Gill & McCaffery 1999) and from the wintering grounds, a number subsequently revised to 120,000 (McCaffery & Gill 2001). The estimate of 170,000 in WPE3 was based on unpublished population estimates in the East Asian – Australasian Flyway, a number which has since been revised to 155,000 (M.J. Bamford pers. comm.). Steep population declines, however, have been noted in recent years in western Alaska as well as on the wintering grounds (McCaffery *et al.* 2006), and modeling and aerial surveys suggest a decline of 9–10% per year between 1997 and 2005. Counts on the wintering grounds indicate the population in Australia and New Zealand may have fallen from around 120,000 in the late 1990s

to about 90,000 in 2005 (REG, BMcC, unpubl. data). We therefore suggest an estimate of 90,000 is currently appropriate.

USSCP (2004) indicates the trend as **3** (stable or unknown), which should be revised to declining.

Marbled Godwit *Limosa fedoa*

No new information on population size for the three populations occurring in North America (Morrison *et al.* 2001b). The mid-continental population is currently estimated as 170,000; recent work on populations in James Bay/Hudson Bay (approximately 1,200; Abraham & Ross 2006) and in Alaska (1,350 in half the species' breeding range, high count totals of 2,000–3,000 at estuaries; Tibbitts *et al.* 2006) indicates that previous estimates for the populations in these areas (James Bay: 1,000–2,000; Alaska: 1,000–3,000) are probably in the correct range. Winn *et al.* (2006) reported a recent estimate of 2,226 Marbled Godwits wintering in the southeastern Atlantic states of the United States: these birds are likely mostly from the James Bay area, though it is not know to what extent birds from the mid-continental population may also occur in the area.

Population trend listed as **4** (possibly declining) by USSCP (2004).

Ruddy Turnstone *Arenaria interpres*

Previous estimates by Morrison *et al.* (2001b) of sizes of the three populations breeding in North America were 180,000 for *A. i. morinella*, 20,000 for the Alaskan population of *A. i. interpres*, and at least 35,000 for those *A. i. interpres* breeding in the northeastern part of the Canadian Arctic (Morrison *et al.* 2001b, also see Nettleship 2000). No new information is available for the Alaskan population of *A. i. interpres* or for *A. i. morinella*, which occupies central parts of the Canadian Arctic into eastern Alaska (Morrison *et al.* 2001b).

Uncertainties involved in making estimates of populations are well illustrated by the case of *A. i. interpres* breeding in northeastern Canada and Greenland and wintering in Europe/Africa. The previous estimate of 35,000 for the Canadian portion of the range was based on the assumption that somewhat more than half of the estimated 67,000 wintering in Europe bred in Canada (the rest in Greenland; see references in Morrison *et al.* 2001b). A more recent estimate of the European wintering population was given as 94,000 (WPE3). Meltofte (2004) provided updated estimates from the breeding grounds, which included 15,000–30,000 pairs in Canada and 20,000–40,000 pairs in Greenland, for a combined total of 35,000–70,000 pairs, or 70,000–140,000 individuals. The midpoint of this estimate is fairly close to the recent estimate of the wintering population, but it would only involve breeding adults. Meltofte (2004) estimated the wintering population would be larger than the adult breeding population owing to the presence of immature birds, and suggested that the midwinter population could be estimated from the summer breeding population by adding an average of one juvenile still alive per pair and a further 50% of these surviving as non-breeding immatures until the next winter. This would give a winter population of 120,000–245,000 individuals, some 25,000–150,000 more than the midwinter counts. On the basis of Meltofte's (2004) estimate of 15,000–30,000 pairs in the Canadian Arctic, we suggest adopting the midpoint of 22,500 pairs, or 45,000 individuals for the Canadian portion

of the range. The midpoint of the total population, including breeders in Canada and Greenland, would be 52,500 pairs or 105,000 individuals.

The species is thought to be declining in North America (Morrison *et al.* 2001a); population trend score **4** (USSCP 2004).

Black Turnstone *Arenaria melanocephala*

The previous estimate of 80,000 birds given in Morrison *et al.* (2001b) represents the mid-point of the range of 61,000–99,000 (reported in WPE3), this range being the 95% confidence interval of the estimate for the central Yukon Kuskokwim Delta, where most of the birds of this species are thought to breed in Alaska (Handel & Gill 1992). Handel & Gill (1992) estimated that 15,000 others nested elsewhere in the state, so that the estimate for the population (global and North American) should best be given as 95,000 (Handel & Gill 2001).

USSCP (2004) indicates the trend as **3** (stable or unknown).

Surfbird *Aphriza virgata*

No new information on population size (currently 70,000).

USSCP (2004) indicates the trend as **4** (possibly declining).

Red Knot *Calidris canutus*

There are currently considered to be six subspecies of the Red Knot (Harrington 2001, Piersma & Davidson 1992, Piersma & Spaans 2004, Tomkovitch 2001, Wetlands International 2002). In North America, these include: *C. c. islandica*, which breeds in the northeastern Canadian High Arctic (as well as Greenland) and migrates to Europe; *C. c. rufa*, which breeds in the central parts of the Canadian Arctic and migrates to (southern) South America; and *C. c. roselaari*, which breeds on Wrangel Island but is also thought to be the form nesting in northern Alaska. The non-breeding range of *C. c. roselaari* is poorly known and may include the west coast of the Americas and possibly the Gulf of Mexico (including Florida?) and Caribbean (Harrington 2001).

Apart from the Pacific coast, which is considered to be occupied by *C. c. roselaari*, there are three other main wintering regions in the Americas: Florida/SE United States, Maranhão/north-central Brazil, and Tierra del Fuego/Patagonia in southern South America (Baker *et al.* 2005, Morrison & Ross 1989, Morrison *et al.* 2005a, Niles *et al.* 2006a, 2006b). It now appears that each of these areas is occupied by a distinct biogeographic population. The southern South American wintering areas are occupied by what is considered to be *C. c. rufa*. Uncertainty exists over the identity of the birds wintering in Maranhão and Florida: they may be separate populations of *C .c. rufa*, perhaps *C. c. roselaari*, or a yet-to-be-determined subspecies. Although the *C. c. rufa* population that winters in southern South America mixes with more northerly wintering groups during migration through eastern North America (Harrington *et al.* 1988), there has been no detectable interchange between wintering populations based on banding results (Baker *et al.* 2005). Knot subspecies are thought to have arisen as a result of the eastward expansion of birds originally breeding in unglaciated regions of northern Eurasia (central Russia) into Alaska and

the North American Arctic as glaciers retreated over the past 20,000 years (Buehler & Baker 2005). Whereas this genetic analysis suggests the birds wintering in Florida might be *C. c. roselaari*, evidence from banding and stable isotope work is not always consistent with this interpretation (Atkinson *et al.* 2005): further work is needed to elucidate the details of the population/subspecific status of birds wintering on the north coast of South America, in Central America, and around the Gulf of Mexico/Florida.

Little new information is available for *C. c. islandica* from the breeding grounds in North America, and the estimate of breeding birds in Canada has been left at 80,000 (Meltofte 2004, Morrison *et al.* 2001b). This population is thought to be declining (WPE4).

The *C. c. rufa* population wintering in southern South America has undergone very substantial declines in recent years (Morrison *et al.* 2004). Totals at all the major wintering areas in Tierra del Fuego fell from over 51,000 in 2000 to 27,000–31,000 between 2002 and 2004, and still further to around 17,700 in 2005 (Morrison *et al.* 2004, RIGM, R.K. Ross & L.J. Niles unpubl. data), a decline confirmed by surveys in January 2006 (total 17,211; RIGM & R.K. Ross unpubl. data). Numbers at the main wintering site at Bahia Lomas fell by approximately 50% from over 45,000 to the low 20,000s between 2000 and 2002, remained in the mid 20,000s during 2003 and 2004, and fell again in 2005 to less than 10,000 (9,827, a figure confirmed by ground counts, L.J. Niles unpubl. data), and remained at this level in January 2006 (9,630; RIGM & R.K. Ross, unpubl. data). Few birds were found outside the major wintering areas during coverage of the coast of Patagonia from 2002–2004, although such areas had held moderate numbers of knots in the mid 1980s (Morrison & Ross 1989). The aerial survey results suggest the population may have fallen as low as 20,000.

The status of other populations, including *C. c. roselaari*, is less certain, and is complicated by the taxonomic uncertainties of the various groups. The figure of 20,000 for *C. c. roselaari* quoted in WPE3 refers to birds from "central North America"; it is based on counts from the 1980s and 1990s and on the assumption that birds taking the interior route are likely to be from Florida (and northern South America?) and thus possibly *C. c. roselaari*. As indicated above, however, the biogeographical and subspecific status of birds wintering around the Gulf of Mexico/Florida, Caribbean, and northern South America is not currently entirely clear. Stable isotope analysis of feathers (Atkinson *et al.* 2005, P. Atkinson & N. Clark pers. comm.) indicates that knots from Florida may belong to the *C. c. rufa* group and that birds from wintering areas on the north coast of South America are not *C. c. roselaari*; both are distinguishable from *C. c. rufa* wintering in southern South America. The birds wintering in northern Brazil appear to comprise a separate biogeographical population from those in southern South America, as indicated by work involving color banded individuals (Baker *et al.* 2005). The current estimate for the Florida/SE United States population is about 7,500 individuals, based on aerial survey data (Morrison *et al.* 2005a), though only about 4,000 were found during surveys in January 2006 (Niles *et al.* 2006c). Suggestions the population might reach 20,000 have not been supported by survey data in recent years (B.A. Harrington pers. comm.). There have been reports of up to 3,000 knots wintering on the coast of Texas (Skagen *et al.* 1999), but recent observations suggest there are now only a few hundred (300). Numbers on the north coast of South America

totaled about 9,000 in the 1980s (Morrison & Ross 1989), and the most recent estimate for the Maranhão area during aerial surveys was about 7,600 (Baker *et al.* 2005).

Similar uncertainties exist concerning the numbers of knots on the Pacific coast of the Americas, which presumably do represent *C. c. roselaari*. The largest estimates for the U.S. Pacific coast to date involved 9,035 birds during spring migration, and 4,813 in winter, though these were derived from counts at all sites summed across years between 1988 and 1995 (Page *et al.* 1999), and a better assessment of knot numbers on the coast comes from sums of median or mean numbers of shorebirds at these sites, which were in the 1,000–2,000 range in winter and spring, and somewhat over 2,000 in fall (Page *et al.* 1999). Paulson (1993) reported some 6,000 Red Knots at Gray's Harbor in the Pacific northwest of the United States in 1981, but numbers in this area have since declined considerably; high counts in the region were around 2,500 in 1997, and have been less than 1,000 since then (D. Paulson pers. comm.). In Mexico, Morrison & Ross (2006) concluded from their aerial survey results and counts made by Engilis *et al.* (1998) that several thousand knots were likely to use the Pacific coast of Mexico, a figure closer to a recent estimate of 2,000–4,000 for the entire Pacific coast (GP & D. Paulson pers. comm.) and comparable to observations of almost 3,000 birds on the Baja California peninsula in October (R. Carmona pers. comm. to H.P. Sitters 2005) and 2,000–3,000 birds near Grays Harbor during southward migration in 2006 (J. Buchanan pers. comm.).

Numbers from Alaska quoted by Morrison *et al.* (2001b) are problematical and require reassessment. The maximum count of 110,000 from the Yukon Kuskokwim Delta (YKD) was recorded in spring 1980, and similar numbers have not been seen either before or since at this site (BMcC unpubl. data). Observers at coastal camps on the YKD in recent years have reported "thousands" of knots, which suggests (allowing for underestimation) totals may approach the low tens of thousands. At the Copper River Delta, a maximum count of 40,000 was recorded in spring 1975, and up to 100,000 have been thought to use the area (Islieb 1979, Kessel 1989, Kessel & Gibson 1978); the largest estimate involved extrapolation, and similar numbers have not been recorded in recent years or in previous years. There is also the possibility that migrants at Copper River may move on to the YKD during migration, so counts at the two areas should not be summed. Whether birds at the two areas are from the same biogeographical population is also not known, and some are likely to involve *C. c. rogersi* breeding in eastern Siberia and wintering in Australasia. In addition, the breeding population of *roselaari* in Alaska may only involve a few thousand birds scattered across montane tundra in N and NW Alaska (R.E. Gill in USFWS 2004). The latter estimate would be more in line with recent winter estimates from the Pacific coast.

Although the taxonomic identity of these groups remains uncertain, it seems that many may involve distinct biogeographic populations, and that there are many fewer birds involved than previously thought, even considering the difficulties in finding and counting the birds over the large geographical ranges involved. When the most recent estimates for birds wintering in Florida/SE United States (7,500), Texas (300), Venezuela (520, Morrison & Ross 1989), Maranhão (7,600), Panama (200, Buehler 2002), and the Pacific coast (say 4,000) are added, the total is 20,120, substantially less than the 35,000–50,000 suggested when some of the birds

from Alaska are included in the group currently loosely described as *C. c. roselaari*. We suggest a total of 20,000 for "*C. c. roselaari*", recognizing that this group contains a number of distinct populations whose taxonomic identity is likely to change.

Sanderling *Calidris alba*

No new information on population size; current estimate is 300,000. See also *Birds of North America* account (MacWhirter *et al.* 2002).

Trend estimates have been consistently negative and statistically significant (Bart *et al.* 2007, Morrison & Hicklin 2001, Morrison *et al.* 2001a, USSCP 2004).

Semipalmated Sandpiper *Calidris pusilla*

Population trend estimates have been consistently negative in many areas for this species over the past few decades (Morrison *et al.* 2001a), and it would appear appropriate to adjust the previous population estimate (3.5 million) downwards. Mark-recapture work in the Bay of Fundy has suggested that the source population for Semipalmated Sandpipers using the Johnson's Mills area fell from an estimated 800,000 birds in 1982 to about 260,000 in 2004, a decrease of about 68%, consistent with an annual rate of decline of 5% (Hicklin & Chardine 2006, unpubl. data). If one assumes that 75% of the North American population of the species migrates through the Bay of Fundy, that a 5% annual decline in this part of the population has occurred over a 15-year period, and that the other 25% of the population has not been affected, the initial population of 3.5 million would be reduced to approximately 2 million. We suggest adopting this number until further information is available.

A two-year survey of the Prairie Pothole Region in 2002–2003 produced an average of $170,681 \pm 43,645$ (SE) birds in the study area during northward migration and $60,716 \pm 26,860$ (SE) birds during southward migration (SKS unpubl. data). Assuming a residency period of seven days for each season, these estimates imply that 743,700 and 121,400 birds passed through the area in spring and fall, respectively (SKS unpubl. data). Using a conservative approach, if it is assumed that the true number lies 1 SE below the mean, then with turnover the total passing through the area in spring and fall would be 553,500 and 67,700, respectively.

Western Sandpiper *Calidris mauri*

Although there have been substantial apparent declines in Western Sandpipers migrating through key sites in British Columbia (Butler & Lemon 2001), it appears that the decline in numbers may be at least partly the result of the sandpipers passing through the area more rapidly in recent years owing to an increased predation risk from Peregrine Falcons (*Falco peregrinus*), rather than simply a decrease in population size (Ydenberg *et al.* 2004). Until the relative contributions of these factors are resolved, we suggest retaining the current estimate of 3.5 million. An earlier estimate of 6.5 million appears too high (Islieb 1979, Wilson 1994).

Least Sandpiper *Calidris minutilla*

Not a great deal of new information is available on which to

base revisions. In the United States, a two-year survey of the Prairie Pothole Region in 2002–2003 produced an average of 145,642± 34,152 (SE) birds in the study area during northward migration and 96,473± 24,022 (SE) birds during southward migration (SKS unpubl. data). Assuming a residency period of seven days for each season, these estimates imply that 634,600 and 193,000 birds passed through the area in spring and fall, respectively (SKS unpubl. data). Using a conservative approach, if it is assumed that the true number lies 1 SE below the mean, then with turnover the total passing through the area in spring and fall would be 485,800 and 144,900, respectively. This compares to the previously reported maximum count total for the Interior Flyway during autumn of 322,700 (Morrison *et al.* 2001b). These numbers suggest a moderate increase from the previous total of 600,000 would be in order. Adopting an estimate of >600,000 for spring migrants passing through the interior and adding previous maximum count totals for Atlantic and Pacific coasts of 37,300 and 48,000, respectively (Morrison *et al.* 2001b), a total of closer to 700,000 is obtained.

Despite the small increase suggested above based on improved estimates from central North America, consistent declines have been noted in eastern North America (Bart *et al.* 2007, Morrison & Hicklin 2001, Morrison *et al.* 2001a).

White-rumped Sandpiper *Calidris fuscicollis*

The previous estimate of 400,000 (Morrison *et al.* 2001b) was based mainly on numbers on northward migration in the Interior Flyway and estimates from the breeding grounds, and was considered likely to be low. New information from a two-year survey of the Prairie Pothole Region in 2002–2003 produced a mean spring total of 388,781±132,773 (SE) for the area, which could imply that a total of 1,694,000 birds passed through the area assuming a residency period of seven days (SKS unpubl. data). Using a conservative approach, if it is assumed that the true number lies 1 SE below the mean, then with turnover the total passing through the area would be 1,116,000. These totals are far greater than numbers than have been detected or reported on the wintering grounds, though the species is very difficult to count during aerial surveys when birds are dispersed or scattered along beaches roosting in tide wrack at high tide (RIGM & R. K. Ross pers. obs.) or use habitats away from the coastline for roosting (Minton *et al.* 1995). We suggest adopting the "conservative" estimate from the interior of the United States, of 1.12 million, pending further information.

USSCP (2004) indicates the trend as **3** (stable or unknown). Declines were noted in the estimated population nesting on Prince Charles Island in the Canadian Arctic between 1989 (Morrison 1997) and 1996–97 (61%; V. Johnston pers. comm.); slight declines (non-significant) were noted on the Rasmussen Lowlands between the mid 1970s and mid 1990s (Gratto-Trevor *et al.* 1998), and there has been no obvious trend on Southampton Island in recent years (P.A. Smith pers. comm.). We suggest a designation of declining.

Baird's Sandpiper *Calidris bairdii*

No new information on population size (Moskoff & Montgomerie 2002); current estimate is 300,000.

USSCP (2004) indicates the trend as **3** (stable or unknown), though little information is available for this species.

Pectoral Sandpiper *Calidris melanotos*

Morrison *et al.* (2001b) noted that the species is one of the most abundant migrants in the interior of the United States and that an estimate for the region of 250,000 – well above the counted total (83,800) – would be appropriate. New information from the central parts of the United States tends to confirm this interpretation. A two-year survey of the Prairie Pothole Region in 2002–2003 produced an average of 55,730±14,998 (SE) birds in the study area during northward migration and 356,712±98,380 (SE) birds during southward migration. Assuming a residency period of seven days for each season, these estimates imply that 242,800 and 713,400 birds passed through the area in spring and fall, respectively (SKS unpubl. data). Using a conservative approach, if it is assumed that the true number lies 1 SE below the mean, then with turnover the total passing through the area in spring and fall would be 177,500 and 516,700, respectively.

The breeding range extends well into central and eastern Siberia (Holmes & Pitelka 1998), with birds from these areas passing south through the Americas to wintering areas in South America. The population may be much larger than currently thought; pending further information, we suggest increasing the estimate from the present 400,000 to 500,000 on the basis of the analyses from the central United States.

USSCP (2004) indicates the trend as **3** (stable or unknown); trend estimates have been variable (Morrison *et al.* 2001a), though Bart *et al.* (2007) found a significant decline in numbers in eastern North America.

Sharp-tailed Sandpiper *Calidris acuminata*

The previous estimate for the global population of 166,000 in Morrison *et al.* (2001b) was adjusted to 160,000 in WPE3 on the basis of unpublished information from M. J. Bamford (see Alaska Science Centre 2006). Estimates of the numbers of Sharp-tailed Sandpipers reaching North America are uncertain, since adults move northwards to and southwards from the eastern Siberian breeding grounds on the Asian side of the Pacific, whereas most or possibly all of the juveniles pass through Alaska in the autumn before migrating southwards across the Pacific to wintering areas in Australasia (Alaska Science Centre 2006). Assuming that 160,000 represents the breeding population, and that annual production is 10–30%, somewhere between 15,000 and 50,000 (approximate midpoint 30,000) Sharp-tailed Sandpiper juveniles could reach Alaska each autumn, an estimate compatible with survey data from that state (REG unpubl. data). Consideration of data on the percentage of juvenile Sharp-tailed Sandpipers in samples of the species trapped in Australia on the wintering grounds (Minton *et al.* 2005) leads to a similar conclusion. Minton *et al.* (2005) found a long-term (25 year) average of 16.5± 0.48 (SE) % juveniles, which if applied to the Bamford (unpublished) population size of 160,000 birds would give a juvenile population of 26,400, most of which are thought to migrate through Alaska. The number in Alaska would likely be somewhat higher owing to mortality during the first migration southwards. Until more accurate estimates of the numbers visiting Alaska are obtained, a figure of 30,000 is suggested for the North American estimate; considerably fewer (previously suggested 1,000) are likely to reach the Canadian coastline south of Alaska (Morrison *et al.* 2001b).

USSCP (2004) lists the population trend as **3** (stable or unknown).

Purple Sandpiper *Calidris maritima*

Little new information is available on population sizes of Purple Sandpipers in North America. Birds wintering on the east coast are likely to include *C. m. belcheri*, which breeds on the Belcher Islands and around Hudson Bay, and *C. m. maritima*, which breeds elsewhere in the northeastern Canadian Arctic. The current estimate of 15,000 is based on combined maximum counts from sites covered on Christmas Bird Counts in eastern North America (K. Rosenberg in Morrison *et al.* 2001b), though counts in individual years have not totaled more than approximately 6,000 (Audubon 2005). An estimated 7,350 (7,150–7,650) were found wintering on the coast of Maine in the period 2001–2004 (G. Mittelauser unpubl. data). See also account in *Birds of North America* (Payne & Pierce 2002).

USSCP (2004) indicates the trend as **3** (stable or unknown).

Rock Sandpiper *Calidris ptilocnemis*

Current estimates (Table 1) are considered acceptable for the three (of four) recognized subspecies breeding in North America (BMcC & REG unpubl. data, see also Gill *et al.* 2002b).

USSCP (2004) indicates the trend as **3** (stable or unknown) for the *Calidris p. tschuktschorum* (50,000) and *C. p. cousei* (75,000) populations and as **4** (declining) for the *C. p. ptilocnemis* (25,000) population.

Dunlin *Calidris alpina*

Calidris a. articola. We suggest retaining the current estimate of 750,000 (Morrison *et al.* 2001b) pending a revision being undertaken in association with an update of the Alaska Shorebird Conservation Plan. Opinions vary regarding the accuracy of the original estimate, which was based on numbers of nests on the North Slope of Alaska, with some considering the estimate low or at least conservative, and others considering the estimate high, perhaps considerably so. Preliminary analyses of data from recent surveys have suggested a lower total, though fuller analysis and peer review is needed before reassessment can be completed. Estimates for the other two subspecies occurring in North America remain unchanged at 550,000 (500,000–600,000) for *C. a. pacifica* and at 225,000 (150,000–300,000) for *C. a. hudsonia* (Morrison *et al.* 2001b).

All three North American subspecies are thought to be declining (Brown *et al.* 2001, USSCP 2004).

Stilt Sandpiper *Calidris himantopus*

The previous estimate of 200,000 was based on spring and fall counts of around 150,000 in North America (Morrison *et al.* 2001b), and new information from the interior of the United States suggests that this total should be considerably higher. A two-year survey of the Prairie Pothole Region in 2002–2003 produced an average of 285,440±96,597 (SE) birds in the study area during northward migration and 225,412±106,268 (SE) birds during southward migration.

Assuming a residency period of seven days for each season, these estimates imply that 1,243,700 and 450,825 birds passed through the area in spring and fall, respectively (Skagen *et al.* unpubl. data). Using a conservative approach, if it is assumed that the true number lies 1 SE below the mean, then with turnover the total passing through the area in spring and fall would be 822,800 and 238,300, respectively. Given the relatively low totals in other flyways (Morrison *et al.* 2001b), we suggest revising the current estimate to 820,000, pending further information.

USSCP (2004) indicates the trend as **3** (stable or unknown).

Buff-breasted Sandpiper *Tryngites subruficollis*

Based on recent estimates of numbers passing through the Rainwater Basin of Nebraska (Jorgensen *et al.* 2006), it would appear that 16,000–32,000 may be more appropriate than the previously reported estimate of 15,000 (Morrison *et al.* 2001b, Wetlands International 2002). The numbers from the Rainwater Basin are likely to be conservative because they were based on the lower confidence levels of densities calculated using the distance sampling program (Thomas *et al.* 2004) and did not take into account turnover rates. Surveys of rice fields in the Gulf Coastal Plain of Louisiana and Texas also indicated higher than previously reported numbers of the species. Extrapolations based on sampling 2.16% of the study area and assuming a 5 and 15-day length of stay, yielded estimates of 28,000 and 84,000 birds, respectively (W. Norling unpubl. data.). Given these two sources of information a more realistic estimate might be 30,000 birds or more.

USSCP (2004) indicates the trend as **5** (declining) although anecdotal trend data are only available for a few locations (Lanctot *et al.* 2002).

Short-billed Dowitcher *Limnodromus griseus*

Morrison *et al.* (2001b) reported an estimate of 320,000 Short-billed Dowitchers, involving three subspecies (*L. g. griseus*: 110,000; *L. g. hendersoni*: 60,000; and *L. g. caurinus*: 150,000). Estimates provided by Jehl *et al.* (2001), however, were rather lower, with a total of 153,000 for these populations (*L. g. griseus* and *L. g. hendersoni* combined 78,000, *L. g. caurinus* 75,000). Jehl *et al.* (2001) noted a striking correspondence between winter and spring counts of *L. g. caurinus*, which lends some strength to their estimate. Given the unknown potential for double counting of birds during migration period in some of the regional estimates produced by Morrison *et al.* (2001b), we feel it may be appropriate to adopt the estimates made by Jehl *et al.* (2001).

Population trend estimates have generally been negative and significant in eastern Canada (Morrison & Hicklin 2001, Morrison *et al.* 2001a), though Bart *et al.* (2007) noted non-significant positive trends in the North Atlantic and Midwest regions of North America.

Long-billed Dowitcher *Limnodromus scolopaceus*

Similar uncertainties noted for Short-billed Dowitchers may be expressed for Long-billed Dowitchers concerning the possibility of double counting birds during summing of seasonal totals as were expressed for Short-billed Dowitchers

(see above). Totals for counts presented in *The Birds of North America* account for Long-billed Dowitchers (Takekawa & Warnock 2000) are: spring 361,000, autumn 241,000, and winter 281,000 (combining winter count information with that in Morrison *et al.* 2001b), suggesting the population may be lower than the estimate of 500,000 presented by Morrison *et al.* (2001b). We suggest adopting an intermediate number of 400,000 until further information becomes available.

Although USSCP (2004) lists the population trend as **2** (possibly increasing), it is not known whether some reported increases may be due to redistribution rather than higher numbers (Takekawa & Warnock 2000). We suggest indicating the trend as "stable (?)" (see Bart *et al.* 2007).

Wilson's Snipe *Gallinago delicata*

No new information on population size. We suggest retaining the current estimate of 2 million, even though some earlier estimates were considerably larger (Mueller 1999). Declines appear to have taken place in population and harvest over the past few decades. Harvest of snipe decreased from some 600,000 to around 200,000 in the United States between the mid 1970s and early 2000s, and from about 100,000 to around 10,000 in Canada over the same period (CWSWC 2004), suggesting a population in the millions. Population trends over the period 1968–2002 were negative in the Great Basin and Atlantic Forest ecozones and positive in the Prairie ecozone (CWSWC 2004); overall the species is thought to be declining.

American Woodcock *Scolopax minor*

Little information is generally available on population size (Keppie & Whiting 1994), though long term declines in numbers and revisions of harvest estimates suggest the population may be somewhat lower than previously suggested. Although Singing-ground Surveys in North America indicate that there have been no significant changes for Eastern and Central populations of American Woodcocks in recent years (1995–2004), the long term (1968–2004) trends for both populations are significantly negative (–1% and –1.8% per year, respectively, p < 0.01; Kelley 2004, CWSWC 2004). In Canada, significant increases occurred in Eastern populations and significant declines in Central populations during 1995–2004. Degradation and loss of suitable habitat on breeding and wintering grounds are thought to be causing the overall declines (Kelley 2004). Estimated annual harvests of American Woodcocks have declined from around 850,000 to about 300,000 in the United States and from 100,000–150,000 to around 50,000 in Canada between the late 1970s and early 2000s; these numbers are somewhat lower than those previously referenced (Keppie & Whiting 1994, Morrison *et al.* 2001b) but still suggest a population in the millions. If harvest levels represent 10–11% of the population, this would suggest a total of 3–4 million (J. Kelley pers. comm.). We suggest lowering the population estimate from 5 million to 3.5 (range 3–4) million.

Wilson's Phalarope *Phalaropus tricolor*

No new information available on population estimate (currently 1.5 million).

USSCP (2004) indicates the trend as **5** (decreasing).

Red-necked Phalarope *Phalaropus lobatus*

Revision of the current estimate of 2.5 million (Morrison *et al.* 2001b, Rubega *et al.* 2000) remains highly problematical. This figure was based on counts of very large concentrations in the Bay of Fundy, but the species has almost entirely disappeared from previously occupied areas (Brown *et al.* 2004, Morrison *et al.* 2001b, Wetlands International 2002). In addition, numbers in some parts of the breeding range in the Arctic have declined (see Morrison *et al.* 2001b). At present, it is not known whether the population has crashed, or whether the birds may have moved to other marine areas on migration (Brown *et al.* 2004, J. Chardine pers comm.). Until new information is forthcoming, we suggest retaining the current estimate.

USSCP (2004) indicates the trend as **4** (possibly declining).

Red Phalarope *Phalaropus fulicarius*

Tracy *et al.* (2002) estimated the global population at some 5 million individuals (3.4 million adults and 1.6 million fledged juveniles). Alaskan and Canadian populations were estimated at 750,000 and 500,000, respectively, which would give a North America total of 1.25 million. Estimates from breeding grounds in Canada totaled 663,000 (compared with 624,000 in Morrison *et al.* 2001b) and from offshore areas around North America 1.145 million. These numbers suggest that the total is over 1 million birds and may be closer to 1.5 million. We suggest a range of 1–1.5 million (midpoint 1.25 million).

USSCP (2004) indicates the trend as **5** (declining), and the species appears to have declined at several important breeding sites in the Arctic (Gratto-Trevor *et al.* 1998, V. Johnston pers comm., P.A. Smith pers comm.).

DISCUSSION

Updated estimates of population size for 52 species of shorebirds occurring in North America (46 species that are found with some regularity plus six that are considered to be "at risk" (i.e., endangered, threatened, vulnerable; Morrison *et al.* 2001b) are shown in Table 1; the table includes available information on different subspecies or functionally separate populations of shorebirds, involving a total of some 75 separate biogeographic populations or taxa.

Information on how estimates of shorebird populations were originally derived was published in Morrison *et al.* (2000, 2001b) and is not repeated here. The present report documents new sources of information – both published, unpublished, and derived from expert opinion – that provides a basis for updating or revising the previous estimates.

New information resulted in a changed population estimate for over half (53%, 40 taxa) of the 75 biogeographic populations (Table 2). Of these, 25 involved an increased estimate and 15 a decreased estimate. Because shorebird populations are difficult to count or survey, especially when they occur in remote areas or habitats (e.g., the Arctic), are dispersed widely across the landscape, or display cryptic behavior, they are often thought to be underestimated, and this was considered to be the case in the previous estimates (Morrison *et al.* 2000, 2001b). The predominance of increased estimates in the present updates is therefore likely to

Table 2. Number of biogeographic populations (taxa) of shorebird species for which estimates have changed, based on new information, compared to Morrison *et al.* (2001b).

Estimate compared to Morrison *et al.* (2001b)	No. of taxa
Same estimate	35
New estimate higher (increase)	25
New estimate lower (decrease)	15
Total	**75**

Table 3. Current trends for 75 biogeographic populations of shorebirds occurring in North America.

Category of trend estimate	No. of taxa
Stable, possibly stable, unknown, possibly extinct	31
Declining, possibly declining	42
Increasing	2
Total	**75**

reflect more complete or improved coverage of areas in which the species occurs rather than an actual increase in the population itself. The magnitude of the increases ranged from just over 1.0 to 12.5 times the previous North American estimate (averaging 2.50±0.49 (SE) times). At the lower end of this range, the increase of 1.02 times for the mid-continental population of Marbled Godwits represented a minor adjustment of the previous estimate to be consistent with the WPE3 estimate, and the increase of 1.1 times for the Black Oystercatcher involved an increase in the estimated population from 8,900 to 10,000 resulting from the inclusion of previously uncounted birds from Middleton Island (the count still being within the previous range of 6,900–10,800). At the upper end of the range, the increase of 12.5 times comes from a revision to the estimated population of the *T. s. cinnamonmea* race of Solitary Sandpipers from 4,000 to 50,000. The overall estimate for both races of Solitary Sandpipers increased from 25,000 to 150,000 (the upper end of the previously suggested range), a more likely figure for the species, considering its size and the extent of its range, and the fact that it is difficult to detect and count owing to its dispersed distribution (Morrison *et al.* 2001b). The population estimate for the Long-billed Curlew also increased dramatically (6.2 times), from 20,000 in Morrison *et al.* (2001b) to 123,500 (Stanley & Skagen 2005); this example involves a species that has a dispersed and patchy distribution on the breeding grounds, and hence is usually only seen in small numbers. This work is one of an increasing number of investigations that are attempting to develop a more robust statistical sampling framework for species that are dispersed or patchily distributed during breeding and migration. In addition to the Long-billed Curlew work (Stanley & Skagen 2005), examples include assessment of the numbers of birds migrating through the central United States (SKS unpubl. data), through the Rainwater Basin (Jorgensen 2006) and Gulf Coastal Plain (Norling unpubl. data), as well as numbers of birds on the Arctic breeding grounds (Skagen *et al.* 2003).

Decreases averaged 0.65± 0.07 (SE) times the previous North American estimates. They varied from relatively small adjustments to population size, as with the change for Sharp-tailed Sandpiper (from 166,000 to 160,000 based on more recent information from wintering areas – this estimate was adopted in WPE3), to major changes resulting not only from better counts but also from major population declines, as with the *C. c. rufa* population of Red Knots, which dropped from a previous 170,000 (considered high at the time) to a possible 20,000, 0.12 times the previous estimate.

Many shorebird species in North America are thought to be declining and to have been declining for some time (Howe *et al.* 1989, Morrison *et al.* 1994, 2001a); indeed, declines in shorebird populations appear to be occurring on a worldwide scale (IWSG 2003). The information on trends in Table 1 was

gathered from recent analyses and from an update to the US Shorebird Conservation list of priority shorebird species (USSCP 2004), and indicates that declines significantly outnumber increases. Of the 75 biogeographic populations considered, the trends for 31 were considered stable, possibly stable, unknown, or possibly extinct, with 42 thought to be declining and only two increasing (Table 3), a statistically significant difference (from an equal number of declines and increases: $\chi^2 = 36.4$, d.f. = 1, p < 0.0001). The overwhelmingly disproportionate number of declines compared to increases among trends is not incompatible with the predominance of increases among the revised population estimates, since the latter come principally from improved estimates of numbers. However, many of the species for which there is no new information are thought to be declining, but it is not clear whether their population estimates should be adjusted downwards. In some cases, new information has enabled a new population estimate to be made based on observed declines: examples include the Semipalmated Sandpiper and Bar-tailed Godwit. Declines have also been noted for the Western Sandpiper on the Pacific coast of North America (Butler & Lemon 2001), but it is now thought that a shorter length-of-stay caused by increasing number of predators (falcons) at stopover areas may result in apparent decreases in counts at some sites (Ydenberg *et al.* 2004). Whether this phenomenon is occurring elsewhere or with other species, or even whether it is enough to account for all or only part of the apparent decline in Western Sandpipers, is not known. The almost complete disappearance of Red-necked Phalaropes from the Bay of Fundy suggests a population decline, though it is not known whether the species may have moved elsewhere (Brown *et al.* 2004, Duncan *et al.* 2001), making adjustment of the population estimate problematical.

Many recent population and trend estimates have attempted to move beyond expert opinion and adopt a more rigorous statistically based system of data collection. Obtaining such data is both expensive and challenging. While many of the data that are currently available were collected for other purposes (e.g., distributional studies), they have historically produced defensible trend or population estimates (Howe *et al.* 1989, Morrison *et al.* 1994), albeit with relatively low but acceptable statistical power. For management purposes, it is important to minimize making type II errors, where true trends are rejected, and improved statistical design should help address these issues.

Despite the new information available, the "accuracy rating" (Donaldson *et al.* 2000) or "confidence" (Brown *et al.* 2001) in the population estimates has not changed for many species, and overall remains low. Some suggested changes are as follows. The accuracy rating for the *C. c. rufa* population of Red Knots should be upgraded from a **3** (moderate) to **4** (systematic estimating effort), since the winter surveys

in Tierra del Fuego in recent years have covered all the known wintering habitat (Morrison *et al.* 2004) and the counts are in effect a census rather than a survey, albeit an aerial one. Similarly, the range-wide surveys of American Oystercatchers (Brown *et al.* 2005) may warrant the accuracy rating being increased from **3** to **4**. On the other hand, the rating for the Interior population of Snowy Plovers *C. a. nivosus* could perhaps be downgraded from a **4** (good) to a **3** (moderate), since it is based on extrapolations, and field observations have suggested fewer birds than the present estimate (this would also move the rating for the species to **3**). New information from the central United States has improved the basis for assessing populations of a number of species, and has led to or contributed to increased estimates for five species (Hudsonian Godwit, Least Sandpiper, White-rumped Sandpiper, Stilt Sandpiper, Pectoral Sandpiper), and a decreased estimate for one species (Lesser Yellowlegs), with one species (Killdeer) remaining unchanged. The accuracy rating for most of these species, however, should probably remain similar that given in previous assessments, at the "2–3" (low to moderate) level, though we would suggest upgrading Least Sandpipers and Pectoral Sandpipers from **1** (poor) to **2** (low).

Improvements in estimates have generally come from – and are likely to continue to come from – surveys or censuses designed to target particular species, often ones of conservation concern (e.g., Snowy Plover, Piping Plover, Mountain Plover, American Oystercatcher, Long-billed Curlew and Red Knot). Broader landscape and monitoring surveys, such as those conducted in the interior of the United States (Skagen *et al.* 1999, SKS unpubl. data) and on the coasts of North America and Canada (Maritimes Shorebird Surveys, International Shorebird Surveys, Pacific Shorebird Surveys) will continue to contribute information that will help refine population estimates and provide estimates of population trends. Improved estimates in the future should also come from work being conducted under the Program for Regional and International Shorebird Monitoring (PRISM), set up following the completion of the shorebird conservation plans in the United States and Canada. One of the objectives of PRISM is to estimate the size of breeding populations of 74 shorebird taxa in North America, and information from the arctic surveys portion of this program may in the future be able to provide new estimates for some 34 species of shorebirds (Skagen *et al.* 2003). Results from the first four years of the project in the Arctic have enabled estimates of regional shorebird populations to be made, though extrapolated estimates for the entire breeding range are not yet available; preliminary analyses (J. Bart unpubl. data) suggest estimates are generally larger than those currently available (RIGM unpubl. data). We have refrained from using these estimates for the present revisions.

Two criteria are widely used to evaluate whether a wetland may be considered to be of international importance: these are Criteria 5 and 6 of the Ramsar Convention, which respectively state that a wetland should be considered internationally important if it regularly supports 20,000 or more waterbirds, or if it regularly supports 1% or more of the individuals of a biogeographic population of a waterbird species. These two criteria have now been adopted by most of the major wetland and shorebird conservation programs and organizations, including the Ramsar Convention (Ramsar Convention Bureau 2005), the Important Bird Areas program of BirdLife International (BirdLife International 2004), the

East Asian Australasian Shorebird Site Network (Environment Australia and Wetlands International – Oceania 2002), and the Western Hemisphere Shorebird Reserve Network (Morrison *et al.* 2005b, WHSRN 2005), thus bringing a common set of criteria to all initiatives. It is important to have an internationally agreed set of data for waterbird population numbers from which 1% criteria can be derived, and that these data are regularly reviewed and updated. Wetlands International coordinates the collection and publication of such data every three years in its Waterbird Population Estimates series, to coincide with the triennial meeting of the Conference of the Contracting Parties to the Ramsar Convention (WPE3 was published in 2002). Since waterbird populations fluctuate through time (though the extent of such "natural" fluctuations is rarely known), major reassessment of 1% criteria are only undertaken at every third meeting of the Conference of the Contracting Parties (i.e., every nine years). Where populations are poorly known or are rapidly changing, the criteria may be adjusted after the triennial update, and a number of species of North American shorebirds should have their 1% criteria revised on this basis. There are some 15 species for which the new population estimate has changed considerably (arbitrarily taken as more than double or less than half the previous estimate), including ten populations with increases and five with decreases (Table 1).

In view of the widespread decline in shorebird populations, increased efforts need to be made to update population estimates for North American shorebird populations in time for the major reassessment of global waterfowl populations planned for 2008.

ACKNOWLEDGEMENTS

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