Conservation of migrating shorebirds: staging areas, geographic bottlenecks, and regional movements

A call for volunteers in an important cooperative field work survey

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EACH YEAR MILLIONS of shorebirds migrate between the northern and southern hemispheres of the New World. In spring they fly north to the taiga and tundra of the arctic. In fall they sweep southward toward wintering grounds along the coasts of Suriname, Brazil, Colombia, Venezuela, Peru and Ecuador, to palm swamps in Paraguay, the Argentine Pampas, and to rich wetland and grassland habitats throughout South America.

The number of individuals and species making this journey is staggering (Table 1), and the journey itself makes impressive demands of each bird making the trip. For one individual the energy needed for just a one-way migratory trip may exhaust several times the body's pre-migratory accumulation of fat (McNeil and Cadieaux 1972). It certainly takes several day's flying time, perhaps accomplished in three or four long-distance nonstop flights at 60-70 km/hr (Harrington 1982). And it exposes the migrants to the risks of finding food as well as avoiding predators in unfamiliar places.

Of increasing concern today is the fact that these migrations carry the shorebirds across international boundaries and thus through regions with varying conservation practices. Even in the most conservation-minded countries, land management rarely is tuned to the requirements of migrating shorebirds. Unfortunately, population sizes are determined not by the best but rather by the worst conditions that the birds encounter *en route*.

Shorebird habitat has disappeared at an alarming rate throughout the last century In California, for example, more than 70% of intertidal wetlands were altered to meet human needs during the last 100 years (Speth 1979). Comparable figures are not available for the Western Hemisphere as a whole. Indeed, only now are continent-wide efforts being made to assess the conditions of South American wetlands. This important step is being taken by the International Waterfowl Research Board, with collaboration from a series of international and national conservation organizations, including the International Council for Bird Preservation.

The disappearance of shorebird habitats surely has taken its toll on the size of wintering shorebird populations. In the Americas it is not possible to measure the overall effect directly because measurements are lacking for the period prior to the start of massive habitat destruction. Recent work on winter shorebird ecology, particularly studies on the effects of habitat removal in British estuaries (Goss-Custard 1977, 1979) and on shorebirds' cumulative impact on invertebrate prey (Evans *et al.* 1979, Goss-Custard 1980, Quammen 1980, Schneider and Harrington 1981) carries a clear message: shorebirds use their winter habitats and food resources to the limit. Removing pieces of prime intertidal acreage means fewer shorebirds.

That effect would be serious enough were it confined to a local site. But an environmental disturbance at one location may have unexpected, and severe consequences that spread far beyond the physical evidence. As a result, the number of birds apparently harmed by a simple local disturbance, may be in reality, far greater. Two aspects of shorebird biology are responsible for spreading the impact: migration and regional movements in the nonbreeding season.

THE PROBLEM ARISING from migration is simple in concept but hemispheric in significance.

Shorebirds migrate along traditional routes characterized by a chain of key staging areas. These are sites along the migration corridors where birds stop to feed *en route,* and are essential to successful migration. Shorebirds reach staging areas with depleted fat reserves after many hours of nonstop flight Without access to the energy available from staging sites, they would be unable to continue. Shifting to alternative staging areas usually is not a simple matter. More often than not, the massive staging areas within North America—for example, the Copper River Delta of southeastern Alaska, the Delaware Bay in New Jersey and Delaware, Grays Harbor in Washington—are the only sites within hundreds of coastline miles uniquely able to support the numbers of shorebirds that stop there to "refuel " Without each of those sites a key link in the migration chain is broken.

In essence, these staging areas are geographic bottlenecks, and the populations within entire migration corridors can be affected by their environmental health.

The largest staging area known in North America is the Copper River Delta of southeastern Alaska (Isleib 1979, Senner 1979). Some 20 million shorebirds pass through this region each spring. This cumulative total represents wintering populations from all along the United States West Coast and southward toward South America. It represents breeding birds from all over western Alaska and probably Siberia as well Entire races of several shorebirds most likely are utterly dependent for their breeding success on the clams of the Copper River Delta. The Delaware Bay plays a similar role in spring migration along the eastern seaboard (Dunne *et al* 1982).

These geographic bottlenecks have tremendous conservation significance for shorebird populations. Many shorebird species may appear to be immune

to environmental threats because of their abundance. The problem is that abundance does not always confer immunity. It can, if the deaths of individuals are independent, or if only a small fraction of the total population is likely to be adversely affected by a particular environmental disturbance. But staging areas remove that independence. To varying degrees, shorebird species are dispersed geographically in the breeding season and again during winter. In migration, however, they concentrate as they pass through staging areas. As a result, sheer numerical abundance affords little guarantee against severe population declines or even extinction. In this regard it is worth recalling the devastating effects that concentrated hunting in staging areas had on many shorebird populations during the 19th century. Some have yet to recover.

WINTER MOVEMENTS

On the wintering grounds during the nonbreeding season, what appear to be local populations are actually changing mixtures of individuals moving locally and regionally between different estuaries. This has important consequences for assessing how many birds a local environmental disturbance might affect. For example, while censuses might reveal 3000 shorebirds at one beach on one day, and 3000 four days later, a significant fraction of those 3000 counted during the second census may be different individuals.

Work in progress by my research group at the Bodega Marine Laboratory in California, for example, indicates that a given census may underestimate the true local population of Sanderling—defined as the cumulative number of individuals using the system during a given month—by up to 50%. Those not counted during a particular census are off in another estuary or on another beach that may be up to 40 km distant. During the month some individuals always remain at Bodega Bay. But others come and go, wandering between different estuaries on the central California coastline. This means that the effects of environmental measures we might take to protect Bodega Bay's populations would be lessened as the birds passed in and out of areas beyond the zone of protection. This pattern of movements appears to be true for a wide range of shorebird species (Pienkowski and Clark 1979).

Table 1. North American shorebirds with substantial populations migrating to Neotropical wintering grounds

Species	*Southern limit of usual winter distribution*
Black-bellied Plover *Pluvialis squatarola*	Argentina, Chile
American Golden Plover *P. dominica*	Argentina, Chile
Snowy Plover *Charadrius alexandrinus*	Mexico, Caribbean
Wilson's Plover *C. wilsonia*	Brazil
Semipalmated Plover *C. semipalmatus*	Brazil, Peru
Killdeer *C. vociferus*	Colombia, Ecuador
Mountain Plover *C. montanus*	Mexico
Black-necked Stilt *Himantopus himantopus*	Central America
American Avocet *Recurvirostra americana*	Central America
Greater Yellowlegs *Tringa melanoleuca*	Argentina, Chile
Lesser Yellowlegs *T. flavipes*	Argentina, Chile
Solitary Sandpiper *T. solitaria*	Argentina
Willet *Catoptrophorus semipalmatus*	Venezuela, Suriname, Peru
Wandering Tattler *Heteroscelus incanus*	Ecuador
Spotted Sandpiper *Actites macularia*	Brazil, Peru
Upland Sandpiper *Bartramia longicauda*	Argentina
Eskimo Curlew *Numenius borealis*	Argentina
Whimbrel *N. phaeopus*	Argentina, Chile
Long-billed Curlew *N. americanus*	Central America
Hudsonian Godwit *Limosa haemastica*	Argentina, Chile
Marbled Godwit *L. fedoa*	Central America
Ruddy Turnstone *Arenaria interpres*	Argentina, Chile
Black Turnstone *A. melanocephala*	Mexico
Surfbird *Aphriza virgata*	Chile
Red Knot *Calidris canutus*	Argentina
Sanderling *C. alba*	Argentina, Chile
Semipalmated Sandpiper *C. pusilla*	Brazil, Peru
Western Sandpiper *C. mauri*	Suriname, Peru
Least Sandpiper *C. minutilla*	Brazil, Peru
White-rumped Sandpiper *C. fuscicollis*	Argentina
Baird's Sandpiper *C. bairdii*	Argentina, Chile
Pectoral Sandpiper *C. melanotos*	Argentina, Peru
Stilt Sandpiper *C. himantopus*	Argentina
Buff-breasted Sandpiper *Tryngites subruficollis*	Argentina
Short-billed Dowitcher *Limnodromus griseus*	Suriname, Peru

Species	*Southern limit of usual winter distribution*
Long-billed Dowitcher *L scolopaceus*	Central America
Common Snipe *Gallinago gallinago*	Brazil, Paraguay
Wilson's Phalarope *Phalaropus tricolor*	Chile, Argentina
Northern Phalarope *P lobatus*	Chile
Red Phalarope *P fulicarius*	Chile

THE PANAMERICAN SHOREBIRD PROGRAM

THE CONSERVATION problems faced by shorebirds migrating between hemispheres clearly are substantial. They require coordinated research and management efforts, involving investigators and planners from throughout the Americas.

With major support from the World Wildlife Fund—US, and with the aid and cooperation of a series of participating private and governmental groups (Table 2), the PanAmerican Shorebird Program has begun to work on these issues, building on pioneering work by Brian Harrington and R.I.G. Morrison with Red Knot and Semipalmated Sandpiper migrations, and following the lead of Britain's Wader Study Group. The Program's first goals are to map the migration pathways of shorebird populations as they move northward from South American wintering grounds through staging areas in the northern hemisphere. This information is essential for estimating the importance of particular wintering and staging sites.

During the nonbreeding season of 1982/83 shorebirds of several species, particularly Sanderlings, Red Knots and Black-bellied Plovers have been color marked on their wintering sites with colored leg-flags and bands. Marking sites include important wintering areas in Peru, Chile, Ecuador, and Brazil. During spring migrations in 1983 and 1984 collaborators will be searching for migrants from these areas in different staging sites in North America.

Volunteers are needed to participate in the searching effort on beaches on all three United States coastlines: Atlantic, Pacific, and Gulf. Anyone interested in participating should contact the PanAmerican Shorebird Program through the author or one of the groups listed in Table 2.

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Table 2. Organizations participating in the PanAmerican Shorebird Program

Academy of Natural Sciences of Philadelphia
Bodega Marine Laboratory
Canadian Wildlife Service
Instituto Nacional Forestal y de Fauna del Peru
International Shorebird Survey
Manomet Bird Observatory
Museo Nacional de Historia Natural, Santiago, Chile
North Carolina State University
U.S. Fish and Wildlife Service
Wader Study Group
World Wildlife Fund—US