

SHOREBIRDS AT CHINCOTEAGUE

*Patterns of Migration on the
Virginia Coast*

by

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EVOLUTION OF THE SURVEY

Assateague, a long coastal barrier island lying just south of Ocean City, Maryland, straddles the Maryland-Virginia line. The fourteen miles in Virginia, from the state line to Fishing Point at the southern tip, comprise Chincoteague ^{National} Wildlife Refuge. (The refuge is confusingly named after the island and village that lie just west of it and east of the mainland, which is linked to it by a five-mile-long causeway across the marshes and channels in between.) The mixture of extensive wetland habitats on the refuge--open and sheltered beaches, tidal mudflats and marshes, freshwater impoundments, swamps, and marshes--make it a major sanctuary for water birds of all kinds throughout the year.

In 1973 the refuge experimented briefly with a series of one-day bird surveys in which participating groups of birders were assigned sections of the refuge to census. On one survey in late May I was lucky enough to be assigned the Washflats impoundment, normally an area inaccessible to the public. Thousands of shorebirds were present, far too many to identify or count precisely, many more than I had ever seen in one place before (in rather less than three years of birding experience.)

The following spring the Canadian Wildlife Service and Manomet Bird Observatory in Manomet, Massachusetts, with financial support from the U.S. Fish and Wildlife Service, announced the need for volunteers to participate in the International Shorebird Surveys (ISS), a cooperative plan for censusing shorebirds in southbound migration from eastern Canada to South America. Participants were choose their own areas and, to the extent possible, conduct at least one census in each third of every month from July

to October. The purpose of the surveys was to establish the migration route and schedule for each species and to identify the major shorebird concentration points along the way, providing data on which to make decisions about areas most in need of protection from threats to the environment.

From an entirely personal perspective, the multiple benefits of volunteering to cover Chincoteague for the survey were instantly apparent: I would have the opportunity and excuse to make frequent visits to the refuge (which was the best shorebird area I had ever seen), to improve my skills in identifying a difficult group of birds of special interest to me, to gain extensive experience in estimating large numbers of birds, and to do some purposeful and useful birding that would make a small but recognizable contribution to ornithological knowledge.

From the beginning the managers of the refuge, first J.C. Appel and then Dennis Holland, gave me total access to the refuge, and all members of the staff provided every possible assistance making the rather formidable task of covering the area easier. In return, I submitted the results of each survey for the refuge records.

The first two years of the survey were largely periods of learning and exploration. I attempted to find where, aside from the impoundments, the shorebirds might be, and to work out routes and a schedule that would allow me to cover the area efficiently. Since 1974 was possibly the best year in the history of the survey in terms of the extent and duration of good shorebird habitat and the numbers of birds using it, it presented an overwhelming challenge to my skills of identification and estimation, and I no longer trust the accuracy of the totals reported in that year. 1975 was one of the wettest years of the survey and one in which only six censuses

were taken. In neither year was the North Beach surveyed. The totals for these years have been omitted from the data analysis, although the rarities sighted in 1974 have been included. (There were none in 1975.)

Scheduling was a serious problem in the early days. Chincoteague is a drive of 3.5-4 hours from my home in Washington, D.C. For the first two years it seemed important for some reason to try to complete the survey in 24 hours. Initially the walk on the Hook down to Fishing Point from the last parking lot was about five miles long and took about three hours; the Washflats, not yet divided into two impoundments, required a loop hike or about the same length from the north end. In 1974 and 1975 I drove down from Washington one morning, set out for Fishing Point at noon, and spent the late afternoon censusing the lower impoundments (Snow Goose Pool, Black Duck Marsh, and Swan Cove) as well as the off-refuge flats along the causeway to the mainland. The next morning I surveyed the Bayside Flats and the Washflats. The mid-day walk down the Hook on hot summer days proved to be exhausting, and since 1976 the surveys have begun at dawn with the hike around the Hook after a night spent in Chincoteague, and the afternoons have been spent in more leisurely censusing from the car, including the Bayside Flats and the west side of the Washflats. On the second morning the east side of the Washflats and the North Beach are surveyed in a circuit hike. The extra time built in to the schedule has enabled me to expand the survey to include all waterbirds other than waterfowl, to study plumages and molts, and to do some photography.

The problem of satisfying the requirement for one count in each third of the month took longer. A two-day trip is more easily fitted into a weekly or bi-weekly schedule than into one at ten-day intervals, which do not match

the real world's calendar rhythms. In the early years the gaps between surveys were very erratic, between six and seventeen days, and did not average three a month until 1978. The changes in shorebird populations in the longer intervals were always so substantial that it became clear that closer spacing of my visits was much more desirable. In 1981 I resigned myself to a weekly survey and made a point of trying to find a reliable substitute whenever I could not conduct it myself. (This effort has excluded the last two weeks of June, when so few shorebirds are around that it seems unfair to ask anyone to help, as well as Pony Penning Week the last week in July, when the area is flooded by tourists, and accommodations are expensive and hard to come by.)

No spring surveys were taken until 1978, when five were done experimentally: two in April, two in May, and one in June. In 1980 the coordinators of the ISS asked all cooperators to extend their survey schedule to include April 1-June 10. Other commitments, however, required that I drop my own participation in the surveys completely for all of 1979 and for 1980 up to mid-July. Since then all surveys have included the spring migration period set by the ISS, with occasional surveys in late March and in the last two-thirds of June as well. (The irregularity and infrequency of the March surveys and of several taken on various dates in November have precluded the drawing of any confident conclusion about these periods, and the data from them have been excluded from this report other than in the species accounts where appropriate.)

Defining the census areas was as much a problem as figuring out how to fit them into the time available. All the areas accessible by car--the lower impoundments, the western Washflats, the head of Tom's Cove, the Bayside Flats, and the off-refuge areas--were determined by the location of

shorebird habitat that could be observed from the road. None of the counts in the 1970s, however, allowed the precision of peep identification in Snow Goose Pool and Swan Cove that was possible in the drought years of the 1980s, when the outer edges of these impoundments dried up and the centers could be reached on foot.

In 1974 the Washflats had so much good habitat from east to west and north to south that the only way to count all the birds was to zigzag down from the north on one side and back up on the other. In 1975 it was flooded all summer, and in subsequent years, except sometimes in May, the zone used by shorebirds has been narrow enough that it has usually been possible to survey it in one direction and return to the starting point via the North Beach. The construction in 1980 of a crossdike two thirds the way down the impoundment made access to the east side and to the beach much easier. Much of the Washflats can now be surveyed by car in a dry season, especially on the south side of the dike; often all the birds utilizing the South Washflats can be identified from the road.

The route on the Hook has changed over the years. After nearly birdless walks down the Tom's Cove Beach in the first two years, I substituted a walk through the central marsh, which had extensive flats and rainpools, especially in July, in the 1970s. Vegetation has largely filled in this area in the 1980s. At the same time the width of the adjacent ocean beach has nearly doubled since the survey began, and good habitat provided by tidal pools and rain pools has attracted numbers of shorebirds not seen earlier on the beach. After the importance of the Tom's Cove Beach for shorebirds in spring became clear in June 1981, an attempt was made for the next year to reach Fishing Point by that course and to wander back and forth between the

ocean beach and the marsh on the return journey. When part of the road halfway down the Hook was washed out by a storm in late October 1982, reaching Fishing Point by even the most direct route turned into an eight-mile hike, and the census of the central marsh was abandoned in favor of a survey of the periphery of the Hook.

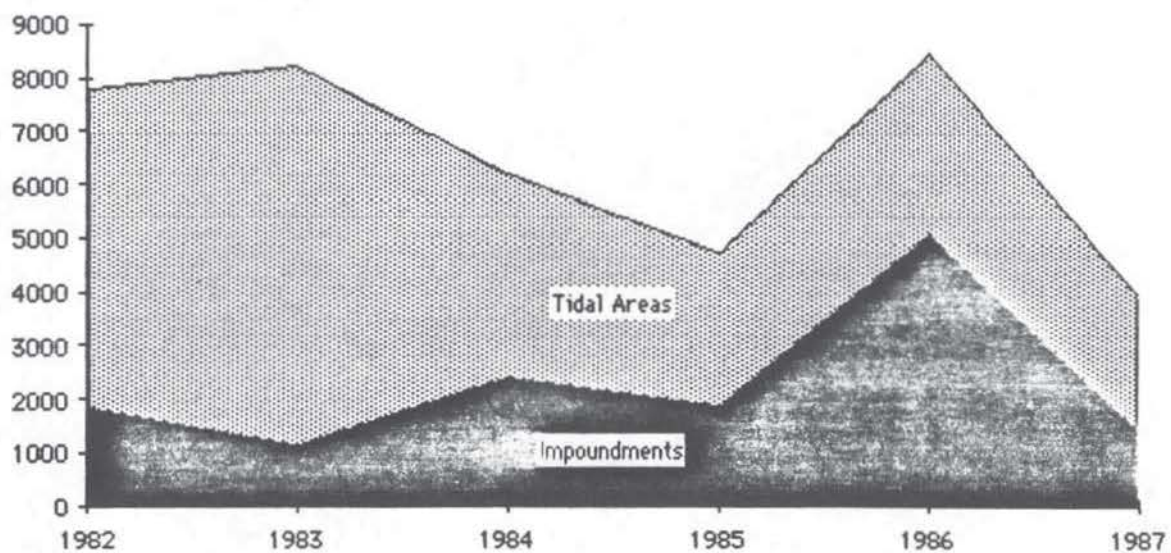
Record-keeping evolved as well, but regrettably slowly. The ISS asked for an annual summary of the habitats surveyed and the percentage of each in the whole survey area, and, for each census, the status of tides and the hours in which the survey was conducted. From 1974 to 1978 this information and the total count for each species were the only records kept.

When the survey was resumed in 1980 I devised a weekly summary sheet, with a column for each census area and a row for each species, including room for very brief notes for such items as races represented or arrival of juveniles. It provided space at the bottom for notes on weather conditions, tides, and water levels in each impoundment, as well as any other factor that might affect numbers in a census area (disturbance by raptors, for example). Unfortunately the first version of the form pooled all the birds seen on the Hook. The second version, put into use at the start of the surveys in 1982, broke the Hook numbers into four components: Tom's Cove, Fishing Point, Hook Beach, and Hook Marsh. The last area, however, was rarely censused after 1982.

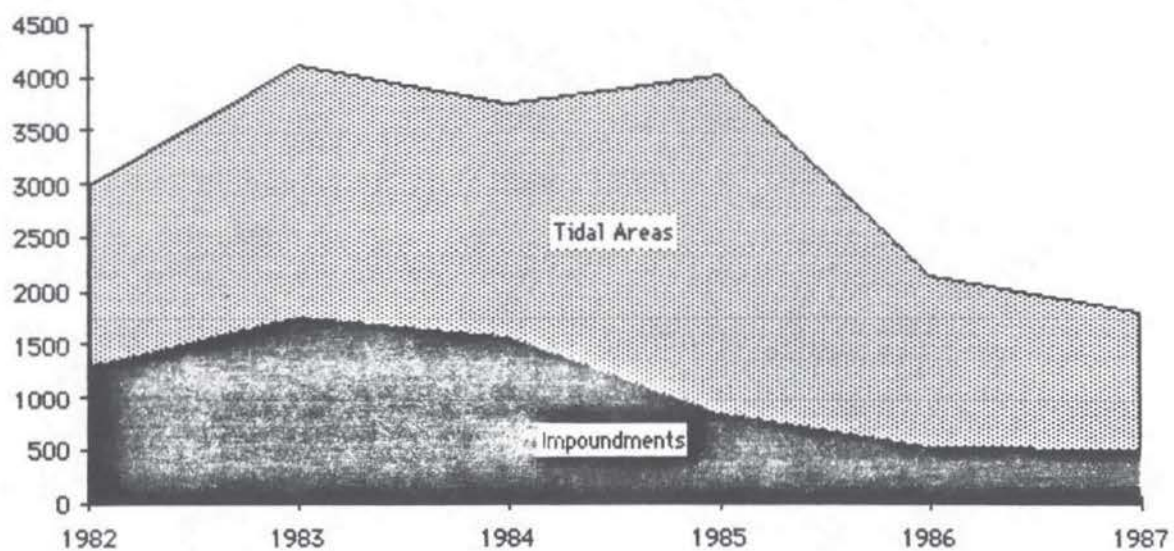
Because of the growing refinement of the records, analysis of the census areas in this report includes information on the five impoundments from 1980 (from mid-July on) to 1987, but comparative data for all eleven census areas only from 1982 to 1987.

A few counts have been curtailed because of bad weather. On several dates it was impossible to survey the Hook and/or the North Beach, and on a few the Washflats could only be surveyed from the car. In addition, of the 19 (out of 275) surveys done by substitute observers two in 1982 omitted the Hook, and two, in 1974 and 1976, included areas not regularly a part of the survey. Totals in the latter group have been dropped from the analysis, but partial surveys have been included in the species data. On the table of survey totals (page 000), a count that excluded most or all of the Hook areas is indicated by a box enclosing the total.

DISTRIBUTION OF SHOREBIRDS: Spring Migration



DISTRIBUTION OF SHOREBIRDS: Fall Migration



CENSUS AREAS

Of the eleven census areas covered in the survey, five are freshwater impoundments; two are ocean beaches, one of which is subject to regular disturbance by vehicles; one is an island tip combining open beach, dunes, sandflats and mudflats, and some saltmarsh; one is a sheltered beach with some mudflats and saltmarsh; and two are a mixture of tidal mudflats, oyster beds, and saltmarsh.

The impoundments are entirely dependent on rainfall for fresh water; in extreme drought three of them can be replenished to a small degree by letting in salt water during the highest tides, but this remedy modifies the vegetation, reducing the food available to waterfowl, and has not been used in recent years. When water levels are very high, the two Washflats can be drained, and Swan Cove can be partially drained. The constant menace of drought breeds a natural reluctance to choose this course, however, at least in Swan Cove, where islands used by nesting geese and ducks need the protection from foxes and raccoons that the water provides. Thus, relatively little management for shorebirds is possible in these areas.

Impoundments

1. North Washflats. Largest of the five impoundments in the survey, this census area contains 800 acres. The potential shorebird habitat is about 2.3 miles long and .4-.7 mile wide, though the actual extent available is limited by the area covered by water and the area baked dry. It is bordered on the east by a strip .2-.3 mile wide of vegetation that has grown rapidly in the past twelve years, a mixture dominated by wax myrtle, seaside goldenrod, saltmeadow grass, and American beach grass. This strip is backed by the dunes that separate the impoundment from the North Beach. West of the strip is an expanse .1-.2 mile wide of bare sand, broken by scattered, low,

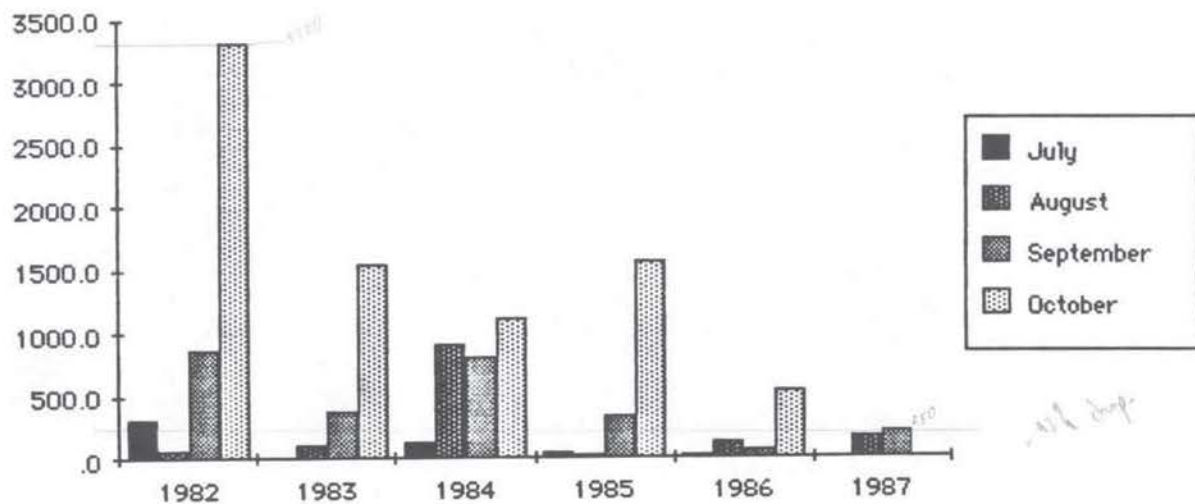
lightly vegetated ridges and used as a nesting area by Piping Plovers. Next to this area the surface slopes gently westward to the deep ditch adjacent to the dike topped by the service road. This is normally the area covered by water in a wet period; the water is typically less than 6" deep except in the ditch, where it may be as much as 4' deep or more. Migrant shorebirds tend to cluster close to the water's edge and spread across the damper parts of the adjacent flats. As the water evaporates or drains, the Dwarf Spikerush *Eliocharis parvula*, which covers most of the impoundment between the sand and the ditch, is gradually exposed, leaving minor areas of bare ground.

North Washflats is normally the impoundment most heavily used by shorebirds from May to mid-June and in October. In the wetter years it used to be the main concentration point in July and early August as well, but it has been utilized very little in summer since 1983. Beginning in that year, the water level has been lowered (when necessary) in April to improve the nesting opportunities of Piping Plovers, and early summer rainfall since then has been negligible. As a result, only 6 % of July birds and 18 % of August birds utilizing the impoundments have been found here.

In a period so wet that all the spikerush is under water and some of the sandflats as well, very few birds use the impoundment. The longer-billed and longer-legged species, such as godwits, yellowlegs, dowitchers, oystercatchers, and whimbrel may drop in briefly, especially at high tide, but even likely-looking areas are usually deserted.

When the impoundment is appropriately wet (that is, with 20% or more of the spikerush area free of standing water), though not normally before May, it is heavily used as a feeding area by all species but Black-bellied Plover, American Oystercatcher, Whimbrel, Red Knot, and Sanderling,

**North Washflats:
Weekly Averages**



which use it primarily as a resting area during high tides and periods of strong onshore winds. Birds feeding on the Washflats usually do not move in numbers to the Bayside Flats as the tide falls, though resting birds do. Total numbers on the Bayside Flats tend to be lower when conditions on the Washflats are unsatisfactory.

In periods of moderate drought, when broad expanses of spikerush are exposed but the ground is still damp, the impoundment draws "grasspipers" in some numbers, mainly in September: most abundantly Pectoral and Least Sandpipers as well as the ubiquitous Semipalmated Plover, but also smaller numbers of Lesser Golden-Plover and Buff-Breasted Sandpiper (up to several dozen), and occasionally a Baird's Sandpiper or two.

2. South Washflats. Half as large as North Washflats (400 acres), this impoundment was divided from the one above it in 1980, when the crossdike was built in the hope of having the lower pool serve as a reservoir for the upper one in times of drought. In the event, this impoundment has never retained water well, and the chief improvement for the shorebirds has been a ditch on either side of the new dike, providing a little habitat in times of severe drought.

Roughly oblong in shape but narrowing sharply at the south end, the impoundment is backed on the east by a broad area of wax myrtle scrub. The sand flats adjacent to the scrub comprise about half the impoundment; the remainder to the west is covered with Dwarf Spikerush, which is denser and taller in all seasons than the vegetation in the North Washflats. Three-square Scirpus spp. has spread throughout the spikerush in the mid 1980s. A stand of pine scrub and wax myrtle thickets along the west side of the impoundment separate it from the service road for half its length.

Species using the impoundment in spring are approximately the same as those in the North Washflats. In summer and fall there tend to be very few birds except immediately after a rain. Most are peep and Spotted Sandpipers along the ditch edges, grasspipers in the vegetated areas if the plants are not too thick or too tall, and yellowlegs and dowitchers if there is plenty of standing water. All the species that feed on the Bayside Flats may come into to rest at high tide, usually gathering around the water control structure near the south end. The shorebirds are often crowded out of this spot by gulls in September and October, and none may be present in the impoundment in this period.

3. Snow Goose Pool, a roughly egg-shaped 450-acre impoundment with its narrow tip at the northeast end, is bordered on the west by freshwater marsh, stands of pine, and wax myrtle scrub, on the southwest and southeast by a dike supporting the wildlife drive, and on the east by pine woods. The northern 20% is separated from the rest of the impoundment by a crossdike. This upper section is an area of open flats, broken up by islands of wax myrtle and stands of pine, and divided from the crossdike by a ditch. Except for one small island of trees and bushes the main pool consists of open flats, draining toward ditches along the southern dike and toward a shallow channel that curves down from the crossdike to the water control structure in the south corner. A few tall stands of *Phragmites* grow along a ridge parallel to the southeast dike, 0-100 yards northwest of the adjacent ditch.

In all but drought years or extremely wet ones Snow Goose Pool is covered by water until July or early August. It typically dries from the edges toward the center, but the unevenness of the surface allows for

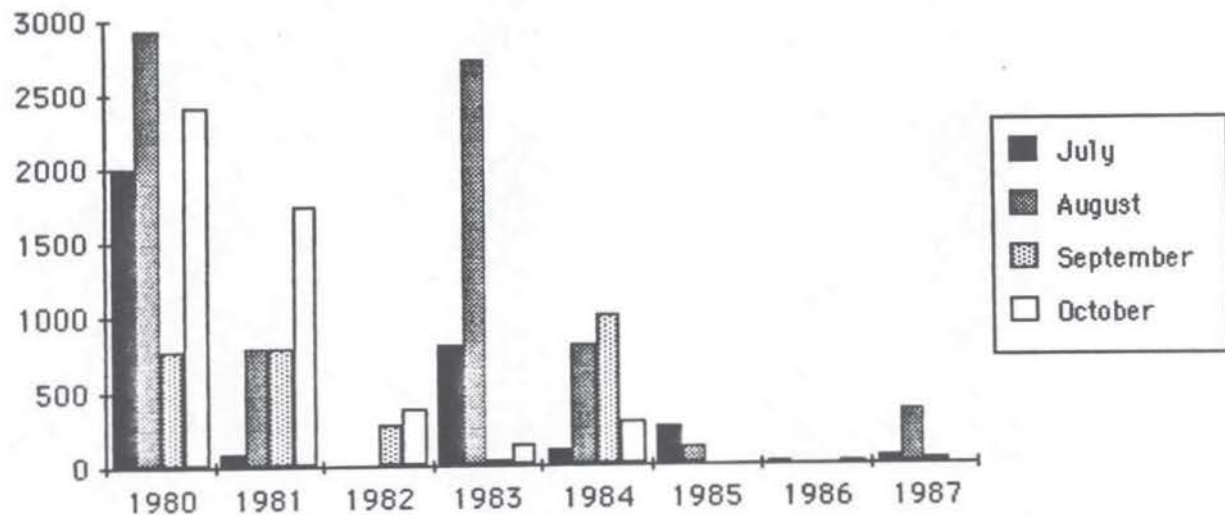
several shallow pools to remain wet for nearly as long as the central channel. The last areas to dry up completely in a drought are the roadside ditches, providing habitat for a few dozen birds, mostly peep and yellow-legs, for a month after most birds have abandoned the flats for wetter areas.

Until 1983 the flats in Snow Goose Pool were mostly bare mud, though covered in some areas by Dwarf Spikerush, which grew in thick tufts only close to the central channel, especially near the south end. In 1984 lines of Woolgrass Bulrush (*Scirpus cyperinus*) began to crisscross the main pool, and the northern flats were taken over by Three-square, which has since spread widely across the main pool as well, filling in the deeper areas of the marsh to the west and the ditch and flats east of the reeds to the southeast. With this spread of vegetation the impoundment dries up in a drought much more rapidly than in earlier years, often supporting large numbers of shorebirds for only two or three weeks instead of five or six. Even peak counts have dropped, except when they occur in spring, as in 1986, before there is much vegetative growth.

Every species that uses the impoundments for feeding has occurred in Snow Goose Pool, often in its maximum abundance. The gentle undulation of its surface has allowed grasspipers to feed on green flats while Western Sandpipers feed in the shallows and dowitchers and godwits explore the deeper water. Birds that feed only on the tidal flats and beaches (American Oystercatcher, Red Knot, Sanderling) almost never have found their way here, however.

4. Black Duck Marsh. Smallest (130 acres) and least important of the five impoundments in the survey, this census area supports, on average, less

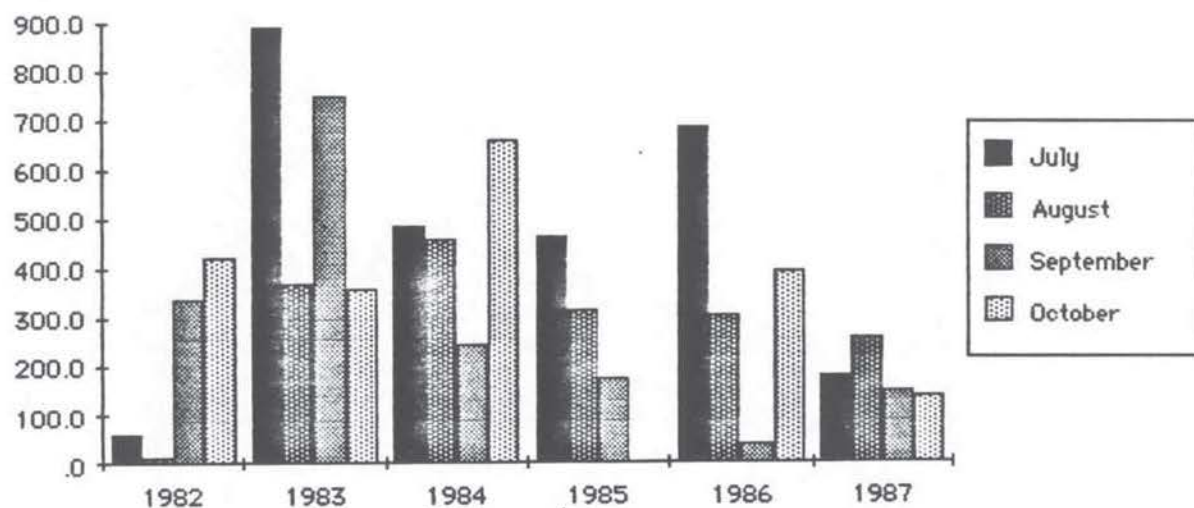
**SNOW GOOSE POOL:
Weekly Averages**



than 1% of the shorebirds at Chincoteague. It is bordered on the east by the Wildlife Drive and on the west by a ditch that separates it from the road to the beach. Pine woods form the south side, and stands of pine cover three islands in the center of the pool. To the north it is separated from a bicycle trail linking the wildlife drive and the beach road by extensive stands of Phragmites, pines, and a ditch. In an average spring the water in it is usually too deep for shorebirds. As the water level drops, 25-30% of the pool, on the north side, is revealed as a shallowly covered mudflat. As long as there is some standing water (normally for no more than three weeks at a time if there is no rain), shorebirds are attracted: at first, yellowlegs and dowitchers and Stilt Sandpipers, then Semipalmated Plovers and peep. The last area to dry up is the ditch at the northeast corner, where the wildlife drive meets the bicycle trail. When the flats and ditches are dry, all shorebirds leave, and the bare area is gradually covered by Dwarf Spikerush. This plant and Three-square dominate the rest of the impoundment; both were much sparser in the 1970s, but in the 1980s the vegetation has been so thick that the south side of the pool has little habitat for shorebirds except in a dry spring, when the plants are short and thinly spaced.

5. Swan Cove. This 475-acre impoundment is unique in that about a third of it is so deep that it never dries up. Even after the longest periods of drought Double-Crested Cormorants *Phalacrocorax auritus* can swim completely submerged in the central pool. Extensive mudflats, broken by small islands of wax myrtle and by fingers of deep water, are slowly exposed in the course of a dry season, and the impoundment offers some shorebird habitat at all times except in really wet periods. Most species that use the impoundments for feeding are found here, though dowitchers, Lesser

**SWAN COVE:
Weekly Averages**



Yellowlegs, and Stilt Sandpipers move out when the mud is baked dry, and the numbers of other species drop sharply. Its relative importance has increased as that of Snow Goose Pool has declined, especially from July to September, but, in absolute numbers, shorebirds are decreasing here, too.

Tidal Areas

1. North Beach. This census area along the open ocean and adjacent to the Washflats runs from Kilometer 6 to Kilometer 10 (north from Kilometer 0 at beach parking lot #1). The broadest stretch of beach, broken by free-standing dunes, is from KM6 to KM7. Piping Plovers and sometimes a pair of American Oystercatchers nest in this area, and migrant species may gather at high tide to rest around a long temporary lagoon, occasionally filled by storm tides or heavy rains, that lies close to the main dune line. From KM7 to KM10 the beach is much narrower. Little used by shorebirds in spring, the entire North Beach may be lined from mid-July on with flocks of Sanderlings, Whimbrel, Willets, sometimes Red Knots, and smaller numbers of Black-bellied, Piping, and Semipalmated Plovers, Ruddy Turnstones, and all the peep. High totals are closely correlated with the slope of the intertidal zone (the flatter the better), the lack of an easterly wind, and the timing of the survey (best near low tide). This beach is normally undisturbed except for a daily refuge patrol vehicle and an occasional long-distance hiker, but from late September to late October it is frequently traversed by the fast-moving vehicles of the Peregrine banders.

2. Bayside Flats. Between the Washflats and Assateague Channel lie a narrow strip of marsh and, farther north, a broad tidal mud flat about .6 mile long, both of which can be observed from the service road that runs up the west side of the impoundments. The marsh serves as a high-tide resting area for shorebirds that feed at low tide on the oysterbeds out in the

channel (which are also included in the census area), especially for American Oystercatchers, Ruddy Turnstones, Short-billed Dowitchers, and Willets, though it too can be flooded on the highest tides. The mud flat is most heavily used as a feeding area when the Washflats provide good habitat as well, for both feeding and resting. Major users are Semipalmated and Black-bellied Plovers, Dunlin, Semipalmated and Western Sandpipers, and, in smaller numbers, Short-billed Dowitchers and Greater Yellowlegs. The tide on the Bayside Flats is high about two hours later than on the ocean beach, and Sanderlings and Red Knots often cross over to rest and escape the high surf.

3. Hook Beach. For purposes of this survey, this area is defined as the ocean beach, from the southernmost parking lot accessible to 2-wheel-drive cars (at present lot #4) southwest to a point about a half-mile above Chinco-teague inlet, opposite a mast rising from a sunken boat offshore. The northern leg of this L-shaped beach has eroded and moved rapidly westward in the 1980's, destroying a mile of dune and paved road. This change has extended the length of the census area from the original 2 miles to 3.5 miles. The first mile is heavily disturbed by pedestrians from mid-May to mid-September, and its utilization during that period by shorebirds is mostly limited to the first hour or two after dawn. Below that stretch, down to the inlet, the beach is open to off-road vehicles (no more than 42 of them at a time), but disturbance is only moderate except on weekends. Where the beach curves west it widens rapidly, becoming as much as a quarter-mile wide at low tide, when a mixture of lagoons and flats provides excellent habitat for beach-feeding species. The inner third of this part of the beach has been fenced off in the mid-1980s to protect nesting Piping Plovers, and

the protected part has become a valuable resting area at high tide for migrants, now that it no longer serves as a highway for vehicles. Below the bend the last half-mile of the census area is much narrower and the slope at the water's edge steep except at low tide.

4. Fishing Point. The last half-mile or so of the Hook, below the offshore sunken boat on the ocean side and a convergence of two tidal guts on the Tom's Cove side, is defined in this report as Fishing Point. It has expanded rapidly westward, nearly doubling in size since the survey began. A large tidal lagoon, protected on both sides by dunes, has shifted with it; the eastern part of the lagoon has developed into a marsh curving around a permanent pool. The tip of the point has evolved into an broad area of incipient dunes among flats that are flooded only at the highest tides, which turns them into temporary pools that may last for a week or more. Tern and skimmer nesting colonies have come and gone despite efforts at protection. Whereas the tidal flats used to attract large numbers of birds at all tides, they have filled in to some extent and have declined in the 1980s as a feeding area; they now serve mainly as a rest area during high tides. Sanderlings and smaller numbers of other beach species feed at the surf's edge. Disturbance by vehicles in recent years has been limited to the ocean and inlet beach; the fence preventing short-cuts through the dunes and across the flats has appreciably improved the nesting success of Piping Plovers, American Oystercatchers, and Willets. Wilson's Plovers have not bred at the point since 1983, however.

5. Tom's Cove extends from Fishing Point up to the main road to the beach. Only the head of the cove and the narrow beach on the east side of the cove, along the Hook, are included in the survey. Few shorebirds (less than 5

percent of the census totals) frequent the beach most of the year. In late May and early June, however, Horseshoe Crabs *Limulus polyphemus* come up onto the beach in large numbers at high tide to lay their eggs, attracting hundreds, sometimes thousands of Ruddy Turnstones, Sanderlings, Red Knots, and Semipalmated Sandpipers and smaller numbers of many other species. In this period shorebird numbers are usually highest from high tide to mid-tide; only Ruddy Turnstones tend to feed here intensively at other hours.

All spring the mud flats bordering the marshes at the head of the cove (named Little Tom's Cove on some maps) are utilized as a feeding area by Dunlin, Short-billed Dowitchers, Black-bellied Plovers, American Oystercatchers, and other species. As soon as the water temperature becomes pleasant for wading, however, birds are replaced by clam-diggers, and very few shorebirds are seen on the flats from June to October.

6. Off-refuge Areas. Several locations west of the refuge are censused (on a single pass) as time and tides permit, and an aggregate total is recorded. Two are most fruitful for shorebirds at high tide, two at mid-tide, and two at low tide.

The flats and oysterbeds on the south side of the bridge over Assateague Channel attract American Oystercatchers, Short-billed Dowitchers, and Dunlin in spring at low tide.

At high tide the salt pannes on the west side of the marsh adjacent to the channel are used both for resting and feeding by the same species as well as Semipalmated and Black-bellied Plovers, yellowlegs and peep. (All these species are the ones that are regularly found in the other off-refuge areas as well.)

Along Route 175 between Chincoteague Island and the mainland, the flats next to the only paved pulloff on the north side are exposed only at low tide. The presence of shorebirds here is unpredictable.

Across the road and .1-.3 mile to the east a long irregular pool in the marsh is an important resting area at high tide, especially in spring and in October for Black-bellied Plover, Dunlin, and Short-billed Dowitchers.

Just east of the bridge over Queen Sound a large tidal flat of major importance to shorebirds stretches away on the north side of the road. At low tide it is so large that small birds at the far end cannot be identified from the road; it is checked whenever possible at mid-tide.

Immediately west of Queen Sound a spur road south of the highway lies adjacent to oysterbeds particularly attractive to Oystercatchers at mid-tide, but used by other species as well, particularly when the mud between them is exposed.

PATTERNS AND TRENDS

Three factors appear to determine the variety and the overall number of shorebirds at Chincoteague on any one survey: the date, the extent and depth of water and of vegetation in the impoundments, and the weather during and immediately preceding the census. Because local conditions are so unpredictable and so controlling, it would be unwise to extrapolate from the data collected at this single site to conclusions about fluctuations or trends in the size of total populations of individual species. Still, both the stability and the changes in some patterns at Chincoteague are conspicuous.

CONTOURS OF ABUNDANCE AND DIVERSITY

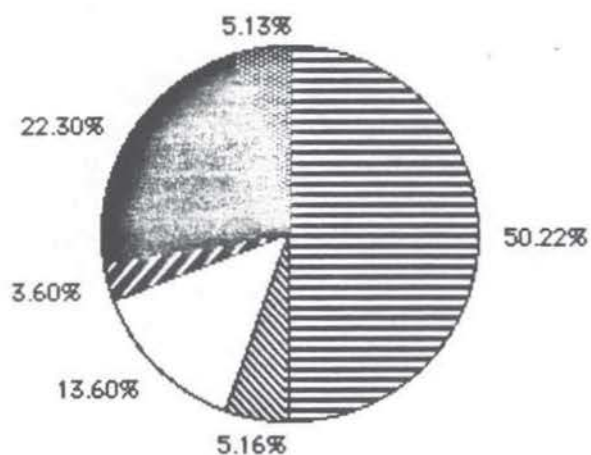
Spring migration begins for Piping Plovers in March, before the start of the survey, but there is normally little sign of migration before mid-April except for the locally breeding Willets and the first Whimbrel and Short-billed Dowitchers, which may all appear at the beginning of the month. From 1000 to 4000 birds may be present at any time in April, but the great majority of them are Dunlin (50%) and Sanderlings (22%), with their numbers fluctuating so much that they are likely to be winter residents rather than transients.

The arrival of migrants accelerates rapidly in May, and from 6000 to 26000 (typically 14000-15000) birds, 46% of them Semipalmated Sandpipers, are present from the second week in May through the first week in June. Numbers then drop quickly, and all but 200-300 birds--the resident nesters and a few sub-adult transients, not likely to reach the breeding grounds--have normally left by June 20.

Although the period of very high totals varies from year to year, usually lasting about three weeks out of the month, the diversity increases quickly

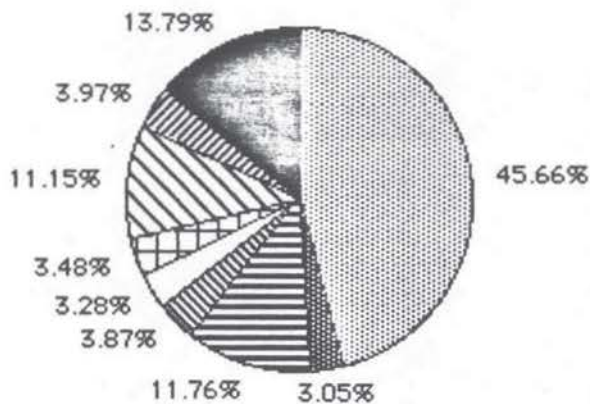
COMMON SPECIES
Early Spring (April 7-May 6)

Average weekly total = 2187



COMMON SPECIES
Late Spring (May 7-June 6)

Average weekly total = 12549



- Semipalmated Plover
- Ruddy Turnstone
- Red Knot
- Sanderling
- Semipalmated Sandpiper
- Least Sandpiper
- Dunlin
- Short-billed Dowitcher
- All Others

from 12 or 13 species at the end of April to a peak of 19 to 23 May 13-18, declining to 16 or 17 by June 1 and to 10 or 11 by June 20. Normally 25 to 29 species have been recorded by the end of June, but several species are often represented by only one or two individuals.

Fall migration begins quite promptly about July 1, but Short-billed Dowitchers are the only common transients at first, soon joined by fair numbers of Greater and Lesser Yellowlegs and Least and Semipalmated Sandpipers, and a handful of others. Numbers increase at a variable rate, but 3000-7000 birds are usually present from July 20 to September 20. More than two-fifths of them are Sanderlings.

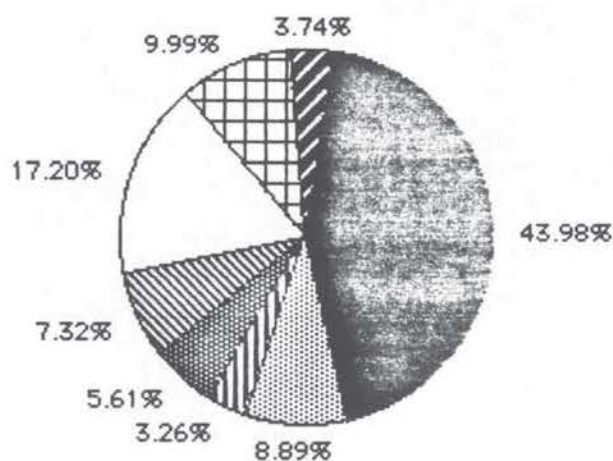
Virtually all birds in July, except for species nesting in the region, are adults, though a few pioneer juveniles (Lesser Yellowlegs, Least Sandpipers, and Short-billed Dowitchers) sometimes arrive in the last week of the month, becoming common in the next week or two. The young of most other species are not common until the last third of August; by the last third of September they are usually the only shorebirds around, except for White-rumped Sandpipers and those species that winter in Virginia.

With the departure of most adults, total numbers decline steadily in September, sometimes to fewer than 1000 birds by the end of the month. This trend is reversed as the Dunlin arrive for the winter. In the last half of October 5000-6000 birds on average are present, mostly Dunlin (57%) and Sanderlings (19%), though many other transient species linger on until at least the end of the year.

Diversity is always greater in fall migration than in spring: Hudsonian Godwits and Buff-breasted Sandpipers occur only from July on, while Marbled Godwit, Pectoral, Western, and Baird's Sandpipers and Long-billed

COMMON SPECIES
Summer (July 13-August 31)

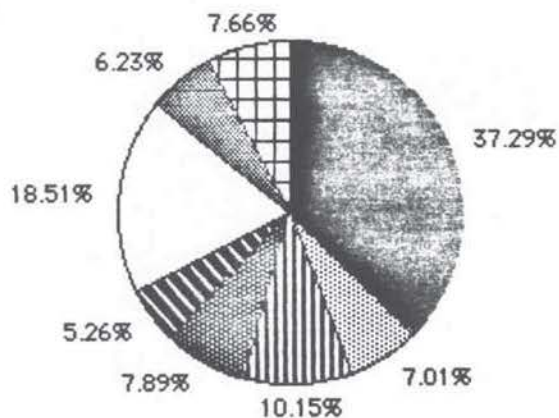
Average weekly total = 3967



-  Semipalmated Plover
-  Red Knot
-  Sanderling
-  Semipalmated Sandpiper
-  Western Sandpiper
-  Least Sandpiper
-  Short-billed Dowitcher
-  All Others

COMMON SPECIES
September

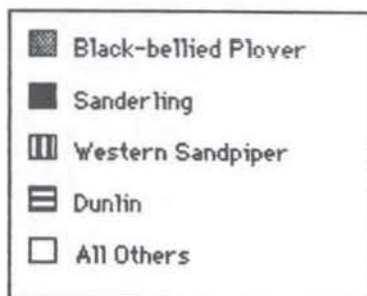
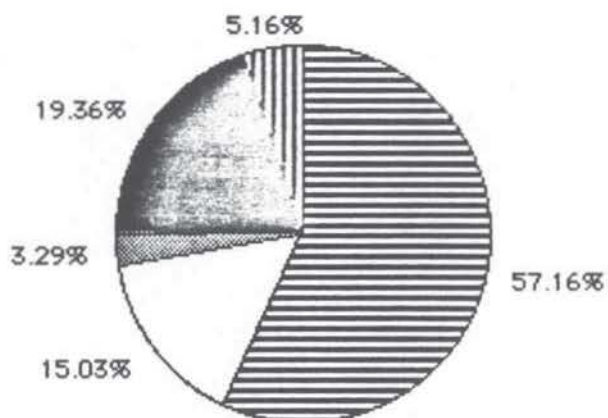
Average weekly Total = 2675



- Black-bellied Plover
- Semipalmated Plover
- Sanderling
- Semipalmated Sandpiper
- Western Sandpiper
- Least Sandpiper
- Pectoral Sandpiper
- All Others

COMMON SPECIES
October

Average weekly total = 3886



Dowitchers, all rare to accidental in spring, are regular fall migrants. The single peak count of the migration, from 23 to 31 species, has occurred as early as August 7 and as late as October 12, though the last three weeks of August tend to reflect the greatest variety, averaging more than 23 species each week. The decline through September and October is slight and very gradual; at the end of the survey period 16 to 20 species are normally still present.

HABITAT REQUIREMENTS

All shorebirds that regularly use the refuge in migration require extensive open space with water not too deep for comfortable standing and wading; fairly level, well-packed areas of mud or sand; and vegetation not too tall to see over and not too dense to walk between. Within these limits, the number of individuals and species using the refuge at any one time correlates closely with the extent of the preferred habitat of each. In the years 1980-1986 (beginning in mid-July 1980 and ending with August 1986) 45% of the shorebirds in spring migration, 44% in July and August, and 50% in September and October were found in the impoundments. If Sanderlings are excluded, these percentages rise to 53%, 69%, and 68% respectively.

In spring, these percentages are affected chiefly by the abundance of Horseshoe Crabs laying eggs in Tom's Cove, which can greatly increase the number of birds feeding there, and by the availability of good habitat in the Washflats impoundments. In summer and fall, the percentages depend very much on the extent and diversity of appropriate feeding habitats in three of the five impoundments surveyed: Swan Cove, Snow Goose Pool, and North Washflats.

Water 3-8cm deep. Species with bills and tarsi more than 35mm long require this condition for more than very brief stops. Regular migrants in this category include American Avocet, Hudsonian and Marbled Godwits, Greater and Lesser Yellowlegs, Short-billed and Long-billed Dowitcher, and Stilt Sandpiper. Rarities include Black-necked Stilt and Ruff and the two pelagic species, Red-necked and Red Phalaropes.

It would seem that this depth of water is almost always available in Swan Cove; in fact, however, these species leave the impoundment (except for an occasional straggler) in conditions of extreme drought or of water too high for any flats to be exposed.

Though these species, except for the godwits, use the Washflats in spring, very few of them (yellowlegs and godwits, mostly) return there in fall after the flats have dried up completely, even when water levels look appropriate.

Water less than 3cm deep and water's edge. This habitat is used by the greatest number of species: Semipalmated Plover, Semipalmated, Western, White-rumped, Solitary, and Spotted Sandpiper, Dunlin, and Wilson's Phalarope, as well as, rarely, Curlew Sandpiper.

Damp mudflats and sandflats, with or without short, sparse vegetation primarily attract Semipalmated, Piping, and Black-bellied Plover, Least Sandpiper, and Ruddy Turnstone.

Damp mudflats with short, sparse vegetation are required by Lesser Golden-Plover, Killdeer, Pectoral, Baird's, and Buff-breasted Sandpiper, and one-time visitors: Mountain Plover and Sharp-tailed Sandpiper.

Species that normally do all their feeding in tidal areas use all the feeding habitats (as size permits) in the impoundments as rest areas when

Species that normally do all their feeding in tidal areas use all the feeding habitats (as size permits) in the impoundments as rest areas when tides are high or strong winds eliminate their normal roosts. These species include American Oystercatcher, Whimbrel, Willet, Red Knot, and Sanderling.

The converse, however, is not true: species that normally do all or a substantial fraction of their feeding in the impoundments do not often increase their numbers in the tidal areas when their normal habitat is lacking; in most cases they simply do not use the Refuge as much or at all.

Factors reducing shorebird numbers. A review of the records for fall migration shows several periods with impoundment numbers sharply below average: summer (July-August) 1982 with 512 birds per count, summer 1986 with 648 birds per count, and summer 1987 with 618 birds per count vs. an average 1661 for 1980-1986; fall (September-October) 1985 with 1026 birds per count, fall 1986 with 591 birds per count, and fall 1987 with 303 birds per count vs. an average 2026 for 1980-1986. One or more of three factors account for all these far-below-normal figures.

1. High water. This condition eliminates all habitat. From early August to mid-September 1982 and from mid-August to mid-September 1985 and 1986 water was very high in all impoundments.

2. Extended and acute drought. This condition obtained in July and half of August 1986 and all of the summer and fall of 1987. In most years of the survey droughts have first dried up South Washflats, then North Washflats, then Black Duck Marsh, then Snow Goose Pool, and finally most of Swan Cove, at a rate that usually provides at least three of the four habitats in several areas. It is not until water has disappeared from all areas but central Swan Cove and the roadside ditches that numbers have dropped

3. Vegetation. While high water and dry flats are temporary conditions, the most serious menace to Chincoteague's status as a major stop for shorebirds has been the rapid increase in tall, coarse, dense vegetation, particularly in Snow Goose Pool, which in all but the wettest summers up to 1984 supported 56% of the birds in the impoundments. In autumn it sustained 33%. The vegetation began to be a problem in 1984 and has spread throughout the impoundment. In summer 1985-1987 only 23% of all impoundment birds were in Snow Goose Pool. In fall 1985-1987 the percentage dropped to less than 1%.

In the years when Snow Goose Pool was the most valuable area for shorebirds in fall migration the entire impoundment had the potential for utilization as it dried up over a period of several weeks, with all four habitats often available at once over most of the 450 acres. These conditions have not^{been} obtained for the past three years. If the open flats that once characterized the impoundment cannot be restored, the refuge is likely to lose much of its value to southbound shorebirds.

The situation is less serious but more long-term in South Washflats, which supports 24% of impoundment birds in spring, but only 7% in summer and 5% in fall, mostly in the ditches and along the edges of the grass-filled flats, where some open mudflats remain on the east side.

Black Duck Marsh has not been an important area for shorebirds since the 1970s because of the vegetation that has expanded to make more than two-thirds of the pool unusable, except before mid-May in a dry year.

Both South Washflats and Black Duck Marsh when dry absorb rain so quickly that 2 inches or more are required for standing water to remain for more than a day afterward.

As of 1987 neither Swan Cove nor North Washflats are seriously threatened by the spread of vegetation, but both have lost some areas in the 1980s that were formerly utilized by shorebirds in the 1970s.

CHANGES IN TIDAL AREAS

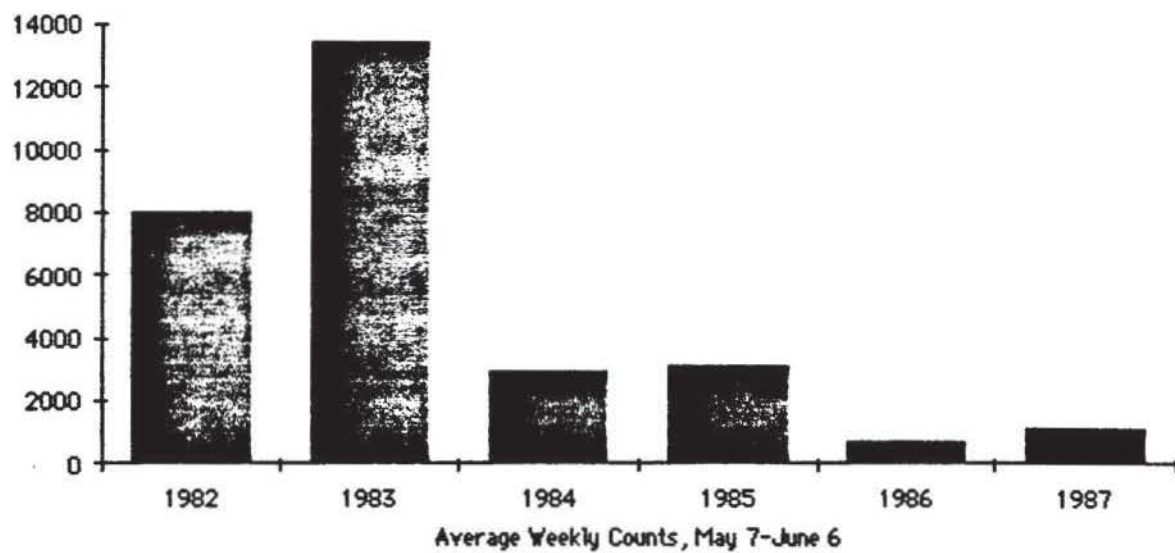
The numbers of shorebirds using the tidal areas have generally been much more stable; the norm is fluctuation rather than consistent change.

Tom's Cove Beach is the only tidal area that has declined in its share of the refuge shorebirds. Because it is utilized by so few birds in fall migration, it was eliminated from the census route after the first two years of the survey and ignored in the spring surveys of 1978 and 1981. In response to the advice of others who were aware of its importance, weekly surveys were started in 1982. The beach was as unpopulated as ever in April, but Horseshoe Crabs began to come in for egg-laying the second week of May and were soon present by the thousands from then to mid-June. Simultaneously shorebird numbers for that period soared to a weekly average of 8000 birds, mostly Ruddy Turnstones, Sanderlings, Semipalmated Sandpipers, Red Knot, and Dunlin.

Spring averages were even higher the following year--nearly 13500 a week--though this increase may have been due in part to an extension of the area covered. A late October storm in 1982 washed out part of the road down the Hook and required a 1.5-mile extension of the walk between the southernmost accessible parking lot and Fishing Point, most of it lined in spring with crabs and shorebirds.

Though the road and dunes were rebuilt in August 1983, a second storm washed them out again in late September. Since then the area has been left

SPRING TOTALS IN TOM'S COVE



alone, and subsequent washovers of sand into Tom's Cove have recurred annually. In addition, the Hook itself has grown, extending Fishing Point by at least a quarter-mile into Chincoteague Inlet.

Simultaneously, but perhaps coincidentally, the number of Horseshoe Crabs coming ashore in the cove have conspicuously declined, especially in the second and third week of May. The impact of this reduced food supply on shorebird numbers has been dramatic: weekly averages in 1984 and 1985 fell to 3000 birds and in 1986 to 700. The rise in 1987 to an average 1100 per census seems too small to warrant optimism about a comeback. The species whose overall numbers in the spring surveys have been most reduced by this change are Ruddy Turnstone, Sanderling, and, especially, Red Knot.

The ocean beaches -- North Beach, Hook Beach, and the beach area of Fishing Point--vary in the number of birds using them principally in relation to the steepness of their contours and the extent of the flats at low tide. A steep slope in the intertidal zone can virtually eliminate utilization by feeding birds, and in most cases birds that find the feeding area unfruitful avoid the site altogether rather than choosing to rest beyond the waves at high tide. With Sanderling the overwhelmingly dominant beach bird, totals swell conspicuously when the surf rolls gently in over extensive shallows and drop sharply when the beach changes shape.

The forces of beach dynamics are too complex to allow even short-term prediction about the availability of shorebird habitat. Still, extra-high tides and heavy rains are required to fill and sustain pools and lagoons behind the normal high-tide line, and the presence of these sheltered waters attract several species, such as Black-bellied and Semipalmated Plovers, Greater Yellowlegs, Dunlin, Short-billed Dowitcher, and peep, that are less enthusiastic about the turbulence of the ocean edge. A dry and tranquil

season minimizes the availability of this habitat.

The North Beach varies sharply in width, height, and steepness from year to year, but a long-term trend is not clear.

On the Hook, however, three areas are changing rapidly. The narrow neck at the north end is eroding continuously and shifting west with each storm that causes a washover. The flatness of the shoreline that follows a washover evolves to a steep slope that invites day-to-day scouring before the next shift west. The beach below the washover seems to be moving south, narrowing the area between water and dunes, and building up the elbow where the shoreline bends northwest. The beach at and beyond the curve has been expanding annually and is now very broad and flat, full of tidal lagoons and, close to the duneline, of potential rainpool flats. Farther west the beach narrows and steepens abruptly before flattening and expanding again at Fishing Point, where the beach and dune area has doubled in the years of the survey.

Overall, the extent of good shorebird habitats on the Hook does not seem to have changed a great deal; it is the location and distribution of these areas that evolve as the beaches move.

WEATHER PATTERNS

Since the survey began in 1974 the single greatest influence on shorebird numbers on the refuge has been the pattern of rainfall and drought. The weather patterns of the last six years of the 1970s are so different from those of the first eight years of the 1980s that the predictability of good habitat during the migration periods is still far lower than a fourteen-year study might lead one to expect.

Throughout this period the water-level gauges in the refuge impoundments have been in such poor condition and placed so unsatisfactorily for the purposes of this survey that actual depth in any location has necessarily been estimated from the leg length of birds using the site.

Official records of rainfall and storms have been equally unusable. Until very recently the reports used by the refuge were from data collected at the NOAA station on the mainland west of the Chincoteague marshes. A remarkably high percentage of the showers and heavy rains that wet the mainland do not cross the marshes, and many that do are lighter and briefer on the islands. In addition, the length of the refuge--10 miles (in a straight line) from the top of the Washflats to Fishing Point--ensures that rain that falls in one part of the area often misses another.

The summary that follows is based primarily on notes taken on the survey, supplemented (1974-1979 only) by the weather analyses found in the seasonal reports for the region in American Birds. It includes spring weather only for the seven years in which spring censuses were taken.

It should be noted that the central 25-30% of Swan Cove is a deep-water area that never dries out even in the most acute drought. The description, "all impoundments dry", excludes this area.

1974 Early June rains, which filled the impoundments, were followed by a near-drought, resulting in excellent habitat in the Washflats by late July. Rains in August and September were frequent but light, and the impoundments dried up slowly. They were all dry in October and stayed that way until the end of the month.

- 1975 Heavy rainfall in the first half of July kept the impoundments mostly full through a dry August. Rainfall in September was again very heavy, and the impoundments remained full through a normal October.
- 1976 A drought completely dried the Washflats and produced good habitat in the lower impoundments in the first half of the summer. It was ended by a hurricane on August 9, which dumped 7 inches of rain on the refuge, eliminating all impoundment flats. Rainfall was normal in early fall, and only the Washflats had good shorebird habitat in October.
- 1977 A drought from July to early October dried up all the impoundments by August, and water levels were replenished only by mid-October rains.
- 1978 Spring rains were below normal, and water levels were quite low at the end of May. Above-normal rainfall in June and early July filled the impoundments, which gradually dried out again in the drought of August-October. Habitat in the Washflats was good by late July and in the lower impoundments by mid-August.
- 1979 (A year when the survey was not conducted.) Above-normal rainfall was recorded all summer and fall.
- 1980 Even the lower impoundments were nearly dry by mid-July, but light rain in late July and mid-August mitigated a summer-long drought,

which was not really broken until heavy rain on October 17.

1981 Good water levels in the first half of May were raised by rain in late May and June. Levels dropped through a dry summer, producing good conditions from July on, with enough rain at the end of August to provide excellent habitat through the fall, which was punctuated by light rains.

1982 May levels were slightly above those of 1981; frequent heavy rains in June, July, and August minimized impoundment habitat. A drier September and October led to some habitat after the equinox in all impoundments and excellent conditions in the Washflats.

1983 A drought beginning in May lasted until September, with all impoundments dry by mid-August. Rains in mid-September and in October resulted in extensive shorebird habitat for the rest of the period.

1984 A moderately wet spring was followed by a drought diminished by occasional light rains in July and August. All impoundments were excellent in August, but dry in September and October, except for some rain in the North Washflats late in the period.

1985 A moderately dry spring was interrupted by a storm with heavy rain on May 23. Acute drought in the summer was broken by light rain on August 8 and very heavy rain on August 18, which filled the impoundments. Good habitat had returned to the Washflats by late

September, was eliminated by a hurricane on September 26, and was not again available until mid-October.

1986 Drought beginning in late winter resulted in excellent habitat in all impoundments by May, but continued until late August, with all impoundments dry from June on and thickly vegetated by July. Heavy rain at the end of August combined with the vegetation to minimize habitat until the end of October.

1987 A normally wet spring was followed by a severe drought beginning in early July and continuing into October, relieved very temporarily by only a few light rains from late August on.

Conditions, then, were much more variable in the 1970s, with two very wet years (1975 and 1979), one year of drought (1977), one of drought ended by an August hurricane (1986), and two of gradual drying, eased by regular light rains (1974 and 1978).

In the 1980s there has been only one very wet year (1982), one year of gradual drying (1981) and six drought years of variable length and severity (1980, 1983-1987), five of them consecutive.

Ideal years, from the perspective of shorebird migration, are all too few. A typical spring consists of a moderately rainy April and a moderately dry May, producing plenty of good habitat in the Washflats and some flats in Swan Cove. Those conditions are probably the most satisfactory one should hope for. The drought in the spring of 1986, which began in March, led to spectacular numbers in all impoundments in May; but its continuation

through the summer was catastrophic: only Swan Cove had damp flats, and thick vegetation spread through the other impoundments.

A wet June, though unwelcome to nesting species, if followed by a very dry July and a late summer and fall punctuated by frequent light rains, would produce the nearly perfect conditions for fall migration that were almost achieved in 1974, which was flawed only by its late drought.

Unfortunately the norm seems to be tending toward a moderately dry spring and a very dry summer, perhaps terminated by heavy rains in early fall, perhaps continuing as an acute autumn drought. Such a weather pattern is likely to make the profile of shorebird migration recorded in this report a matter of historical interest only.

SPECIES ACCOUNTS

Terms of abundance and frequency of occurrence within the periods specified for each species should be interpreted as follows:

Abundant. More than 500 birds encountered on almost every survey.

Common. 50-500 birds encountered on almost every survey.

Fairly common. 20-49 birds encountered on more than half the surveys.

Uncommon. Fewer than 20 birds encountered on more than half the surveys; usually present.

Rare. Recorded no more than 2-3 times a season (i.e., spring migration, April to June, and fall migration, July to October) and in very small numbers; not necessarily recorded every year.

Casual. Few records; not recorded every year or even most years, but a general pattern of occurrence is suggested.

Irregular. Presence varies from year to year, usually depending on the availability of suitable habitat. May be absent altogether or fit any category from 'rare' to 'common'.

Black-bellied Plover *Pluvialis squatarola*. Present on and around refuge all year, with principal migration periods April 25-May 31 and August 10-November 10. Uncommon in June and July, common the rest of the year (as reflected in Christmas Bird Count records and random winter censuses, as well as in this survey). The first juveniles arrive the last week of August to the second week of September (earliest date August 27). Although this species uses all census areas, the main areas for feeding and resting are Fishing Point, Bayside Flats, and off-refuge flats and marshes. When these

areas are covered, birds often move to the impoundments when water levels permit, usually to Swan Cove and North Washflats.

Lesser Golden-Plover *Pluvialis dominica*. Uncommon to fairly common but irregular fall migrant; most likely to be present September 1-October 20 (both adults and juveniles). Usually found on the refuge in drought periods when there are extensive grassy flats in the impoundments, especially the Washflats, Snow Goose Pool, and Swan Cove. Occasionally seen on beaches and tidal flats. One record each in April, May, and June; counts of 1 to 9 birds recorded about one year in three in July, August, late October, November.

Wilson's Plover *Charadrius wilsonia*. One to two pairs bred in the survey area, in the Hook Marshes and at Fishing Point, up to 1983, close to tidal flats in dry sand with sparse vegetation. Increasingly rare and irregular, found only at Fishing Point on 2 June surveys in 1985, 3 August surveys in 1984, and on one August survey in 1986; one on South Washflats in May 1987. (Other observers reported one May sighting and one August sighting in 1985 and one May sighting in 1986, all at Fishing Point.) Earliest spring survey record April 19, 1981, latest fall survey record September 10, 1981; most sightings May 10-September 5. Peak count 19 on July 27, 1980.

Semipalmated Plover *Charadrius semipalmatus*. Abundant spring and fall migrant. Spring migration April 25-June 12; fall migration July 13-November 12, with very small numbers recorded between these two periods and in late fall and early winter. First juveniles arrive the third or fourth week of August (earliest on August 16). Found in all census areas, especially on damp flats with little or no vegetation.

Piping Plover *Charadrius melodus*. Uncommon to fairly common breeder and migrant March 21-September 24. Because of the presence of breeding birds and their young, migration dates are difficult to determine. Spring migration begins before surveys start in late March (20 were recorded on March 13, 1982, on one of only two surveys conducted before March 21). Downy young are seen throughout June (with the earliest recorded May 24); juveniles are found from June 24 on. Small groups (up to 24 birds) are occasionally found up to mid-October; and a straggler or two may be recorded in November. Recorded in all census areas, but found regularly only at Fishing Point, on the ocean beaches, and on the driest, least vegetated parts of the Washflats.

Killdeer *Charadrius vociferus*. Irregular breeder and visitant, predictably present in small numbers (2-20) only October 17-24, on impoundment grass flats. Recorded almost annually from March to June, but usually only once or twice. Present (1-17 on any one survey) one year in three on most surveys from July to mid-October and erratically (up to 22) in late October and early November.

Mountain Plover *Charadrius montanus*. One record: a juvenile, October 16-17, 1976, on dry grass flats in North Washflats.

American Oystercatcher *Haematopus palliatus*. Fairly common to common resident. There is no particular pattern to survey numbers, though totals tend to be lower April-July. Routinely present on tidal flats at Fishing Point, in Tom's Cove, on Bayside Flats, and in off-refuge oysterbeds, flats, and marshes; frequently seen along the ocean beaches, especially close to the dune line; and occasionally found in Swan Cove and on the Washflats, resting at high tide. Several pairs (usually fewer than ten) nest

regularly on the refuge at Fishing Point and occasionally on the beaches and the Washflats.

Black-necked Stilt *Himantopus mexicanus*. Casual visitant from May to early September, most frequently recorded from mid-May to mid-June, in open marshy ponds at the northwest end of Swan Cove and along the causeway to the mainland.

American Avocet *Recurvirostra americana*. Rare visitant in April (1-4 birds present all month in 1985, 1986, and 1987) and July to mid-August; uncommon to fairly common mid-August to mid-November. Likely to be found in the west half of Swan Cove; also on the Bayside Flats and in Snow Goose Pool and the Washflats when water levels are adequate for wading. Flocks apparently spend several weeks in the area but may retreat for long intervals to Walker Marsh in Chincoteague Bay.

Greater Yellowlegs *Tringa melanoleuca*. Uncommon to fairly common spring migrant, uncommon to common fall migrant; non-breeders present on most surveys in June. Juveniles are usually first recorded the first week in September. Numbers fluctuate according to water levels in the impoundments; usually only single birds are seen in the tidal areas. Numbers are lowest in a wet spring and a dry summer or fall, when appropriate habitat for wading is minimal.

Lesser Yellowlegs *Tringa flavipes*. Rare to uncommon spring migrant in April and May, most likely to be present April 24-May 12. A very few records the first and last weeks of June. Fairly common to abundant July to mid-November. Juveniles are usually first recorded the second week of August (earliest date July 27). Found in all impoundments, especially Snow Goose Pool and Swan Cove, when water levels are appropriate for wading;

rarely seen in tidal areas.

Solitary Sandpiper *Tringa solitaria*. Rare in both spring and fall.

Regularly present only the first week in May, but recorded in all months except June from mid-April to mid-October, almost always along the edges of ponds and roadside ditches.

Willet *Cataporphorus semipalmatus*. Common breeder and fairly common fall migrant. Migrants impossible to separate from local nesters in spring; first birds arrive at the beginning of April and numbers stabilize the third week in April. Totals increase with the appearance of juveniles at the beginning of July (earliest date June 24), the irregular influx of migrants of the nominate (eastern) subspecies the second week of July, and the arrival of individuals of the larger, paler western subspecies *inornatus* the third or fourth week of July. After a sharp drop in numbers at the end of the month, most Willets seen from August on are eastern juveniles and western birds. Almost all have left the refuge by mid-October. Most common on the beaches, marshes, and tidal flats, and along the borrow ditches of the impoundments.

Spotted Sandpiper *Actitis macularia*. Uncommon to fairly common migrant April 25-June 6, June 30-September 16. One earlier record (April 15, 1978), three in mid- to late June, and a few sightings the first week in October. Juveniles begin to arrive in the last third of July. Most sightings along the borrow ditches of the impoundments and on Tom's Cove Beach; a few are seen on the ocean beaches.

Upland Sandpiper *Bartramia longicauda*. A casual summer visitant with five survey records: one on August 13, 1977; one on September 14, 1978; seven on July 25, 1980; four on August 7, 1980; and one on August 21, 1980

(the last two sightings possibly of birds seen in July). All sightings were on the east side of the Washflats, in thick, fairly tall grass (often higher than the bird), always in periods of drought. (In addition, one bird was seen outside the survey area, on a lawn on Chincoteague village on April 24, 1985.)

Whimbrel *Numenius phaeopus*. Common spring migrant and fairly common fall migrant. The first birds arrive between April 1 and 14; abundance increases abruptly in the third week of April and declines abruptly the last week of May, with stragglers occasionally present in June. Southbound migrants begin to arrive the first week of July and are most common the second half of the month. Numbers decline steadily in August and September; October sightings are rare. Regularly found on ocean beaches and at Fishing Point, occasionally in salt marshes and on oysterbeds, and, rarely, in impoundments (usually during high tides and easterly winds).

Hudsonian Godwit *Limosa haemastica*. Uncommon fall migrant. The first birds normally arrive in early July, and small numbers are regularly present through September 6, irregularly until late October. Three November records of single birds. Usually seen in Swan Cove and occasionally in Snow Goose Pool and the Washflats, always when water levels permit wading.

Marbled Godwit *Limosa fedoa*. Casual spring and summer visitant (April-July); rare to uncommon fall migrant (August-October). Found occasionally on the ocean beaches but most frequently observed on tidal flats and in impoundments when water levels permit wading.

Ruddy Turnstone *Arenaria interpres*. In spring migration uncommon in March and April, common to abundant in May and early June. Non-breeders uncommon and irregular from mid-June to mid-July. In fall migration uncommon to common late July to September; uncommon in October and

November. May be present in all census areas throughout the survey period, but very large numbers are often found in late spring on Tom's Cove Beach, coinciding with egg-laying by Horseshoe Crabs *Limulus polyphemus*.

Red Knot *Calidris canutus*. Uncommon to abundant spring and fall migrant, with numbers fluctuating sharply not just from year to year or week to week but from morning to afternoon of the same day. In spring, rare in April, but often abundant May 15-June 15, with almost all birds found on Tom's Cove Beach feeding on Horseshoe Crab eggs. Fall migrants are usually rare before July 19. Most adults move through from late July to early September. Juveniles begin to arrive the last week in August and are irregularly common until mid-November. In fall, occasionally present in small numbers in the impoundments, but most often seen at Fishing Point, on the ocean beaches, and sometimes on tidal flats. The largest numbers are usually seen on North Washflats when the impoundment is neither very dry nor very wet, when tides are especially high, and when there are strong easterly winds. Smaller numbers are seen on the ocean beaches, on tidal flats, and at Fishing Point.

Sanderling *Calidris alba*. Common to abundant spring and fall migrant; uncommon and irregular between migrations (June 19-July 8). From May 10 to June 15 almost all birds are on Tom's Cove Beach, feeding on Horseshoe Crab eggs. For the rest of the survey period most birds are at Fishing Point and on the ocean beaches, with small numbers on the tidal flats and, at high tides, in the impoundments. Juveniles begin to arrive the last week in August (earliest date August 20) and are as common as adults after mid-September; the juveniles in particular make intensive use of North Washflats as a resting area during high tides and easterly winds.

Semipalmated Sandpiper *Calidris pusilla*. Abundant spring migrant; common to abundant fall migrant. The first northbound birds arrive the last week in April; several thousand are present from the second week in May to about June 12, but only small numbers (usually fewer than 10) are found between then and the main southbound migration that begins the second half of July. The first juveniles usually arrive in the last ten days of August (earliest date August 13). Adults are rarely present after September 10, but juveniles continue to arrive until at least mid-October. No birds of this species have been recorded on any survey after the first week of November. In spring Semipalmated Sandpipers are concentrated on Tom's Cove Beach, eating Horseshoe Crab eggs, and on North Washflats. In fall they are encountered in all census areas, but the great majority utilize the impoundments, both mud flats and the shallowest areas of standing water. Numbers of fall migrants drop sharply in periods of severe drought or of high water. (Exact counts of this species are often impossible to obtain when mixed flocks of Semipalmated and Western Sandpipers are concentrated in distant and inaccessible parts of the three southern impoundments.)

Western Sandpiper *Calidris mauri*. Rare in spring, fairly common to common in fall. One April record: 12 birds in basic plumage on the causeway tidal flats on April 17, 1986. All other spring sightings, usually of one or two birds, have been made from mid-May to mid-June, usually at Fishing Point. Fall migrants begin to arrive the second week in July; peak counts of adults (in July and August) vary from fewer than 100 to more than 500, almost all on the tidal flats. The first juveniles typically arrive the last ten days of August (earliest date August 20); they are common through October

on both impoundment flats and tidal flats, usually on wet flats and in very shallow water. Westerns have been present on all November counts, often in substantial numbers (up to 251). Throughout fall migration, distant, unidentifiable flocks of small sandpipers are presumed to be a mixture of Semipalmated and Western Sandpipers, but are recorded only as 'peep'.

Least Sandpiper *Calidris minutilla*. Fairly common to abundant spring and fall migrant. One March survey record: 2 on March 27, 1981. Uncommon and irregular before the last week of April. Peak May counts normally occur in the first half of the month; almost all birds depart by the 25th, and June sightings are rare. The first adults return the first week in July; juveniles appear the first week in August, and both age-groups are present for the rest of the month, with few adults seen after early September. Though numbers decrease in October, a few are often present up to late November. Birds of this species utilize the tidal flats and sometimes the beaches but prefer the bare and sparsely vegetated mud flats of the impoundments, generally avoiding standing water. In dry periods they feed on the mats of algae that form on the surface of the borrow ditches.

White-rumped Sandpiper *Calidris fuscicollis*. Uncommon to fairly common spring and fall migrant. The first birds normally arrive the first week in May and the last depart by mid-June. Sightings are rare through July and uncommon and irregular until mid-September, when the first juveniles arrive. Small numbers of adults and juveniles are usually present through October and sometimes to mid-November. Most likely to be found in the impoundments, usually in standing water or close to the water's edge. Sometimes seen on Tom's Cove Beach and at Fishing Point, more rarely on the ocean beaches and the other tidal flats.

Baird's Sandpiper *Calidris bairdii*. One spring survey record: April 19, 1985 on South Washflats. Rare fall migrant from the second week of August to the third week of October, found most regularly September 13-24. Peak counts: 4 birds, September 24, 1978 and September 23, 1983. Usually recorded in the impoundments on sparsely vegetated mud flats, especially on North Washflats, but occasionally found on the ocean beaches in the intertidal zone.

Pectoral Sandpiper *Calidris melanotos*. Rare in spring: all records between April 1 and May 12, most frequently the last week in April. Uncommon to common July to early October; increasingly uncommon and irregular from then to mid-November. Abundance is closely correlated with the availability of short-grass flats (preferably not totally dry), which are usually scarce before August and sometimes extensive in September and October, especially in Swan Cove, Snow Goose Pool, and North Washflats. Juveniles arrive about September 7 and their numbers are typically much higher for the next month than the counts of adults in July and August.

Sharp-tailed Sandpiper *Calidris acuminata*. One record: a juvenile, present with Pectoral Sandpipers in Snow Goose Pool, September 16-21, 1984, a period of severe drought.

Dunlin *Calidris alpina*. Abundant migrant and winter visitant from October to May 25. The last spring migrants have departed by June 6, and summer visitants are rare. The first fall migrants normally arrive in small numbers, adults and juveniles together, any time between September 1 and 17. Dunlins use all census areas and are sometimes common on ocean beaches and grass flats, but they are most common on wet mud flats and in shallow water in the impoundments and on tidal flats. In May large numbers feed on

the Horseshoe Crab eggs on Tom's Cove Beach.

Curlew Sandpiper *Calidris ferruginea*. Recorded every spring since 1981 on or near Fishing Point for all or part of the period of May 15-June 1 (presumably the same bird, since the plumage each year is identical and the locations nearly so). Casual summer visitant, with 4 records, all of adults: July 22, 1982 (Tom's Cove Beach); July 30, 1974 (Washflats); August 12-23, 1984 (Swan Cove and Snow Goose Pool); and August 18-25, 1978 (Black Duck Marsh). One fall record: a juvenile, October 2, 1974.

Stilt Sandpiper *Calidris himantopus*. Rare to uncommon spring migrant April 17-June 3, most likely to be present May 7-24. Peak count: 24 on April 17, 1986. Uncommon to abundant fall migrant July 9-September, becoming increasingly rare and irregular in October. First juveniles recorded August 20. One November record: November 10, 1978. Requires appropriate water levels in impoundments (up to belly level); leaves refuge altogether when impoundments are too wet or too dry.

Buff-breasted Sandpiper *Tryngites subruficollis*. Rare (in wet years) to fairly common (in drought years) fall migrant August 1-October 19, most consistently present and in the largest numbers September 1-24. Heavily dependent on extensive dry flats sparsely covered with short vegetation. Peak count (by R. A. Rowlett): 340 in Snow Goose Pool on September 14, 1980, a date when the impoundment was entirely dry. Utilizes all the impoundments, but most likely to be found on the Washflats.

Ruff *Philomachus pugnax*. Casual visitant, with three spring survey records: April 28, 1981 (South Washflats), May 20-21, 1982 (Swan Cove), May 21, 1987 (North Washflats); 13 other records from July 9 to September 16, always in shallow open water and grassy rainpools of the five

impoundments.

Dowitchers *Limnodromus* species. Survey reports before 1981 either did not differentiate between the two species or are likely to have contained numerous identification errors. Only dowitcher counts from 1981 to 1986 are analyzed here. Even since 1981, the majority of distant and unapproachable dowitchers, especially adults in molt or in basic plumage, have been identifiable only to the genus level. This identification problem is most acute from mid-August through September, after which most dowitchers seen are juveniles (or are in single-species flocks containing juveniles) and thus are identifiable to the end of the survey period.

Short-billed Dowitcher *Limnodromus* *griseus*. Common to abundant spring migrant; uncommon to abundant fall migrant. Two subspecies, nominate *griseus* and *hendersoni*, migrate through the refuge, and most adults in alternate plumage can be distinguished by race from May to July. The first flocks arrive the first week of April; *hendersoni* predominates (60-80%) in the first half of May, the nominate race by the same percentage in the second half of May through the first week of June. Birds in basic plumage or incomplete alternate plumage (i.e., non-breeders) are sometimes present in mid to late June. Almost all southbound migrants, virtually all in full alternate plumage, in the first half of July are *hendersoni*; the two races are usually fairly evenly balanced for the next four weeks, by which time almost all adults have nearly completed their molt into basic plumage and are identifiable only to the species level, even when seen well. Juveniles (not identifiable in the field by race) begin to arrive the first week of August, largely replace the adults in September, and are usually present, though increasingly uncommon, through October. Short-bills utilize

the impoundments for feeding as readily as they do the tidal flats, provided that water levels are adequate (up to belly level). In fall migration especially, appropriate conditions in the impoundments are required if large flocks are to linger on the refuge; smaller numbers are often present on the tidal flats and, in spring, on Tom's Cove Beach.

Long-billed Dowitcher *Limnodromus scolopaceus*. Casual spring visitant; rare to common fall migrant, with presence on refuge limited by the availability of appropriate water levels in the impoundments. Two certain spring survey records: 25 in Swan Cove on April 17, 1986 (13 of which lingered to April 24), in a season with exceptionally low water levels; and one on Bayside Flats on April 26, 1985. Three other sightings in April and May are now regarded as only probable. In fall migration, the first adults arrive between July 21 and August 7; most depart or become unidentifiable by the end of August. Juveniles have been recorded no earlier than September 20 and may be present, often mixed with adults, through the end of the survey period.

Common Snipe *Gallinago gallinago*. In spring, recorded only in 1986 and (once) 1987, April 2-May 19; most sightings were of single birds, but a flock of 10 was present on April 10. In fall, one to four sightings almost annually from August 17 to November 15, usually of 1-3 birds, always in ditches and grassy ponds and impoundment edges.

American Woodcock *Scolopax minor*. Although this species breeds on the refuge, perhaps regularly, and appears to be a year-round resident, it has appeared only once in any of the census areas. On October 29, 1976, one flew straight in from the ocean to land on a well-vegetated sandy mound in North Washflats.

Wilson's Phalarope *Phalaropus tricolor*. Casual visitant, with 30 records, usually of 1-4 birds, scattered through every month from May 13 to October 24. Peak count: 30 on August 23, 1977. Almost always found in the impoundments in shallow water or close to the water's edge, much less often in rain pools and salt pannes along the causeway to the mainland.

Red-necked Phalarope *Phalaropus lobatus*. Casual visitant, with 8 records May 9-July 9 and 4 records July 19-September 24. Most frequently seen in shallow water on the west side of Swan Cove and in North Wash-flats, but also recorded on the tidal flats at Fishing Point and in a tidal pool on the Hook Beach.

Red Phalarope *Phalaropus fulicaria*. Two survey records, both of females in alternate plumage: one on May 16-18, 1986, in shallow water on the west side of Swan Cove; and one on July 7, 1974, walking on the beach at Fishing Point between off-road vehicles.

FINDING SHOREBIRDS AT CHINCOTEAGUE

An effective search for shorebirds at Chincoteague requires knowledge of the current tide schedule and impoundment water levels and an understanding of the impact of wind and sun-position.

Immediately upon your arrival in Chincoteague make a quick television check of cable channel 9, which will reveal (within 5 or 10 minutes) the tide table for the month and the present wind velocity and direction, as well as other useful information like temperature, barometric pressure, and times of sunrise and sunset.

A drive out the main road through the refuge to the beach will provide the basic information you need about water levels. If you arrive after 3 p.m., a swing around the 3-mile wildlife drive will allow you to enjoy it immediately if conditions are good or to decide whether it is worth a return visit. (The rest of the day the drive is open only to walkers and bicyclists.)

I. The Southern Impoundments. In the happy and unlikely event that all three of the southern impoundments have good habitat, there are three elements to consider: sun-position, tide, and wind. The populations are always higher and more varied in these areas when the tidal flats are covered; they are highest when a strong easterly wind drives the beach birds behind the dunes or when a westerly one covers the flats in the channels and bays even near low tide.

Black Duck Marsh can be studied from the main road on its western edge and from the wildlife drive to the east. Because of the pine islands in the impoundment, the only way to see all the flats is to use both roads. To keep the sun behind you, take the wildlife drive in the morning and the main road in the afternoon.

Snow Goose Pool must normally be viewed from the wildlife drive or the

two observation platforms on the marsh trail. Going counterclockwise around the drive (as one must when one is in a car), the first leg, between Snow Goose Pool and Black Duck Marsh, looks east into Snow Goose Pool; thus the birds are backlit in the morning. On the stretch between the junction with the bicycle trail to the main road and the edge of the pine woods, the drive lies south of the impoundment and the viewing is good all day. The east observation platform (at the end of a boardwalk through the woods) has good morning light but is too distant from the impoundment to be good for studying small birds, even with a spotting scope. The crossdike at the far end, beyond the woods, is good for the main pool (on the left or southwest) only in the morning and for the northeast pool only in the afternoon. Access to the northwest side of the impoundment is available only from the west observation platform and the marsh trail that parallels the last half-mile of the drive. Views to the right (south) are poor all day; to the left they are good, especially in the afternoon. When the impoundment is nearly dry, you can walk out into it from the crossdike or the marsh trail and thus get much closer to the shorebirds. In any case, to see all parts of Snow Goose Pool in good light it is necessary to take the wildlife drive twice, once in the morning and once in the afternoon.

Swan Cove has three sets of flats when conditions are good: the eastern flats, north and east of the tollbooth on the main road; the central flats, directly north of the hunter's blind in Tom's Cove; and the western flats, south of the wildlife drive and southeast of the bicycle trail that links it to the main road.

The eastern flats are best explored in the morning by driving to parking lot #1 (north of the traffic circle at the end of the main road) and walking

up the bicycle trail in the northwest corner of the lot. This trail connects with the wildlife drive, passing the northeast corner of Swan Cove and then several small marshy ponds. The views west into Swan Cove are excellent. To get closer to the birds you see to your left, walk out onto the flats and work your way around to the southwest. You can return to the parking lot by a footbridge in the southeast corner of the impoundment. (It is also possible to survey parts of this area in the afternoon from the shoulder of the main road near the tollbooth.)

The central flats are in good light all day from the north shoulder of the main road, from which distant views of the northwest quarter of Swan Cove are also possible.

Just northwest of the entrance to the Pony Trail one can park on the shoulder or in a sandy strip between the road and a parallel bicycle trail and look east (in afternoon light) into the southwest corner of Swan Cove.

Birds on the western flats are often close to the wildlife drive, but the light from there is generally unsatisfactory, especially in the afternoon. As the impoundment dries up, the birds are farther and farther away, and morning light is crucial. When the flats are dry enough to walk on, however, it is best to visit them in the afternoon, walking east from the north end of the bicycle trail between Swan Cove and Black Duck Marsh, then south, then gradually working one's way north along the water's edge.

II. The Hook. This long 8-mile hike can be very worthwhile, if one is prepared for hot sun, wet feet, stretches of soft sand, thirst, and sometimes mosquitoes. There is no perfect time of day to do it, but beating the heat (and the crowds) in the summer should probably be a top priority, and a dawn start is recommended when temperatures in the 80s or above are

forecast. If you plan to take a circuit hike, down the Tom's Cove side and back by the ocean beach, or vice versa, take note that the narrow neck that extends to the old Coast Guard buildings in Tom's Cove and to the vehicle crossover to the beach runs northeast-southwest, while the broad expanse down to Fishing Point runs southeast-northwest. Thus a morning walk gives you the sun at your back going down and in your face coming back, while the reverse is true in the afternoon.

The beach, flats, and marshes of Fishing Point have the greatest concentrations of shorebirds at high tide. The advantage of being there at that time is balanced by the disadvantages of a hike on either beach within three hours of high tide. Tom's Cove Beach has few birds then except between mid-May and mid-June, the sand is fairly soft, and the two tidal creeks that separate Tom's Cove from Fishing Point may have water as much as two feet deep. (If there is a northerly or westerly wind, these creeks can be a foot deep even at low tide.) The ocean beach has a steep upper intertidal zone, and most of the dry sand above it is soft, churned and rutted by the tracks of off-road vehicles. Close to the dunes you can find firmer sand and sometimes interesting pools, but this part of the beach is fenced off from all traffic during the nesting season to protect breeding Piping Plovers. Where the beach is widest you can try walking through the marsh behind the dunes; it has rewarding dunes and flats, attractive to many shorebirds then the rainfall has been just right, but the mosquitoes can make it unbearable. If you take this route from April to July, you will be made aware that you are distressing dozens of nesting Willets.

If you make the hike on a falling tide, Tom's Cove is more interesting when the tide is higher, whereas the ocean beach has more birds and is more pleasant to walk on close to low tide.

III. The North Refuge. If you are not authorized to drive up to the Washflats (and very few people are), there are only two ways to get there: on foot or in the Safari Wagon, which a concessionaire operates on a regular morning schedule--every day in summer, weekends in spring and fall. (It may be chartered by groups at other times.) It is possible to take the wagon up and walk back.

It is approximately seven miles to the top of the Washflats either from the refuge visitor center or from beach parking lot #1.

The four miles up to the south end of the Washflats on the service road (including the last northwest leg of the wildlife drive) are unlikely to produce any shorebirds, since the road lies between pine woods and overgrown marshes and fields. Beyond the gate at the foot of the Washflats, the Bayside Flats open up on the left, the Washflats on the right. When the Bayside Flats are flooded, either by high tide or by westerly or northerly winds, the shorebirds utilizing them move into the Washflats. On a sunny day light is naturally best for the Bayside Flats in the morning, when it is very poor for looking into the Washflats from the service road.

The walk along the ocean beach is far more pleasant from mid-tide to an hour or two after low tide than at any other time because of the softness of the dry sand and the steepness of the upper intertidal zone. Unfortunately the light is unlikely to be really satisfactory at any time because the beach runs north-northeast to south-southwest. A walk up the beach in the morning is into the sun, and so is a walk back in the afternoon. The kilometers are marked, and the highest concentration of shorebirds is usually between KM5 and KM7.

About 50 yards south of KM6 you can cross the dunes to a track that runs

along the fence at the south end of the Washflats to the service road. A path over the dunes just north of KM7 leads to a locked gate at the east end of the Washflats crossdike. A third option is to hike up to a point halfway between KM10 and KM11 where a dune crossing leads to a locked gate just north of the northeast corner of the Washflats.

Unless the Washflats are quite dry, many shorebirds are likely to be too distant from the service road to be identified from there. The crossdike, which runs southeast from the service road, provides good views of the north end of the South Washflats in the morning and of the south end of the North Washflats in the afternoon. Most birds, however, can be studied only by walking the east side of the flats. In both impoundments the light is best if you are southbound in the morning.

There is no good way to do it all in one visit. Perhaps the best solution for a single trip is to take the morning safari trip, seeing what you can on the Bayside Flats from the vehicle. If there are enough shorebirds on the Washflats to warrant the effort, get off at the north end, walk east through the woods to the northeast corner of the Washflats and south down the flats to the crossdike. You can either cross the dunes to the beach from there or continue down the east side of the South Washflats to the gate at the south end, where you can choose to walk south by the beach or the road. (The first and last problem is placing your car in the location that will minimize the length of the hike, especially at the end of the day.)

IV. Off-refuge Areas. The marsh on the south side of the road just east of the fast-food restaurant and west of Assateague Channel is often excellent for shorebirds for an hour or two on either side of high tide, especially in spring. If the day is sunny, the light in the afternoon is abominable from the

road; but it is good all day from the southeast corner of the restaurant parking lot.

Four stops along Route 175 to the mainland are worthwhile, depending on the tide:

1. The oysterbeds along the spur road on the south side of the highway just west of Queen Sound are rewarding, especially for oystercatchers, when partially exposed--usually three to five hours after high tide. Light is much better in the morning.

2. The big tidal flats on the north side of the road just east of Queen Sound are often excellent. At low tide they may be so large that birds on the far side are too distant to identify. When a north wind is blowing they may be covered even at low tide. Normally they are at their best for an hour on either side of half-tide. Light is always good, but somewhat better in the morning than in the afternoon. The shoulder is wide enough to park on with care.

Recommended Itineraries:

Morning

1. The Hook. Allow five to six hours, not including breaks for rest or eating.

2. The Impoundments. Start at the east end of Swan Cove, and then walk the wildlife drive.

Afternoon

Drive the main road, stopping at Black Duck Marsh, the southwest end of Swan Cove (just northwest of the Pony Trail entrance), and the central flats of Swan Cove. If the flats at the head of Tom's Cove are exposed, stop on the south pull-off opposite the hunter's blind in the cove. After 3 p.m. drive the wildlife drive; if Swan Cove is dry, walk out on the western flats.

All day

The Washflats: check in advance with the concessionaire to see if there are enough birds up there to make the effort worthwhile.

Any time

Fit in visits to the off-refuge tidal flats according to the tide schedule. If the tides are right, morning is better than afternoon.