The Cowbirds of Hart Park were readily retrapped and appeared to have a high survival. Since not all birds captured were residents of the area only 31 percent repeated the year following their banding date. However 60 percent of these returned the second year and 75 percent of the 3+ year olds were still alive when 4+ years. Table 10 lists these data.

(to be concluded)

A STUDY OF BOREAL SHOREBIRDS SUMMERING ON APALACHEE BAY, FLORIDA

BY HORACE LOFTIN

INTRODUCTION

At least 30 species of shorebirds (Charadriidae and Scolopacidae) are found regularly on the beaches and mud flats of Florida at one time or another during the year. A limited number of these species breed in Florida. Others are seen as winter residents only or as transients during migrations to and from their northern breeding grounds. Of these 30 species, 19 are known to breed only far to the north, into Canada and Alaska, and even above the Arctic Circle in several instances.

Such boreal-breeding shorebirds typically leave or pass through Florida in spring in the northward migration. In the north they mate, lay eggs, incubate, and rear the young in summer. Southward departure from the breeding grounds may begin for some of them as early as July (or earlier?), but the height of southward migration is typically early in autumn. Thus one might expect these boreal-breeding species to be virtually absent from the southern coasts of the United States and farther south during the breeding season. But of the 19 northern breeders that occur in Florida, individuals of 16 of these species may be found with some regularity in summer months along the coasts of that state. Such individuals constitute the so-called *summering shorebirds.*

As used here, the term *summering* does not necessarily denote a bird which is a *summer resident* in Florida, but rather any boreal-breeding bird there during the breeding season of its species for whatever reason. For the purposes of this study, the term is further restricted to apply to boreal-breeding shorebirds in Florida during the month of *June.*

Both frequency of records and size of flocks seen indicate that summering is far more than a casual occurrence among most of the species in question. The phenomenon apparently involves a significant portion of the total populations in many cases and therefore warrants greater consideration than it has heretofore received in the study of shorebird life histories.

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* This is a contribution from the Florida State University Department of Biological Sciences, and from the F.S.U. Oceanographic Institute, No. 175.

The investigations reported in this paper concern a detailed study of the identity, abundance and characteristics of summering shorebirds as seen over two seasons in the Apalachee Bay area (Wakulla and Franklin Counties) of the northwest Gulf coast of Florida. This study was held in conjunction with a cooperative summering shorebird survey throughout the state of Florida taken in June, 1959, by members of the Florida Audubon Society. The results of this state-wide shorebird count are presented elsewhere (Loftin, 1960a). It was hoped that these investigations together might provide clues toward the understanding of the causes of summering among boreal-breeding species, and provide a basis for further field and laboratory investigation in resolving this problem.

A list of shorebirds which regularly occur in Florida, including species with summering individuals, is presented in Table 1. Scientific

Table 1. A list of shorebirds (Charadriidae and Scolopacidae) occurring in Florida, excluding accidentals.

Species Not Limited to Boreal Breeding Grounds

Charadrius melodus Ord. Piping Plover.
Charadrius alexandrinus Linnaeus. Snowy Plover.
Charadrius wilsonia Ord. Wilson's Plover.
Charadrius vociferus Linnaeus. Killdeer.
Philohela minor (Gmelin). American Woodcock.
Capella gallinago (Linnaeus). Common Snipe.
Numenius americanus Bechstein. Long-billed Curlew.
Bartramia longicauda (Bechstein). Upland Plover.
Actitis macularia (Linnaeus). Spotted Sandpiper.
Tringa solitaria Wilson. Solitary Sandpiper.
Catoptrophorus semipalmatus (Gmelin). Willet.

Species Limited to Boreal Breeding Grounds

Without summering individuals in Florida

Pluvialis dominica (Müller). American Golden Plover.
Erolia melanotus (Vieillot). Pectoral Sandpiper.
Micropalama himantopus (Bonaparte). Stilt Sandpiper.

With summering individuals in Florida

Charadrius semipalmatus Bonaparte. Semipalmated Plover.
Squatarola squatarola (Linnaeus). Black-bellied Plover.
Arenaria interpres (Linnaeus). Ruddy Turnstone.
Numenius phaeopus (Linnaeus). Whimbrel.
Totanus melanoleucus (Gmelin). Greater Yellowlegs.
Totanus flavipes (Gmelin). Lesser Yellowlegs.
Calidris canutus (Linnaeus). Knot.
Erolia fuscicollis (Vieillot). White-rumped Sandpiper.
Erolia minutilla (Vieillot). Least Sandpiper.
Erolia alpina (Linnaeus). Dunlin.
Limnodromus scolopaceus (Say). Long-billed Dowitcher.
Limnodromus griseus (Gmelin). Short-billed Dowitcher.
Ereunetes pusillus (Linnaeus). Semipalmated Sandpiper.
Ereunetes mauri Cabanis. Western Sandpiper.
Limosa fedoa (Linnaeus). Marbled Godwit.
Crocethia alba (Pallas). Sanderling.

names of all species concerned in this study are given in Table 1 and also in the titles of the individual species accounts. Elsewhere the common names recommended by the American Ornithologists' Union (A.O.U. Check-list, 1957) are employed.

SOME HYPOTHESES CONCERNING THE CAUSES OF SUMMERING

Students of bird migration and distribution have long noted the occurrence of shorebirds in summer far south of their breeding grounds. Though few observations or experiments have been addressed directly to the problem of summering, a number of conjectures or "educated guesses" have been made as to the underlying causes of this apparent "loitering." The most pertinent of these are reviewed below. The results of the present investigation will be presented as they bear on these hypotheses, to see if the data lend support to one or more of them or whether further hypotheses may be suggested.

A. *Late Northward and Early Southward Migrations.*

A review of published records (e.g., Bent 1927, 1929) indicates that several of the shorebird species under consideration have a northward spring migration which normally continues well into June. Results of the "cooperative shorebird survey" (Loftin, *op. cit.*) and the present work make it appear that June migration may be even more common than has been supposed. A number of boreal shorebirds, however, essentially complete their spring migration by the end of May; and, therefore, June records of such species in Florida or elsewhere in the south are likely to represent summer loiterers or belated migrants.

Possible explanations for delayed migration are not difficult to conjecture. Any of a number of reasons—e.g., health, weather, distance—might account for late arrival on the Florida coast or late departure from there northward. A suggestion to be discussed later in this paper is that certain young birds may not reach a proper physiological state for migration until late in the season, and thus their northward departure is delayed.

A number of summering records are undoubtedly due to the presence of individuals in the south which have made an early return flight from the north. Several possible explanations for such early "fall" arrivals have been offered. Wetmore (1930:167), citing the case of Wilson's Phalarope in Utah, suggests that nonbreeding birds on the breeding grounds leave early for the south. Lincoln (1952:33) proposed that in many shorebird species the males may incubate and take care of the young almost exclusively. This, he says, would explain "why in southern latitudes so many of the earliest fall arrivals are females. . . . " A corollary to this suggestion would be that male birds which do not participate in incubation and care of the young may abandon the breeding grounds early (see Pickwell, 1930).

B. *Breeding in the Winter Range.*

It has been suggested that certain summering records concern individuals which are actually breeding or attempting to breed in the south. This idea arose previous to the present century when the breeding grounds of many or most shorebirds were not well known. Baird *et al.*

(1884) provide examples of 19th Century suppositions that certain boreal shorebirds such as the Marbled Godwit and the Ruddy Turnstone might nest in the south. Gundlach (*fide* Barbour, 1943:50, 56, 57) believed that summer records of the Dowitcher, Semipalmated Plover and Ruddy Turnstone in Cuba indicated that these species might breed there.

Of the species presently defined as boreal-breeding, there is little probability that any are regular breeders in southern latitudes. However, it is not impossible that some individuals do occasionally nest, or attempt to nest, within the winter range. Therefore, though breeding or attempted breeding in the winter range of such species has not been demonstrated, the possibility that such may be a factor in shorebird summering should not be ignored.

C. *Passing the Austral Winter to the North.*

The northern (boreal) summer corresponds to the southern (austral) winter and the northern winter to southern summer. Most species of shorebirds which are indigenous to southern South America then breed in the season of the boreal winter and migrate northward during the time of the boreal summer (see Goodall *et al.*, 1951). None of these austral breeders are known to reach the southern borders of the United States during their southern winter migration, however.

It has been suggested that certain boreal shorebirds may have populations or races which breed in southern South America. If this be actually the case, then members of such species seen in temperate or tropical South America, or even in the southern United States, in June-July might represent South American populations in the process of *wintering*.

W. H. Hudson, who spent his boyhood and early manhood on the pampas of Argentina, wrote concerning the Hudsonian Godwit (1920:206-207):

> I have met with it in flocks during the summer of the southern hemisphere, and these birds . . . were undoubtedly visitors from the north; but invariably small flocks of half a dozen up to 30 birds begin to appear on the pampas in April, and remain here . . . until September, when northern migrants are nearly due. These individuals must therefore breed near the extremity, or beyond the extremity, of South America.

Hudson (*op. cit.*:199-200) made similar observations concerning the Greater Yellowlegs.

Following a study of northern shorebirds which were passing the boreal winter in southern South America, Wetmore (1926) concluded that reports of both Greater and Lesser Yellowlegs from May to August in Argentina largely concerned injured birds. Elsewhere Wetmore wrote (1930:168) "it may be said definitely that there has never been any proof of the breeding of such species as the Golden Plover, the Yellowlegs, the Godwits or similar species, considered as migrants from the north, during their sojourn south of the Equator in South America or elsewhere."

Bullock (1940) reopened the question of possible austral breeding, calling attention to South American subspecies of the Killdeer and

Snowy Plover and stating he was "of the opinion that we will find another half dozen North American species with allied forms in the southern hemisphere." Bullock pointed out that the extreme southern reaches of South America have "never been systematically studied by any ornithologist during the breeding season of the shorebirds."

In their book, *Las Aves de Chile,* Goodall, Johnson and Philippi (1951, 1957) mention several records of boreal shorebirds in Chile during June-July. Johnson *(in litt.)* remarked, however, that "our opinion, after fairly extensive study and in most cases the collecting of specimens for the express purpose of determining the state of reproductive organs, is that none of these migrants nest in this hemisphere, and that the presence of stragglers during the months of the northern spring or even summer must be accounted for on the basis that the small minority which remain behind are, for one reason or another, non-breeding birds."

There the question seems to rest. But, as if to underline Bullock's suggestion for the need of ornithological exploration, two Whimbrels were found on 29 June 1958, feeding in a field 200 yards from the Straits of Magellan (Belton, 1959).

D. *Sterile, Diseased, Crippled and Senile Birds.*

It is reasonable to assume that a portion of summering shorebird records represent individuals which do not participate in the typical migrations of their species because of physical or physiological handicaps. A number of such birds might be expected south of the breeding range in the breeding season regardless of other causes of summering. The question is, to what extent are such handicapped individuals responsible for summering records?

Several notes by Wetmore (1926, 1927, 1930) indicate that he ranks handicaps high as a cause of summering. Wallace (1955:221) remarked that physical injury may prevent migrating at the normal time and then the urge to go subsides; he also suggested that a "hormonal imbalance" may be an underlying cause of summering. Baird *et al.* (1884:123) mentioned the possibility of senility as a cause of shorebird summering.

E. *Sexual Immaturity.*

Eisenmann (1951, 1952, 1955, 1957) has reported many records of summering shorebirds in Panama; he suggested that "most of these non-breeding birds are immature rather than abnormal. If the impulse to return to the nesting grounds is dependent on the development of the gonads, the immature birds, lacking such a stimulus, might be expected to linger around their winter range." He suggested that social tendencies may cause some of the young birds to accompany flocks of returning adults, accounting for the presence of non-breeding young birds on the nesting grounds.

The possibility that some immature individuals may linger in the south after the close of the "typical" migratory season, only to depart northward later in the season, will be discussed in a later section of this paper.

Though there is little information available concerning the length of

time required for shorebird species to attain sexual maturity, it seems probable that many summering shorebird records concern immature individuals remaining in the winter range during the breeding season. The questions then arise: Which species do and do not normally breed only after one or more years of life? Of those with a prolonged period of immaturity, what percentage of the young birds remain south in summer? How much of the total summering phenomenon is due to the presence of such immature individuals?

PROCEDURES

Description of the Area

Apalachee Bay is an ill-defined, wide, shallow bay on the Gulf coast of northwest Florida. Its western extremity is Alligator Point (Franklin Co.) and its eastern extremity approximately the mouth of the Fenholloway River (Taylor Co.). At its deepest, the bay only attains some 20 feet mean low water. Broad stretches of the bay contain sand, mud and oyster reefs which are exposed at low tide, furnishing ideal feeding conditions for many shorebirds. The shoreline is one vast marshland, with few sandy beaches. Except by boat, access to the shore is limited to a few roads which lead to fishing villages or boat landings.

At the beginning of this study, observations were made more or less regularly from several stations along the western half of the bay, from Alligator Point to the St. Marks Lighthouse. It soon became apparent, however, that the central station, Shell Point, furnished perhaps the best single location in the area for systematic observations and for trapping. Shell Point (Wakulla Co.) constitutes a favorite "loafing spot" for shorebirds of the region, with birds congregating there in large numbers at high tide. Therefore, though the study began in May 1958, observations were centered at Shell Point, after March 1959, with but a few trips to other stations from time to time to maintain a check on the reliability of Shell Point as a representative area.

Field Observations

During the height of the migratory seasons and in summer, three or more field trips per week were generally made. An average of about one trip per week was made in other seasons. Identifications were made using 7 x 35 binoculars and a 30-power spotting telescope (Balscope). Attempts to quantify records on the basis of birds seen per hour or other such measure proved to be impracticable. It was finally decided to record the largest number of birds seen of each species per field trip. Thus, numerical data presented in this study are offered only as a guide to *relative abundance* of each species from trip to trip or season to season. All records presented below are from Shell Point, except for a limited number of observations made during winter months, unless otherwise noted.

In the course of field observations, note was made where possible of the plumage condition of birds seen, injuries noticed, general behavior, and other observations pertinent to the summering phenomenon.

Trapping and Color-marking

A primary purpose of the present investigation was to demonstrate, if possible, the activities of individual birds remaining on Apalachee Bay during summer months. Therefore it was necessary to trap and mark individuals so that they might be readily identified on sight. Attempts were begun in August 1958 to trap shorebirds using a modified "clover-leaf" trap with long guide lines (Low, 1935). Though this trap, specially recommended for shorebirds, was set up under a variety of conditions and in several locations, only 10 sandpipers were captured from August 1958 to April 1959.

In May 1959, a Japanese mist net was obtained. When set on favorite loafing spots or in shallow ponds frequented by shorebirds, the net took an encouraging but still small number of birds. This technique was soon modified by placing simple decoys made of plywood or even pasteboard beneath the net (Loftin and Olson, 1960a). These decoys attracted birds to the net, and by this method a fairly large number of shorebirds, especially Short-billed Dowitchers, Dunlins, Semipalmated Sandpipers and Western Sandpipers, were taken.

Beginning in late May, 1959, for the balance of that month, all birds captured were dyed a bright yellow, using an alcoholic solution of picric acid (Kozlik *et al.*, 1959). All birds taken in June, 1959, were dyed a brilliant scarlet, using Dupont Crocein Scarlet (Winston, 1954). Birds thus dyed stood out from their fellows both on the wing and on the ground, allowing easy identification of these "May" and "June" birds in summer and fall flocks.

All trapped birds were banded with serially marked bands and reported to the U. S. Fish and Wildlife Service. Permission was obtained from the Fish and Wildlife Service to color-mark shorebirds.

Examination of Specimens

Specimens of shorebirds under study were collected through the year. Unfortunately, the number of specimens taken in the critical month of June are limited, due (1) to the scarcity of individuals, (2) to a generally noted wariness at this season among several of the species, and (3) to a conscious effort not to scare the individuals from the areas under observation.

Specimens collected were made into study skins which have been deposited in the museum of Florida State University. I am exceedingly grateful to Mr. Storrs Olson who generously assisted in the preparation of these skins. Most specimens were weighed before skinning and note made of their fat condition. Fat classes used by Wolfson (1940) were employed in appraising fat condition: (1) *no fat*, essentially none, though traces may be present; (2) *little fat*, some fat between the branches of the furculum, but practically none in the abdominal region, flanks and lower back; (3) *medium fat*, present in all the above localities; (4) *heavy fat*, further increase in all these regions, especially the abdomen and lower back.

Gonads of most specimens were preserved in Bouin's solution and were later examined grossly and measured. The left testis of most males was examined microscopically, being stained with Erlich's acid hematoxylin and eosin alcohol. Stages of development of the testes

were rated according to the scale used by Johnston (1956:155-158) for spermatogenesis in the California Gull. Briefly, these are: *Stage 1*, inactive condition, with primary spermatocytes; *Stage 2*, primary spermatocytes in synapsis; *Stage 3*, increase in primary spermatocytes in synapsis; *Stage 4*, secondary spermatocytes; *Stage 5*, spermatids; *Stage 6*, spermatozoa in bundles, the breeding condition; *Stage 7*, spermatozoa in tubular lumen; and *Stage 8*, regression. Preserved ovaries were measured for approximate length and greatest width and for diameter of largest follicle.

Special effort was made to segregate specimens into first-year and older birds. With certain species, retention of juvenal feathers in the first basic and first alternate plumages allows one to separate first-year from older birds. In many cases, however, feather wear makes identification of such juvenal feathers difficult or impossible to accomplish. Thus, the number of individuals which can be absolutely aged by this method is limited. In many instances and with experience, the probable age (one-year or older) can be inferred with some degree of accuracy. In the present study, any age "determination" which is not decidedly clear cut is labelled "probably first year," "probably older bird," or some such modifying phrase.

Dr. O. L. Austin, Jr., of the Florida State Museum, and Dr. Pierce Brodkorb of the University of Florida, generously aided in aging Short-billed Dowitcher specimens. However, the writer is responsible for the final assignment of ages to these specimens. Aging by degree of ossification of the skull or size of the bursa Fabricii was not found to be practicable for this study.

Prepared museum skins were studied as to the character and condition of their "feather coats." Nomenclature used in discussing plumage condition is generally that of Humphrey and Parkes (1959).

PRESENTATION OF FINDINGS

There follow the various accounts by species of the observations on summering shorebirds on Apalachee Bay, Florida, in 1958-1959. Of the 16 species involved, by far the most conspicuous in summer on Apalachee Bay was the Short-billed Dowitcher. Specimens of this shorebird were comparatively easy to take in mist nets and they color-marked well. First-year birds could be separated from older birds by plumage characters with some facility. Furthermore, the Dowitchers have been especially well studied (Pitelka, 1950), so that many basic problems met with in other species have been clarified. For these reasons, the bulk of data on summering shorebirds in the present study concerns this dowitcher. The accounts of species, then, will begin with the Short-billed Dowitcher; thereafter, the presentation is in phylogenetic order.

The Short-billed Dowitcher, *Limnodromus griseus* (Gmelin)

No individuals of the Long-billed Dowitcher *(L. scolopaceus)* were observed in the Apalachee Bay area during this study. Thus, all the remarks refer to the Short-billed Dowitcher with little possibility of misidentification. On the other hand, two subspecies of the Short-bill were identified: *L.g. hendersoni*, the Inland Dowitcher; and *L.g. griseus*, the Eastern Dowitcher.

The majority of summering dowitchers were in basic plumage and were not distinctive in their measurements, so that their subspecies could not be determined. Of 36 specimens collected during the entire study, 11 were *L.g. hendersoni,* 12 were *L.g. griseus,* and the balance were unidentifiable. No attempt is made to discuss observations on dowitchers from Apalachee Bay at the subspecific level. The generous aid of Mr. Bernard M. Feinstein of the U. S. National Museum, and Dr. Kenneth C. Parkes of the Carnegie Museum, in making these subspecific identifications is gratefully acknowledged.

Cycle of Abundance. From very low numbers in winter, large flocks of dowitchers appeared in two pronounced waves during the spring migration: March and May. But by the last of May, average numbers seen per field trip had dropped to 35, as compared to flocks of 1,000 or more early in the month. Birds per field trip continued to drop progressively through June, indicating a continuous movement away from the area. Then in early July a relatively large flock of dowitchers reappeared at Shell Point. For reasons to be discussed below, these were considered to be returning migrants (though not necessarily returning from as far north as the breeding grounds). Numbers per field trip again fell off until the middle of July. Thereafter, waves of fall migrants appeared, with a peak in October. A graph of the average number of birds seem per field trip in 10-day periods from March through October is presented in Figure 1.

Trapping and Color-marking. The June population of Short-billed Dowitchers at Shell Point was very distinctive, being almost wholly of birds in basic plumage and most of them apparently first-year birds (i.e., birds hatched the previous summer). The change into (or emergence of) this population with the close of May and beginning of June is clearly seen from trapping and color-marking records.

On 9 May 1959, only 2 of 27 birds captured were in basic plumage; there were some 1,000 birds on the flats at Shell Point at this time. On 16 May, 2 of 20 birds were in basic plumage; there were about

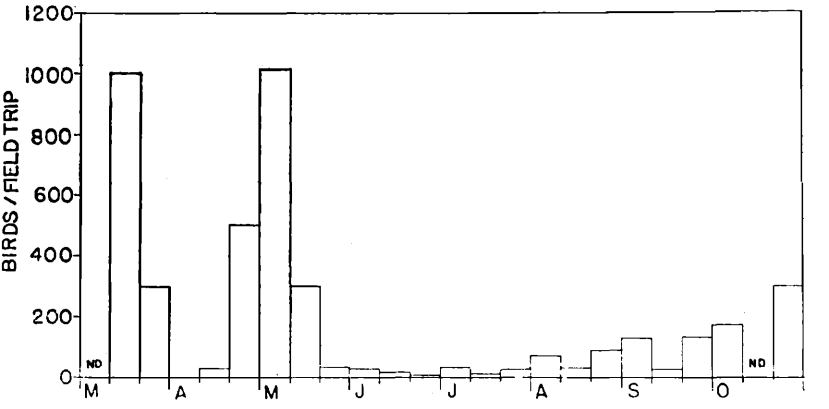

FIGURE 1. Average number of Short-billed Dowitchers seen per field trip in 10-day periods from March through October at Shell Point. (ND=no data).

300 birds present. A marked change was noted on 23 May, when 9 of 10 birds taken were in basic plumage; some 50 birds were present. Few dowitchers were captured in June: 3 from a flock of 50 on 8 June, and 5 from a flock of 25 on 11 June; all birds seen and taken in June were in basic plumage.

In an attempt to determine if any individuals remained on Apalachee Bay throughout June, all birds captured on 16 and 23 May (10 in alternate plumage, 12 in basic) were dyed yellow—"golden birds"; and all taken on 8 and 11 June (8 in basic plumage) were dyed red —"scarlet birds." Dyed birds were seen at Shell Point in June as indicated in Table 2.

No dowitchers were observed at Shell Point or elsewhere on Apalachee Bay after 24 June for the balance of the month. But on 1 July, a sudden influx of shorebirds was noted at Shell Point, including 25 dowitchers in both basic and alternate plumages. One of these basic-plumaged dowitchers was a "golden bird." The specimen was collected, and the band indicated it was first captured on Shell Point on 23 May. From 1 to 9 July, *at least* 3 more "golden" birds and one "scarlet" bird were seen. Few birds were noted from 9 to 18 July, but on the latter date, 2 more "golden" birds appeared in a sizeable flock. These birds were distinct from other "golden" birds seen, as told by the distribution of color on their feathers.

Thus, at least six out of 12 basic-plumaged dowitchers dyed yellow in May returned to Shell Point in July after a lengthy absence, indicating a remarkable degree of "homing" in these birds.

Of the 8 dowitchers dyed red in early June, at least one returned to Shell Point after a month's absence. However, a red-dyed dowitcher was observed on the Banana River Flats near Canaveral, Florida, on 5 July 1959 (Lon Ellis, *fide* W. Foster White, *in litt.*) Since I was the only person authorized to color-mark shorebirds in 1959, this bird apparently was one of those banded and dyed at Shell Point in June.

From trapping and color-marking experiments, then, it was seen that basic-plumage individuals tended to remain on Apalachee Bay in

Table 2. Schedule of dyed Short-billed Dowitchers seen at Shell Point, Florida, in June, 1949. "Golden" birds were dyed in late May; "scarlet" birds in June.

Date	*Number Golden Birds*	*Number Scarlet Birds*	*Size of Flock*
2 June	0	—	20
7 June	3	—	35
8 June	2	—	50
10 June	—	—	0
11 June	1	1*	25
17 June	0	0	1
18 June	1	0	15
20 June	1	0	12
22 June	1	0	12
24 June	0	0	12
27 June	—	—	0

*This bird was seen before other dowitchers were caught and dyed red that day.

early June after their alternate-plumaged companions had departed northward. As the month wore on, these birds began to disappear from the area. No individuals marked in May or early June were seen after 22 June for the balance of the month. Hence, there was no evidence that any individual Short-billed Dowitcher passed the entire month of June on Apalachee Bay, i.e., was a summer resident. In fact, the limited data seem to indicate otherwise. Return of fall migrants from elsewhere (not necessarily from the breeding grounds) occurred as early as 1 July, and July-returning birds included at least 6 out of 12 basic-plumaged dowitchers color-marked the previous May.

Plumages and Age. The plumage "aspects" of Short-billed Dowitchers as seen through the year at Shell Point may be summed up as follows. Through the winter, the few birds present were in drab-gray basic plumage By the last of March, beginnings of a pre-alternate molt were in evidence. In late April and early May, large flocks were comprised almost wholly of birds in alternate plumage. In the latter days of May and into June, the alternate-plumaged birds were gone, leaving behind small groups of basic-plumaged dowitchers. Earliest fall migrants, appearing in July, included individuals in basic and alternate plumages. Late July and August birds were in alternate plumage but showed varying degrees of pre-basic molt. They were all in predominantly winter dress by October. The first juvenile was seen on 25 August.

Six specimens were collected in June, 1959. All of them, on the basis of their plumage, were considered to be first-year birds. Five were in a basic plumage; the sixth was in a partial first alternate plumage. One of the basic-plumaged birds showed no signs of molting, but the other four were in various stages of *molting directly into a second basic (second winter) plumage.*

Twelve Short-bills were taken on 1 July. Two were in typical alternate plumage and were probably adults. A third was in a half-developed alternate plumage and appeared to be a first-year bird The remainder were all in first basic plumage, with slight amounts of alternate plumage on the wings and back, and all beginning a second pre-basic molt

On the basis of these data, it appears that the majority of "June" dowitchers on Apalachee Bay are one-year-old birds in a first basic plumage. Basic-plumaged birds returning in a July "fall" migration are likewise apparently first year birds It is interesting that these birds appear to undergo a molt from one basic plumage directly into another.

Gonadal Development. Two male Short-bills were taken in June, 1959. Both had very small testes (3.1 x 1.6 mm., and 4.6 x 1.3 mm.). The former was in Stage 3 of spermatogenesis and the latter in Stage 4. Of 4 females taken in June, all had quite small ovaries, with largest follicles ranging from 1.0 to 1.6 mm. in diameter. Thus, all specimens taken in June were sexually immature.

Of 9 specimens in basic plumage on 1 July, 7 were males. Testis size was small, averaging 3.2 x 1.3 mm., with little variation from this mean. All testes were in Stages 2 or 3 of spermatogenesis, i.e., quite immature. Ovaries of the 2 females were small, with largest follicles measuring 1.3 and 1.0 mm. The follicles of one female were few and scattered, as if the ovary were regressing.

Testes of alternate-plumaged dowitchers taken on 18 July, by way of contrast, were in advanced stages of spermatogenesis and were undergoing marked regression. An adult female taken the same day had its ovary shrivelled, with few follicles remaining.

Observations on gonadal condition of basic-plumaged birds in summer indicate that these are sexually undeveloped. Alternate-plumaged birds in this season, on the other hand, have attained more advanced states of sexual maturity than the one-year-old, basic-plumaged individuals.

Fat Deposition. It has been suggested (e.g., Odum and Perkerson, 1951; Wolfson, 1945) that a deposit of subcutaneous fat is indicative of physiological readiness for migration in many species of birds. Of the 6 one-year-old specimens collected at Shell Point in June, 4 were "no fat" and 2 were "little fat." On the other hand, of 10 first-year birds "returning" on 1 July, 3 were "no fat," 3 were "little fat," and 4 were "medium fat." These may be compared with fall-returning adult dowitchers: 1, "no fat"; 6, "little fat"; 4, "medium fat"; and 1, "heavy fat."

These data suggest that the one-year-old dowitchers present on Apalachee Bay in June may remain only so long as is necessary to accumulate enough fat (or until a physiological state necessary for migration and accompanied by fat deposition is attained) for a continued northward flight. This would help explain the gradual disappearance of the young birds through early June. It would also help account for the differences of fat deposition noted between loitering June birds and returning July birds in first basic plumage.

Other Observations. No evidence of "breeding behavior" was noted in June-July among dowitchers on Apalachee Bay, and no nests nor young were discovered. The lack of sexual development in June birds taken in this region underlines the improbability of the dowitcher's breeding there. No obviously sick dowitchers and only one crippled bird were observed in the area in June-July.

Semipalmated Plover, *Charadrius semipalmatus* Bonaparte

Cycle of Abundance. Spring migration of the Semipalmated Plover began in force in late March, continuing in waves until about the middle of May, when there was a rapid decline in numbers. This plover was present in small numbers through June, July and early August. A striking increase was noted in the latter part of August, representing easily discernible fall migration. The fall migration terminated in November. A graph of the average number of Semipalmated Plovers seen per field trip in 10-day periods from March through October is presented in Figure 2.

Plumages and Age. Of three specimens taken in June, 1959, one was a male in alternate plumage, with worn feathers and no indication of molting (taken 17 June). Another male (taken 20 June) was in a partial alternate plumage; its body and wing feathers were worn and the first 2 inner primaries were being replaced. It was undergoing a pre-basic molt. The third, a female (taken 22 June), was in worn basic plumage and had commenced a pre-basic molt. On 9 July another female was taken; this bird was in the identical worn plumage condition of the June female, including the pre-basic molt.

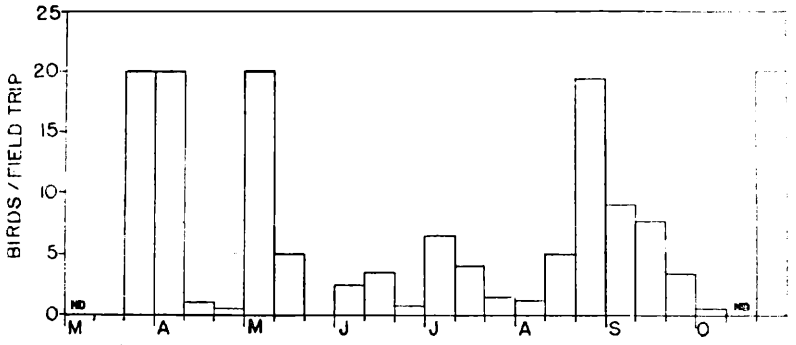

FIGURE 2. Average number of Semipalmated Plovers seen per field trip in 10-day periods from March through October at Shell Point. (ND=no data).

In the case of all four specimens, feather wear was so advanced that presence or absence of retained juvenal feathers could not be determined; thus the birds could not be aged by this method. Both basic-plumaged females and the male in incomplete alternate plumage were undergoing pre-basic molt. It was seen in the case of the Short-billed Dowitcher that many first-year birds molt directly from the first basic to the second basic plumage, by-passing or showing only partially the first alternate plumage: It seems not unlikely that a similar situation obtains with the Semipalmated Plover, and that the two females, and probably the male, were one-year-old birds. The specimen in complete alternate plumage was probably an older bird, a supposition reinforced by its advanced state of sexual maturity (see below).

Gonadal Development. The two females taken in June both had quite small ovaries, with largest follicles not exceeding 0.7 mm. in diameter. The probable first-year male had testes recorded as "very small"; microscopic examination was not made of this specimen. On the other hand, the male in full alternate plumage had relatively large testes (4.0 x 1.9 mm.). Microscopic examination disclosed that the testes contained spermatozoa, though not in abundance.

The possibility arises that this bird, taken 17 June, may have been a summer resident on Apalachee Bay and thus potentially a breeding bird in this low latitude. This suggestion should not be discarded; but in the absence of further evidence it seems more probable that this plover was a transient. It is interesting that this bird was taken in a small flock of similarly plumaged birds in a period (17-20 June) in which total counts of Semipalmated Plovers were noticeably higher than before or after this time in June. None of the Semipalmated Plovers seen in June-July exhibited "breeding behavior," and no nests nor young were found.

Black-bellied Plover. *Squatarola squatarola* Linnaeus

Cycle of Abundance. A peak of spring migration of the Black-bellied Plover was reached in April, dipping somewhat in May. By June and July, numbers of these plovers were very low on Apalachee Bay. An increase was noted in August which continued to a fall peak in

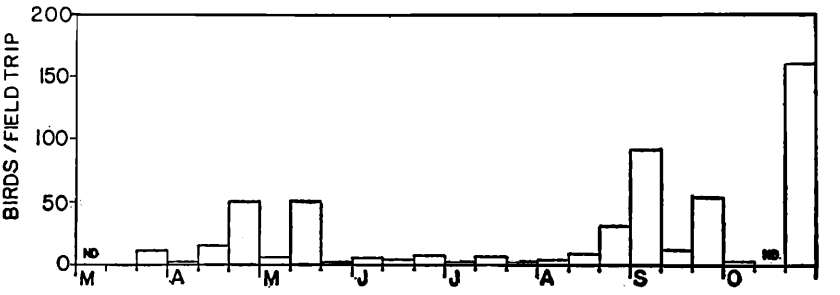

FIGURE 3. Average number of Black-bellied Plovers seen per field trip in 10-day periods from March through October at Shell Point. (ND=no data).

October. Figure 3 summarizes field trip data from March to October in 10-day periods.

Plumage, Age, and Gonadal Condition. In two summers (1958 and 1959) of close observation on Apalachee Bay, only 3 Black-bellied Plovers in alternate plumage were seen; all the rest were in basic plumage. Likewise, of more than 300 individuals reported with plumage data from the statewide "summering shorebird census" for June, 1959 (Loftin, 1960a), only 10 individuals were in alternate plumage.

Only one specimen was collected in June on Apalachee Bay. This bird was in basic plumage, with its testes in a surprisingly advanced stage of development. The left testis measured 5.1 x 2.5 mm., and on microscopic examination was seen to be producing a limited number of spermatozoa. This bird was not in a typical first-year plumage, but worn median coverts suggested retained juvenal feathers. There were both worn and relatively new basic plumage feathers on this individual, the new feathers seen especially in the innermost secondaries and wing coverts. It appears, then, that this bird may have been beginning a pre-basic molt directly from a basic plumage. The specimen was collected on 2 June.

The advanced gonadal development of this plover is of special interest. Black-bellied Plovers in basic plumage are relatively common in Florida in summer, and this suggests the possibility of their breeding in the state. On the other hand, results of the "cooperative summering shorebird survey" (Loftin, *op. cit.*) seem to indicate that these birds move out of the state in late June before the arrival of southbound migrants. Do they then fly to northern breeding grounds for a belated nesting season? Do they breed in a basic plumage—perhaps a *second* basic plumage as suggested by the apparent molting of the specimen taken?

There is need for the collecting of numerous specimens of the Black-bellied Plover throughout Florida during all of June. Plumages should be critically studied, fat deposition determined, and gonads examined microscopically. Until such work is done, the summering Black-bellied Plovers will remain a greater puzzle than ever.

Ruddy Turnstone, *Arenaria interpres* (Linnaeus)

Cycle of Abundance. Figure 4 shows the average number of birds seen per field trip in 10-day periods from March through October. There was a large increase in turnstones from mid-winter to a peak in April. Numbers declined somewhat in May, fell further in June, and reached a low point in mid-July. The beginning of readily discernible fall migration was in August, with peaks observed in September and late October. The continuous drop in numbers seen from June to mid-July seems to indicate continued migration out of Florida which persists into July. Such a steady decline throughout June was noted in the "cooperative summering shorebird survey" (Loftin, *op. cit.*).

Plumage, Age, and Gonadal Development. Many of the turnstones seen in early June on Apalachee Bay were in typical alternate plumage. But as the month wore on, these became fewer and fewer until by the end of the month almost all of the remaining birds were in "mixed" plumage. This is a peculiar feather coat, appearing at first glance to be like the alternate plumage; but a second look discloses the light areas of the head to be brownish rather than white, and in other respects the aspect is that of a mixture of basic and alternate plumages. Bent (1929:285) described this feather coat in some detail, calling it a "first nuptial" (i.e., first alternate) plumage. He believed this to be "a nonbreeding plumage, as it is worn by birds which spend the summer far south of the breeding range."

Finally, by mid-July, even these young birds in mixed plumage had abandoned the Apalachee Bay area.

Thus, there seem to be two periods of migration for the turnstone in "spring": one essentially over in mid-June for the older birds, the other not ending until about mid-July for the younger birds (but it is not known if the young birds fly north or south when they leave). This recalls a similar situation noted for the dowitchers, in which older birds

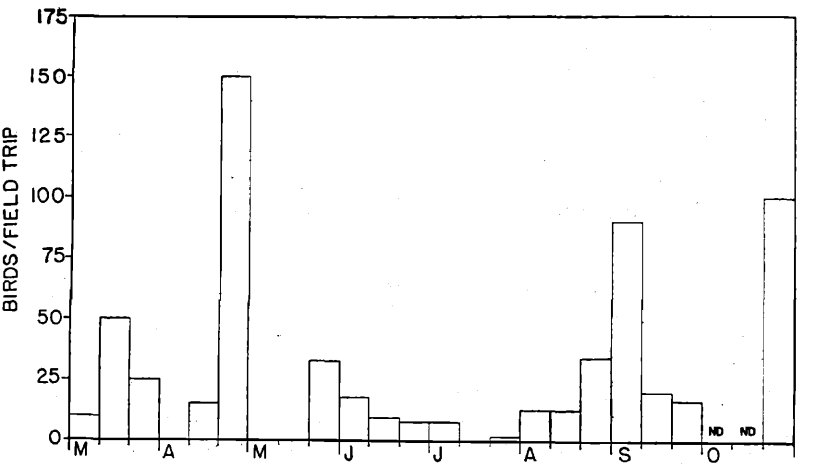

FIGURE 4. Average number of Ruddy Turnstones seen per field trip in 10-day periods from March through October at Shell Point. (ND=no data).

had departed by the end of May, the younger birds lingering well into June before departing.

A male Ruddy Turnstone in typical alternate plumage, taken on 30 May, had comparatively large testes (5.5 x 2.8 mm.) which were in Stage 3 of spermatogenesis. This bird was "medium fat." On 17 June, a male in "mixed," or first alternate, plumage was taken. Its testes were in Stage 1, complete repose. There was no fat deposition, a good indication that this bird was not physiologically ready to undertake a migratory flight. A female in adult alternate plumage was also taken on 17 June. Its ovary was somewhat enlarged (7.4 x 6.3 mm.), with largest follicle 1.8 mm. in diameter. It was "heavy fat," and certainly migratory at this mid-June date.

The above observations pertain to the typical North American subspecies of Ruddy Turnstone, *A. i. morinella.* On 8 June 1959, a specimen of the Old World subspecies, *A. i. interpres,* was taken at Shell Point, and has been reported elsewhere (Loftin and Olson, 1960b). The body and wing feathers of this bird were apparently those of a mature adult in alternate plumage; but the bands of the head and nape were brownish, not white, suggesting the "mixed" plumage. The ovary was relatively large, 9.7 x 7.2 mm., with largest follicle 5.1 mm., indicating a rather advanced degree of sexual maturity. The bird was "medium fat" and obviously migratory.

Whimbrel, *Numenius phaeopus* Latham, **Greater Yellowlegs,** *Totanus melanoleucus* (Gmelin), and **Lesser Yellowlegs,** *Totanus flavipes* (Gmelin)

Only one Whimbrel was seen in June-July during the present study, seen on Alligator Point on 25 June 1958. Only 11 birds were seen on Apalachee Bay during the entire period of study, May 1958 to September 1959.

The Greater Yellowlegs was seen three times in June 1959 on Apalachee Bay: 3 at Wakulla Beach and 1 at Shell Point on 6 June; and 1 at Bald Point on 24 June. Only 19 individuals were noted during the entire period of study.

Only 8 Lesser Yellowlegs were observed in this region during the present investigation. None were seen in June.

On the basis of the above observations and from the results of the "cooperative summering shorebird survey" (Loftin, *op. cit.*), though these three birds do occur from time to time on the Florida coast in June, their "summering" is probably not significant in this region.

Knot, *Calidris canutus* (Wilson)

Cycle of Abundance. A spring peak in numbers was noted in April. Knots were relatively scarce from May through July (with a minor increase noted in June), followed by the beginning of fall migration in August and lasting until about October.

Plumages, Age, and Gonadal Development. A considerable proportion of the Knots seen in June on Apalachee Bay were in alternate plumage, a somewhat different situation than was seen in most other species. Of the three specimens collected in June, one was a male undergoing pre-alternate molt. This bird (taken 8 June) was apparently an adult. Testes were small (3.8 x 2.4 mm.) and were in Stage 3 of sper-

matogenesis. It was "little fat." Two females taken on 20 June were both in first basic plumage. One was beginning a pre-basic molt. They were quite undeveloped sexually and without fat deposits.

By way of contrast, a female taken on 11 July was molting from adult alternate into basic plumage. Its ovary was small but was apparently regressing. It was "medium fat." This suggests that this particular individual may have been returning from the north even at this early date.

White-rumped Sandpiper, *Erolia fuscicollis* (Vieillot), **Least Sandpiper,** *Erolia minutilla* (Vieillot), and **Dunlin,** *Erolia alpina* (Coues)

These three peeps were all noted as present in early June in various places on the Florida coast by the "cooperative summering shorebird survey" (Loftin, *op. cit.*) However, none were seen in the latter part of the month. Only the Dunlin was observed in early June at Apalachee Bay. It appears likely that summering records of these species simply represent birds in normal spring migration which typically continues into early June.

Semipalmated Sandpiper, *Ereunetes pusillus* (Linnaeus) and **Western Sandpiper,** *Ereunetes mauri* Cabanis

Monthly averages of Semipalmated and Western Sandpipers seen per field trip are presented in Figure 5. The Semipalmated Sandpiper was not abundant during the present study except for a migratory peak in May. This bird was present in some numbers in early June, but none was observed after mid-month. This would indicate that spring migration continues to a limited degree in June but soon ends, with little post-migratory loitering. Numbers of Semipalmated Sandpipers remained extremely low for the balance of the year, even during fall migratory months. Thus it appears that migrating birds of this species may employ a different return route south in autumn.

The cycle of abundance of the Western Sandpiper on Apalachee Bay was opposite that of the Semipalmated Sandpiper. The Western Sandpiper was relatively rare in spring, though a slight increase was noted in May. The bird was virtually absent from the area in June, but

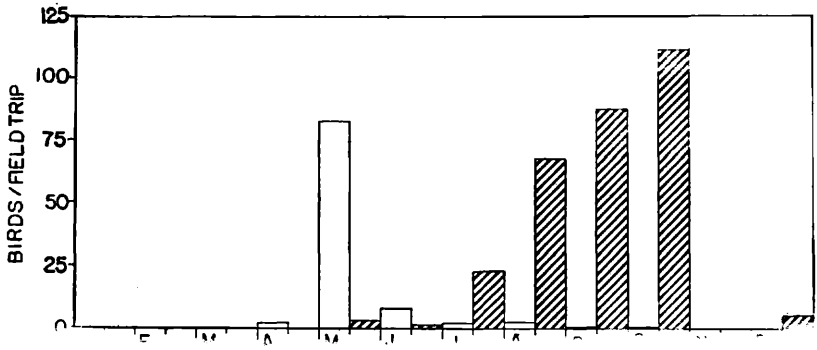

FIGURE 5. Average number of Semipalmated Sandpipers (open bars) and Western Sandpipers (hatched bars) seen per field trip each month at Shell Point.

began to appear regularly as early as 1 July. Thereafter, this species became one of the most abundant birds on the coast, reaching a peak in October. The difference noticed in relative abundance from spring to fall indicates that the Western Sandpiper, like the Semipalmated Sandpiper, probably employs different routes for spring and fall migrations, at least so far as the Apalachee Bay area is concerned.

Plumage, Age and Gonadal Condition. Almost all Semipalmated Sandpipers observed in June were in alternate plumage. Only two specimens were collected in June, both females in alternate plumage and apparently adult. Ovaries of the two measured about 6.3 x 4.0 mm., with largest follicles 1.2 and 2.3 mm. in diameter, respectively. The first of the birds was not fat; the second, with largest follicles, was "medium fat." Five specimens taken in June in mist nets were all in alternate plumage and apparently adult. The few birds seen in July were also in alternate dress, some undergoing pre-basic molt.

The only Western Sandpipers seen in June on Apalachee Bay were a flock of about 25 on Mashes Island on 17 June. Two specimens were collected, both males without fat deposits. These were in basic plumage and probably first-year birds. Testes of both were small and microscopic examination showed them to be in complete repose (Stage 1 of spermatogenesis). Nine specimens were collected from 7 to 28 July, all in alternate plumage. Those taken in the latter part of July showed the beginning of pre-basic molt. Another 43 Western Sandpipers were taken in mist nets in July, all in alternate plumage and many of them molting. It may be pointed out that several of the birds caught in nets were molting their innermost primaries. This finding contradicts Bent's (1927:259) observation that the Western Sandpiper does not molt its wing feathers until November or later.

Thus it appears that Western Sandpipers are rarely seen in June in the Apalachee Bay area; and the few that are include sexually undeveloped individuals which are probably one year old. Birds taken in July seem largely to be comprised of adults, which are undoubtedly returning from the north at this early date.

Marbled Godwit, *Limosa fedoa* (Linnaeus)

All Marbled Godwits observed in the present study were seen in June, 1959. These were noted on 2, 6, 8, and 24 June, one bird on each occasion. One specimen was collected on 8 June. This bird was in worn basic plumage and was apparently a first-year bird. It was without fat deposits. Testes were very small, and microscopic examination showed them to be in complete respose (Stage 1 of spermatogenesis).

Sanderling, *Crocethia alba* (Pallas)

April was the peak month for spring migration of the Sanderling on Apalachee Bay, with smaller numbers present in May. Some Sanderlings were to be seen in June, and there was a further reduction in numbers in July. Peak autumn migration occurred in late September and October. No Sanderlings were seen on Apalachee Bay after 22 June until the following August except for a single individual in the latter part of July. This absence of July records indicates that the majority of Sanderlings seen in June are probably late migratory individuals.

This suggestion is reinforced by the results of the "cooperative summering shorebird survey" (Loftin, *op. cit.*), in which Sanderlings were seen actually to increase in numbers through the middle of June, followed by their virtual absence in the last third of the month.

One Sanderling was collected on 30 May, a male in adult alternate plumage. Its testes were relatively large (5.0 x 2.5 mm.), and on microscopic examination were seen to contain spermatids (Stage 5 of spermatogenesis). Another specimen collected on 22 June was also in adult alternate plumage. Its ovary measured 7.3 x 5.7 mm., with largest follicle 1.0 mm. in diameter. Neither of these birds was fat. The limited development of the ovary of the latter bird and the lack of fat on both might be considered as signs of physiological lateness of the migratory impulse. The absence of fat on the male bird, which was almost in breeding condition, makes one wonder if this individual had not exhausted an initial fat deposit in a long northward flight and was "refueling" in a late stop-over on Apalachee Bay before continuing to the breeding grounds.

SUMMERING HYPOTHESES IN LIGHT OF THE PRESENT INVESTIGATION

A. *Late northward and early southward migration.*

Data from the "cooperative summering shorebird survey" (Loftin, *op. cit.*) showed that there was considerable movement of boreal shorebirds through Florida during the first two-thirds of June. With few exceptions, considerably larger numbers of shorebirds involved were noted in the first and second 10-day periods of the month than in the last. It seems probable that the majority of so-called summering records made in the first 15 or 20 days of June represent late migratory birds and not summer residents.

In a few instances, there was marked increase in the numbers of birds seen per field trip in the middle of the month over the first and last 10-day periods of the cooperative survey. Such was the case with the Sanderling and Black-bellied Plover, indicating migration into Florida in mid-June by these species. These latecomers have mostly migrated out of the state by the last third of the month.

The return of migrants, presumably from the north, by the first of July on Apalachee Bay was demonstrated by the re-appearance of color-marked dowitchers after their absence for about a month. Flocks of early returners also included many dowitchers in alternate plumage such as had not been noted since about mid-May. Less direct evidence (such as their sudden re-appearance along with the above dowitcher flocks, condition of gonads and condition of plumage) suggests that several other species of boreal shorebirds return to Florida by late June or early July. Among these are the Semipalmated Plover, Ruddy Turnstone, and Western Sandpiper; still others are probably involved.

Whether such early fall migrants have been north to the breeding grounds is problematical. In the case of the dyed dowitchers, the time between the apparent departure and return of some of them was so brief that one wonders if such birds only indulged in a short northward flight before returning.

B. *Breeding in the winter range.*

No evidence of breeding behavior was noted in any boreal shorebird on Apalachee Bay in summer. No nests or young were discovered. The only "hints" concerning the possibility of breeding on Apalachee Bay came from a specimen of Semipalmated Plover and one of Black-bellied Plover, both of which were producing spermatozoa. All other specimens taken in June proved to have quite undeveloped gonads or were obviously migratory.

C. *Passing austral winter to the north.*

No comment can be made on this possibility on the basis of observations at Apalachee Bay or from the "cooperative survey." This problem must be attacked "from the bottom up," i.e., by exploration of subantarctic regions of South America during the breeding season. Banding and color-marking in the austral region might prove of great importance in investigating this problem.

D. *Handicapped individuals.*

No obviously ill or senile birds were observed in summer (or at any other time) on Apalachee Bay. A few injured birds of various species were seen, but their numbers were insignificant in comparison with the apparently non-handicapped individuals of the same species present.

E. *Summering due to immaturity.* Immaturity seems to account for a large share of the summer records of boreal birds made at Apalachee Bay. It was demonstrated by color-marked individuals and other means that the majority of Short-billed Dowitchers remaining on Apalachee Bay in June were sexually undeveloped birds in basic plumage which hatched the previous summer. Even these birds, however, apparently left the region before the end of June. The fact that these color-marked birds returned in July shows that they do not depart southward to winter quarters when they disappear in June.

Due to difficulties in discerning age of birds with any degree of accuracy, and to limited collections and observations, the role of immaturity in the summering phenomenon is not so clear among other species. Limited evidence does indicate, however, that one-year-old individuals comprise an appreciable proportion of the June records in Florida of the Semipalmated Plover, Black-bellied Plover, Ruddy Turnstone, Knot, and possibly others.

CONCLUSIONS

That any individual boreal-breeding shorebird remained on Apalachee Bay through the summer was not demonstrated; in fact, the limited data indicated otherwise. Summering records from Apalachee Bay seemed to concern for the most part (1) adult birds whose normal migration lapses into the summer, and (2) young, sexually undeveloped birds which tend to linger into the summer, perhaps due to lack of sufficient physiological stimulus for migration. At least in the case of the Short-billed Dowitcher, even the loitering first-year birds apparently undergo some migration later in the season. Physical or physiological handicaps were not seen to be significant factors in summering. No

evidence of local breeding or of wintering from a possible austral breeding ground was noted.

The high incidence of sexually undeveloped first-year birds on the Florida coast late in June and into July in some instances suggests that the normal life cycle of many shorebird species may require at least two years before breeding ability is attained. This situation obtains among many or most of the Laridae, a group closely related to the shorebirds. Intensive investigation of the life cycles of these species is needed to clarify this important point.

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GENERAL NOTES

Capturing Blackbirds and Starlings in Marsh Roosts with Dip Nets.— The capture of starlings, grackles, and cowbirds in substantial numbers for banding has been accomplished by means of a wide variety of traps, and banding literature covering the past four decades carries many references to effective traps and their use. Capturing large numbers of red-winged blackbirds by these procedures, however, has proved to be a much more difficult task, and the best results have been obtained with lights. In 1957, Neff and Meanley (*Bird-Banding* **23**(4): 154-157) described the use of powerful headlamps in capturing several thousand blackbirds in tree-brush roosts in Arkansas. More recently, personnel of the Patuxent Wildlife Research Center, Laurel, Maryland, have developed and successfully used a large light trap in capturing thousands of birds in such roosts.

Methods employing light, however, have not worked well in roosts in densely vegetated marshes in Colorado, and birds using these roosts have not been trapped successfully at feeding areas. Needing substantial numbers of blackbirds and starlings for laboratory research and for banding, the authors developed a technique employing long-handled dip nets for capturing birds in marsh roosts. Favorable conditions, as follows, are necessary for optimum use of the method: 1) a dark night, 2) vegetation low enough so that the net can be wielded freely, 3) footing firm enough to permit the netter to move swiftly for some distance, and 4) a dense concentration of roosting birds. These conditions frequently prevail in Colorado cattail marsh roosts in winter, particularly when freezing weather encrusts the mud and shallow water, and birds roost densely for warmth. Under such conditions, birds merely "roll away" in a dense wave when disturbed and seldom fly more than a few yards. A rush of 10 to 30 yards will generally place the netter in the midst of a wave of birds, and a quick sweep of the net may ensnare as many as 40 birds. On the initial trial of this method, the authors captured 550 redwings and starlings in 3 hours.

On moonlit nights, birds flushed at greater distances and flew farther than on dark nights. They were, however, reluctant to leave the marsh and could be herded from one spot to another. The birds then were taken most successfully by stationing several netters near a concentration of birds, and having one member of the party slowly drive the birds until they settled within range. No more than 25 birds were netted in any single sweep under such conditions, but the driving technique permitted the capture of birds in mild weather, in marshes with water a foot or more deep, and in vegetation so tall and dense that a netter could not move rapidly.