

Article IV.—A STUDY OF THE ATLANTIC *OCEANITES*

CONTRIBUTIONS FROM THE BREWSTER-SANFORD COLLECTION.—2¹

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Plates I to III

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INTRODUCTION

In the spring of 1916, during the course of the Brewster-Sanford Expedition to the littoral of South America, Mr. Rollo H. Beck collected forty-nine specimens of *Oceanites oceanicus* off Bahia, Brazil. Twenty-one of these birds were identified as males and eleven as females. In the cases of twelve more, the sex is doubtfully designated, the symbols on the labels being followed by question marks; in the remaining five instances the collector found the sex quite indeterminable.

The fact that so expert and reliable a field naturalist as Mr. Beck was unable to ascertain, by examination of the gonads, the sex of 35 per cent of these specimens is, in itself, strong evidence of the immaturity of the birds. Careful inspection of the skins has established that every one of the forty-nine is, indeed, a young bird of the year, wearing, therefore, the juvenal plumage—a plumage that has apparently not been heretofore described or even recognized. This discovery has led me to bring together the following data, based partly upon my own field observations and partly upon a study of more than two hundred skins in the collections of The American Museum of Natural History (including the Brewster-Sanford Coll.), the Brooklyn Museum, the Museum of Comparative Zoology, Dr.

¹ See Bulletin Amer. Mus. Nat. Hist., XXXVII, Art. 35, 1917, for the first Contribution.

Jonathan Dwight, and Dr. L. C. Sanford. To the owners and custodians of these several collections, I herewith express my thanks for permission to make use of the material.

To Mr. Howard H. Cleaves I am deeply indebted for permission to publish several of the interesting photographs of petrels which accompany this article, and to Dr. Paul Bartsch, of the U. S. National Museum, and Dr. W. G. Van Name, of the American Museum of Natural History, for examining the stomach contents of *Oceanites* collected in the tropical Atlantic.

PLUMAGES AND MOLTS OF *OCEANITES OCEANICUS OCEANICUS* (KUHLMANN)

Mathews, in 'The Birds of Australia,' allocates the type station of Kuhl's *Procellaria oceanica* to the South Atlantic, off the Mar del Plata. Since I shall demonstrate below, in contravention of Mr. Mathews's expressed opinion, that one and the same form of *Oceanites* occurs in both the North and South Atlantic, migrating from subantarctic breeding grounds to the coast of Labrador or beyond, I employ here the trinomial of the Atlantic race, the name which is applicable to the bird of the American Ornithologists' Union 'Check-List.'

The grayish-black nestling of *Oceanites oceanicus* has been described by Hall (1900) and others. In agreement with most small Tubinares, this species passes from the downy stage into a plumage substantially resembling that of the adult but differing, as I shall now show, in several particulars. In the first place, juvenal birds, as exemplified by the Bahia specimens, and others, have fresh, black, unworn quills and body feathers, and gray, white-edged greater coverts, at a time of the year when the feathers of old birds show the maximum effects of wear and fading. But the juvenal birds differ just as definitely from adults in new plumage — that is, from adults taken in the northern autumn after completion of the annual molt — for, in a greater or less degree, each of the forty-nine Bahia skins and each of a small series of juvenals from other, widely separated localities is characterized by *conspicuous white edgings on the feathers of the belly, and by a whitish spot in the lores*. When we add to these striking features the fact that young birds, at least up to the middle of their first summer (July); have relatively weaker bills than the adults, with a less pronounced unguis, slighter bones in the tarsi and wings, and smaller claws on the toes, we have a combination of characters by which birds of the year may be recognized until they have attained full growth, which seems to be within six or seven months of hatching. Thereafter they can still be distinguished by conditions of the plumage to be described below.

The Bahia birds were collected on April 15, 27, 28, and May 1, 1916, which implies that they can have been hardly more than two months out of the nest. Practically all of these specimens have slightly shorter wings and tails, and smaller bills, than mature birds collected by the writer at the same season and in nearly the same latitude, but further offshore. They show like indications of immaturity when compared with adults from many other points in the South and North Atlantic; but, on the other hand, they agree in appearance and dimensions with other juvenal specimens collected at approximately the same season of the year in both near and distant localities. As might be expected, they resemble in all particulars eight young birds in the collection of the Museum of Comparative Zoology which were taken at Rio Janeiro in May 1865 by J. A. Allen and N. Dexter.

In general, the feathers of sea birds undergo relatively slight disintegration when compared with those of terrestrial species; but a study of all the juvenal specimens of *Oceanites oceanicus oceanicus* at my disposal shows that the new, soft plumage is subject to rather rapid fading and wearing away, especially after the end of April. Whereas adults collected even several months after the molt are often without noticeable traces of wear, except near the bend of the wing where the feathers undergo constant abrasion during the flexure, the juvenals show much more pronouncedly the destructive effects of aging. The sequence of the changes may best be expressed by a description of specimens illustrating successive stages.

First stage. The forty-nine Bahia skins are very uniform as regards freshness of plumage, the feathers being perceptibly blacker and less frayed than those of juvenals taken only six weeks later in the year. The series exhibits considerable differences in size, as will be shown below; some specimens may well be a number of weeks older than others, for the breeding and nesting season of *Oceanites* is known to stretch through a period approaching five months. In all of these skins, the whitish tips of the greater coverts form a distinct band on the wing. The white edgings on the feathers of the belly are always present, though their extent varies from a small patch to an area covering the entire ventral surface caudad from the breast. The loreal spot is formed by prevaillingly white feathers in this region. In most of the birds this spot is conspicuous, but in a few it is obsolete. Apparently, it ultimately becomes concealed by an overgrowth of the feathers in front of it.

Second stage. A single juvenal, taken off the coast of the French Congo on June 20 (cf. p. 126), resembles the April and May Bahia skins but is somewhat bleached and worn. The white margins on the belly are inconspicuous because the feathers have frayed out. The white spot in the lores, however, is prominent. The quill feathers have begun to disintegrate at their edges.

Slightly more advanced in growth, but showing rather less general wear of the plumage, is a specimen from the coast of Massachusetts (L. C. Sanford Coll., 4089, ♂, 7 miles E. N. E. of Pigeon Cove, July 1, 1911). This bird has a well-marked, though small, area of white edgings on the belly, but the loreal spot is partly concealed. The rusty tinge on the under surface shows the result of two full months of longer life than the Bahia birds.

Third stage. Two specimens from Long Island, N. Y. (Amer. Mus. Nat. Hist., 68167, ♀ Aug. 2, 1891, and Brooklyn Mus., 11050, ♀ ?, Aug. 8, 1915) show decided effects of wear and weathering. The entire plumage is of a dingy, threadbare aspect and the whitish edgings have abraded away from the greater coverts, leaving the latter bleached and frayed. Considerable disintegration has taken place in the vanes of the remiges. The white edgings of the ventral feathers and the white mottling of the lores are still discernible.

From this point onward, I am unable to trace with certainty the plumage changes of juvenal *Oceanites*. North Atlantic specimens of first year birds are rather rare in the collections that I have examined, and it will be necessary to await an opportunity to study September, October, and November juvenals before the season of the first molt can be positively determined. August specimens show no trace of the beginning of a molt, whereas most adults practically complete the process before the end of that month. I am strongly of the opinion that the birds do not molt at all during their first year but retain their juvenal feathers until the second spring. On this hypothesis I interpret the following facts. (1) The old quill feathers of most adult migrant *Oceanites*, collected before or during the summer molt, are relatively only slightly abraded, in spite of the many months of wear that they have undergone. (2) Certain summer birds, however, which have already acquired by molt most of their adult plumage, have the old primaries and rectrices extraordinarily worn and faded, presenting, therefore, a strong contrast to the usual condition and an apparent exception to the general rule that the flight feathers of pelagic birds show only slight or negligible effects of wear. Now the status of such birds as come under this second heading may be explained on the assumption that they are yearlings undergoing their first molt. The last few months of more than a year's wear would be expected to prove highly destructive to a juvenal quill. The result of attrition in the primary feathers of certain specimens so greatly exceeds the effect visible in other specimens that one may circumstantially correlate the difference with a difference in age of the respective groups of birds.

The sequences of plumages of the adult *Oceanites* are shown very clearly in a series of skins now before me. To begin with breeding specimens,

twelve birds from the island of South Georgia (December to February) have only moderately worn plumage, except that the greater coverts of the wing are much frayed and show almost no trace of white or gray edgings. The feathers of the under surface are rather rusty.

April adults from the tropical South Atlantic resemble the South Georgia birds, but, as might be expected, the wear and fading of the contour feathers have progressed a step further. I can find no sign of incipient molt in any one of eight skins. A specimen from the western North Atlantic (Amer. Mus. Nat. Hist., 55092), taken on May 5, has still shabbier body plumage,

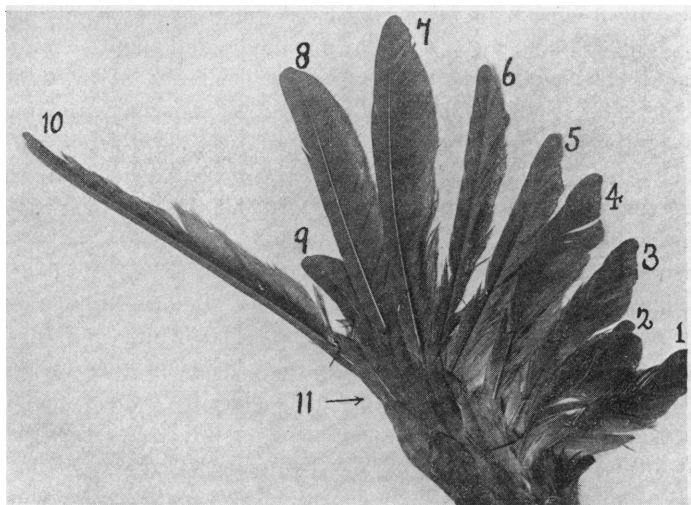


Fig. 1. Molting wing of *Oceanites* (Brooklyn Mus. 11048, Long Island, N. Y., Aug. 8, 1915). The tenth (outermost functional) primary is an old quill, the others are new; only the first (innermost) has attained its full growth. If the tenth primary also had been dropped, the wing would have appeared abnormally short, and the seventh quill would have been for some time the longest.

although the quills are in surprisingly good condition. This bird, too, had apparently not commenced its molt when it was taken.

In two examples collected off Cape Hatteras on June 15, we finally see the molt well under way. One of these (Amer. Mus. Nat. Hist., 96855) has the first, new, ensheathed feathers scattered through the old plumage of its breast and back. It has lost several of its old secondaries, as well as the innermost primaries, and these are being succeeded by young quills. At the same time, new, grayish, greater coverts, with broad white edges, are appearing.

A series of birds taken between July and September along the coasts

of New York and New England shows that the loss and replacement of the flight feathers is finished by about the end of August but that the renewal of the body plumage is slow and irregular and may not be wholly accomplished before the end of September. The remiges are lost before the rectrices, the primaries dropping out approximately by twos (i. e. one in each wing) from the inner towards the outermost feathers, which are the last to go. The order of molt of the tail feathers is, in general, from the central towards the outer feathers nearly or quite symmetrically, the coverts molting at the same time.

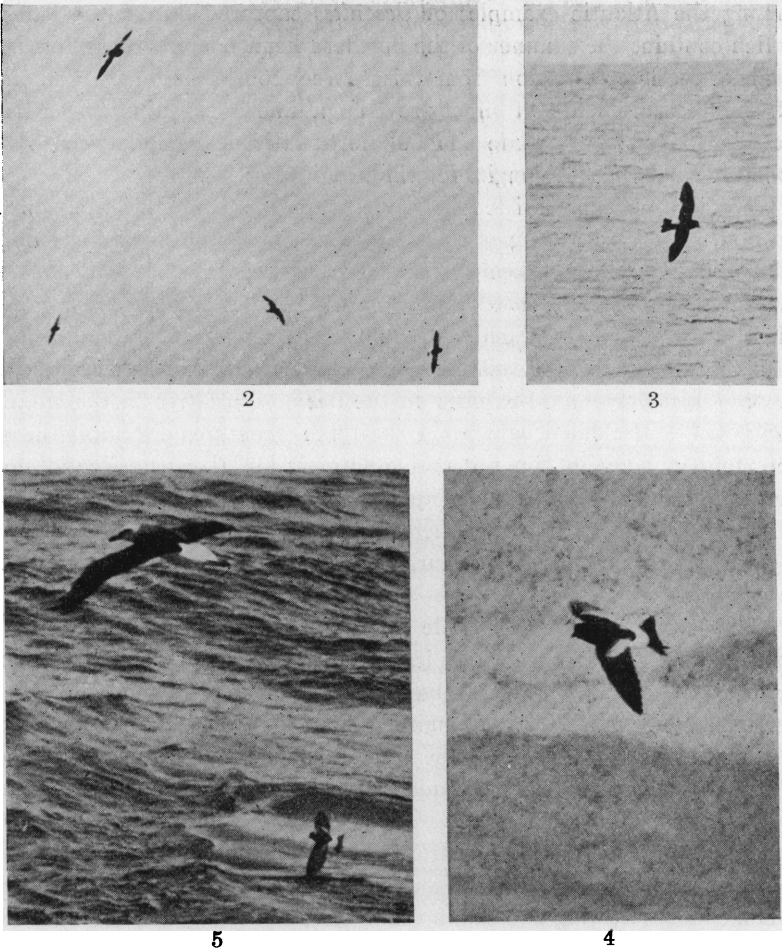
Completion of the primary molt leaves *Oceanites* excessively short-winged. Several August specimens before me have wing-lengths of only 130 mm., which is fully 25 mm. shorter than the maximum, and about 15 mm. shorter than the average, for wings with full-grown primaries. Growth after the molt requires at least a month, for not until the last of September is the normal proportion of the primaries (outermost = third from outermost) restored and the wing length again equal to its measurement before the molt. The bird then has its best physical equipment for the long migration to the breeding grounds.

Salient features of the molt are well illustrated by several of the photographic illustrations published with this article. Before closing the discussion, it remains only to speak of the irregular white markings which frequently appear in the Atlantic *Oceanites*. Some of these are perhaps albinistic, as where specimens from many localities have one or more prominent white feathers on the back, breast, or head. Another case, more difficult to explain, is exemplified by September birds from the eastern tropical Atlantic (Amer. Mus. Nat. Hist., 132474 and 132477) which have white spots on the ends of the outermost rectrices on each side.

TAXONOMIC STATUS OF THE ATLANTIC BIRD

Mathews (1912) states his conclusions concerning the Atlantic *Oceanites* in the following words:

Bonaparte named the North Atlantic form *Procellaria wilsoni*, and recent students have accepted this as a synonym of *O. oceanicus*, typical, concluding that the bird breeding in the Antarctic circle ranges north and becomes common in the North Atlantic in the Antarctic winter, i. e., the northern summer. From my researches I conclude that this is an unsatisfactory explanation, and confidently anticipate the discovery of breeding colonies of a subspecies of *O. oceanicus* on some of the West Indian or North African islands, which would bear the name of *O. o. wilsoni* (Bonaparte).



Figs. 2 and 3. *Oceanites* in the wake of a steamer. Photographed between New York and the West Indies, May 27 or 28, 1912. The molt of the distal secondaries and proximal primaries shows clearly in the bird in Fig. 2.

Fig. 4. *Oceanites* in the wake of the brig *Daisy*, lat. $21^{\circ} 56' S.$, long. $35^{\circ} W.$, Oct. 27, 1912. Completion of the growth of the remiges is indicated by the even edge of the wing, as contrasted with the nicked wing of the bird in Fig. 2. The new, white-tipped greater coverts form a distinct band.

Fig. 5. *Oceanites* in lat. $44^{\circ} 57' S.$, long. $39^{\circ} 51' W.$, Nov. 16, 1912. The bird in the background is an albatross (*Thalassogeron culminatus*).

From the foregoing discussion of the molt and growth of feathers, it is evident that very great variation in length of wing and tail is to be expected among the Atlantic examples of *Oceanites* captured during the half-year which contains the summer of the northern hemisphere. Being forearmed against possible confusion from this source, consideration of a summary of the measurements of ninety-seven specimens taken in the Atlantic between 55° south latitude and 50° north latitude, and between 8° east longitude and 75° west longitude, will be of interest.

The first specimens listed in Table I are the 12 adult birds collected at South Georgia during the breeding season of the antarctic summer. Eleven of these were taken by the writer between Dec. 1, 1912 and Feb. 6, 1913; the other is dated Feb. 10, 1914. All were probably breeding birds, for the sexual organs were enlarged, and two of the males (Amer. Mus. Nat. Hist., 132480, and Brooklyn Mus., 10718) are specifically stated to have had bare brood-patches on the belly. Variation in the length of wing, tail, and culmen, which are the three structures ordinarily showing the greatest range in dimensions, is relatively less than that found among pelagic migrants, such as make up the bulk of the average museum series of *Oceanites*; but this fact is merely an expression of the uniformity, as regards state of plumage and maturity, that breeding birds might be expected to exhibit.

The second series in the table comprises twelve birds collected by the writer at two stations in the tropical Atlantic and at diametrically opposed periods of the year. Four of these were taken in the vicinity of 12° 30' north latitude and 25° west longitude, south of the Cape Verde Islands, on Sept. 23 and 24, 1912. The remaining eight are from 3° 15' south latitude and 33° 40' west longitude, northeast of Cape San Roque, Brazil, and were shot on April 19, 1913. The average measurements of both males and females of this small series are very close to those of the South Georgia specimens, the only noticeable, though slight, discrepancies being the greater average length of wing and tail in the tropical females — a condition wholly produced in this instance by pronounced individual variation in two out of the eight April birds. As suggested above, a wider range between the maxima and minima of wing and tail dimensions is generally to be expected of birds collected at sea than of breeding examples.

The third set of measurements refers to the juvenal, Bahia specimens in the Brewster-Sanford Collection and, in interpreting these, we must consider the factor of uncompleted growth as of more importance than those of individual or seasonal variation. A casual examination of these birds, some of which are characterized by short wings, puny bills, and strikingly delicate tarsi, indicates that many had not yet grown to their full size,

TABLE I.—SUMMARY OF MEASUREMENTS OF 97 SPECIMENS OF OCEANITES FROM THE ATLANTIC

		WING	TAIL	EXPOSED CULMEN	WIDTH OF BILL AT BASE	TARSUS	MIDDLE TOE AND CLAW
		mm.	mm.	mm.	mm.	mm.	mm.
7 males from South Georgia	Minimum	142	60	11.9	6	34	26.4
	Maximum	148	66.4	13	6.6	36	28.7
	Average	145.7	62.2	12.5	6.3	34.8	27.7
5 females from South Georgia	Minimum	140	59.6	11.8	6	33.1	26
	Maximum	146	68	13	6.5	36	28
	Average	144	62.9	12.5	6.2	34.4	27
4 males from the tropical Atlantic	Minimum	141	60.5	12.3	6.2	33.6	26.5
	Maximum	152.6	64	12.8	6.6	35.2	28
	Average	144.9	62.3	12.7	6.5	34.5	27.3
8 females from the tropical Atlantic	Minimum	144	62	12.3	6	34	26
	Maximum	154.5	69	13.1	6.8	36	29.6
	Average	147.7	64.9	12.8	6.5	34.8	28.1
21 males from Bahia, Brazil	Minimum	136	56.5	11.5	4.9	32	25.3
	Maximum	149	68	13	6.7	36.7	29.6
	Average	143.1	61	12.2	5.8	34.7	27.1
11 females from Bahia, Brazil	Minimum	136.5	57.5	11.5	5.2	31.3	26
	Maximum	151	66	12.8	6.4	36.1	28
	Average	143.8	62.4	12	5.8	34.1	26.8
1 female from the French Congo		140	62.2	11.1	6.2	32.7	25.8
2 males from the southern coast of the United States	Minimum	142	64.5	12.7	6.7	35	27.2
	Maximum	143.7	66.2	13	6.8	35.4	28.2
	Average	142.9	65.4	12.9	6.7+	35.2	27.7
2 females from the south- ern coast of the United States	Minimum	146	67.2	12.8	6.1	34	27.2
	Maximum	149.4	69	13.2	6.7	34.6	28
	Average	147.7	68.1	13	6.4	34.3	27.6
12 males from Long Is- land, N. Y.	Minimum	137.4	58.3	11.6	5.7	33	25.8
	Maximum	150	66.5	13	6.5	36.4	29.6
	Average	144	62.7	12.4	6.1	34.4	27.2
9 females from Long Is- land, N. Y.	Minimum	140	57	12	5.9	33.7	26.7
	Maximum	155.5	68	13.2	6.7	36.8	30
	Average	146.2	62.8	12.5	6.2	35	28
9 males from the coasts of New England and New- foundland	Minimum	137.5	59	12.6	5.9	33.6	27
	Maximum	148	65	13	6.9	35.7	29.2
	Average	143	62.7	12.7	6.4	33.7	28.1
6 females from the coasts of Massachusetts and Maine	Minimum	141.6	63	12.4	5.5	33.6	26.3
	Maximum	153	73	13.2	6.9	35.5	29
	Average	145.5	66.4	12.8	6.3	34.7	27.7

an inference confirmed by the low minimum figures in the columns of the thirty-two specimens tabulated. Nevertheless, the maximum dimensions of the most advanced birds in the series fully equal those of adults in fresh plumage and so serve to pull up the averages. The interesting point is that, if only the *average* measurements of these thirty-two juvenals were considered, the unusually low figure for the mean width of the maxilla at its base would alone give a clue to the immaturity of the specimens. In *Oceanites* the total extent of variation in the width of the bill may equal 32 per cent, or approximately one-third, of the average width. I have found that slow development of the bill is typical of many other Tubinares as well, and it is easy to mistake for taxonomic distinctions variations in the structure of this organ which are in reality due to age.

The fourth set of measurements is from a single female petrel (Amer. Mus. Nat. Hist., Belgian Congo Exp. Field Cat. No. 1) collected by Messrs. Lang and Chapin off the coast of French Equatorial Africa, on June 20, 1909. This specimen is small and it has an extremely weak unguis on its bill. These features, added to those of its juvenal plumage (cf. p. 119), give the skin a sufficiently different facies from the well-known adult form of *Oceanites oceanicus oceanicus* to serve an ornithologist who was unacquainted with the characters of the juvenal bird as the type of a new race. Fortunately, the skins from Bahia furnish the key to a comprehension of the African specimen's status: the latter proves to be wholly comparable with other young birds collected while on their first northward migration.

In the fifth series of measurements, we deal with four specimens from the southern Atlantic coast of the United States (Amer. Mus. Nat. Hist., 55091, 55092, 96854, and 96855). One bird of each sex was taken on May 5, 1887, in latitude 26° N., on the route to Pará; the other pair was collected off Cape Hatteras, N. C., on June 15, 1913. Both males chance to have rather short wings, but nothing in the appearance or dimensions of any of the four specimens suggests that they are to be differentiated from tropical or subantarctic representatives. The same statement applies with equal force to the petrels included under the sixth and seventh groups of the table. Here are summarized the measurements of thirty-six birds collected on the coast of New York, New England, and the Maritime Provinces, between the dates of July 1 and September 10. It is during this period that the major part of the molt of remiges and rectrices is undergone, but I have excluded figures referring to birds which had within a brief time dropped the last primary. The maxima and minima therefore represent chiefly the range of individual variation and the effect of wear.

Further evidence in favor of the racial unity of Atlantic birds from widely scattered localities is to be found in the close approximation between

the average measurements of the seven groups of skins which I have used in the statistical treatment and the figures denoting the mid-point between the extreme measurements in the same series of specimens. This is shown in the following table, together with the percentum ratio of the total extent of variation to the averages for each structure. In preparing this table, the sexes have not been segregated, because the data before me give no hint of a constant sexual discrepancy in size.

TABLE II

	WING	TAIL	EXPOSED CULMEN	WIDTH OF BILL AT BASE	TARSUS	MIDDLE TOE AND CLAW
	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>
Average of the 12 sets of averages in the table on p. 125, based upon 97 specimens of both sexes, including juvenals.	144.9	63.7	12.6	6.3	34.6	27.5
Mid-point of range of measurements of 97 specimens.	145.8	64.8	12.2	5.9	34.1	27.7
Variation on either side of mid-point.	9.8	8.3	1.1	1	2.8	1.4
Minima of 97 specimens.	136 ¹	56.5	11.1	4.9	31.3	25.3
Maxima of 97 specimens	155.5	73	13.2	6.9	36.8	30
Percentage of the average to which the total extent of variation amounts.	14%	26%	17%	32%	16%	10%

From all of the above, it appears that we have exact quantitative evidence for believing that a form of *Oceanites* referable to a single subspecies ranges through both the North and South Atlantic Oceans. The specimens studied comprise birds killed during every month of the year excepting March, October, and November, and the observed variation in color and condition of plumage, as well as the range in size and the places of capture, are most

¹ Immediately after molting the outermost primary, some birds have wing-lengths as low as 130 mm.

reasonably explained not by Mr. Mathews' theory but on the generally accepted hypothesis of a post-nuptial migration of the Atlantic birds to the northern ocean from breeding grounds in the Far South.

South Georgia may be positively designated as a nesting station of typical *Oceanites oceanicus oceanicus* (Kuhl), although we have no present means of knowing where the bulk of the incalculable myriads of *Oceanites* in the Atlantic has its source. Since *Oceanites* breeds also at the South Orkneys, and presumably at Bouvet Island in the eastern South Atlantic, the South Sandwich group, and in parts of the American quadrant of the antarctic mainland, it is quite within the range of likelihood that some future "student of speciation," to use a phrase now popular among California naturalists, may be able to demonstrate a constant differentiation, which would have evolutionary significance, between the South Georgia representative and birds breeding elsewhere. Clarke (1913) describes the terrifically severe struggle for existence to which the breeding Wilson's petrel of the South Orkneys is subjected, and it might be supposed that such a factor would tend to accelerate and fix variations of taxonomic worth. In the meanwhile, however, any attempt to draw subspecific distinctions upon the basis of Atlantic specimens obtained through pelagic collecting would be worse than useless. In dealing with such variable avian species as *Oceanites oceanicus*, large series of birds collected at the various breeding grounds, preferably on the nests, would be the only safe materials for a revision of the systematic relationships.

Breeding specimens of *Oceanites* being scarce in collections, it is desirable to publish here the full data for the 12 South Georgia skins. The number is, of course, too small to cover the probable extent of variation (Lönngberg (1906), in fact, records the wing-length of one breeding male from South Georgia as 138 mm., which is lower than in any of my specimens), yet it is unlikely that the addition of even a very much larger number of skins would substantially change the *average* measurements of the twelve examples listed in Table III.

Even aside from the conclusions that I have drawn from a taxonomic study, Mathews' confident belief that breeding colonies of a subspecies of *Oceanites oceanicus* remain to be discovered on some of the West Indian or North African islands surely has less to substantiate it now than it had when he committed his faith to print. The Antilles have been raked over with considerable thoroughness and several expert ornithologists have recently made independent explorations there in special search of Tubinares. Bannerman (1914) has published his admirable studies on the petrels of the North Atlantic islands and has shown that *Oceanites* is no more than a straggler or visitor at the various insular groups between the Cape Verdes

TABLE III.—MEASUREMENTS OF BREEDING SPECIMENS OF OCEANITES OCEANICUS OCEANICUS

COLLECTION AND NUMBER	Sex	LOCALITY	DATE	COLLECTOR	WING	TAIL	EXPOSED CULMEN	WIDTH OF BILL AT BASE	TARSUS	MIDDLE TOE AND CLAW
A. M. N. H., 132479	♂	South Georgia	Dec. 1, 1912	R. C. Murphy	mm. 146.5	mm. 66.4	mm. 13	mm. 6.4	mm. 34.5	mm. 28
Brooklyn Mus., 10714	♂	"	"	"	142.5	60	12	6.6	35.8	26.4
A. M. N. H., 132480	♂	"	Jan. 30, 1913	"	142	61	12.5	6.3	34	28.7
A. M. N. H., 132482	♂	"	Feb. 6, 1913	"	147	60	13	6	36	28.7
A. M. N. H., 132481	♂	"	"	"	148	62	12	6.4	34	26.7
Brooklyn Mus., 10718	♂	"	"	"	146	63	11.9	6	34.6	28
Brooklyn Mus., 10717	♂	"	"	"	148	63.2	12.8	6.1	35	27.6
A. M. N. H., 132483	♀	"	Dec. 1, 1912	"	145	64	12	6.5	35.2	28
Brooklyn Mus., 10715	♀	"	"	"	144	59.6	12.9	6.1	36	26.7
Brooklyn Mus., 10716	♀	"	Feb. 6, 1913	"	145	62	11.8	6.1	33.7	26
A. M. N. H., 132484	♀	"	"	"	140	61	12.7	6	34	28
Brooklyn Mus., 11179	♀	"	Feb. 10, 1914	J. G. Correia	146	68	13	6.3	33.1	26.4

and the Azores.¹ If further testimony be needed to prove beyond a doubt that the Atlantic *Oceanites* has its nesting grounds exclusively in the Far South and that it does make migrations of tremendous extent — regardless of how restricted in distribution certain other races of *Tubinares* are known or believed to be — the following personal log of the observed migration of the bird will supply it.

MIGRATION OF THE ATLANTIC OCEANITES

In 1912 and 1913, the writer made a voyage to South Georgia under the auspices of the Brooklyn Museum and The American Museum of Natural History. Migrating Wilson's petrels were observed throughout most of the itinerary, which was as follows.

I left New York on a Quebec Line steamer on May 25, 1912, arriving at St. Thomas, W. I., on May 31 and at Barbados on June 8. On the 17th of the latter month I joined the New Bedford whaling brig *Daisy*, which proceeded to Dominica. Beginning on July 2, we cruised for four weeks in the waters about Dominica and Martinique, and then started northward, passing Sombbrero on Aug. 2. On Aug. 18 we reached latitude 32° N., in approximately 58° west longitude, and then turned sharply towards the east. Between Sept. 16 and 18 we lay in the harbor of St. Vincent, Cape Verde Islands, and on Oct. 16 made a call at the Brazilian island of Fernando Noronha. Thereafter we sighted no land until Nov. 23, when we reached South Georgia in latitude 54° S. On March 15, 1913, we began the northward voyage and saw land only once, Trinidad Islet in 20° 30' south latitude, until we arrived again at Barbados on May 8. From here I took the first steamer home, reaching New York on May 24, 1913.

The approximate track of the *Daisy's* cruise is shown on the map on p. 131, and the daily reckonings of the brig's position for the greater part of the voyage are recorded in Table IV.

On the morning of May 26, 1912, just after we had left New York, Wilson's petrels picked up the track of the steamer, and they followed us throughout the first fifteen hundred mile lap of the journey, which brought us within sight of Culebra, W. I. This was on May 30, and between that date and Sept. 23, in latitude 12° 46' N., longitude 25° 05' W., I met with

¹ In a popular book, 'Birds That Hunt and Are Hunted,' 1899, the author, Neltje Blanchan, states (p. 71) of *Oceanites oceanicus*, "In the latter month [February] the author has seen the birds in great numbers off the Azores, but, unhappily, not on them. . . .; however, it is not unlikely they nest on these islands. . . ." There is no assurance that the author was capable of distinguishing *Oceanites* in flight from *Thalassidroma pelagica* or one of the species of *Oceanodroma*. Indeed, few persons have had sufficient field experience with the birds to make this discrimination at ordinary distances.

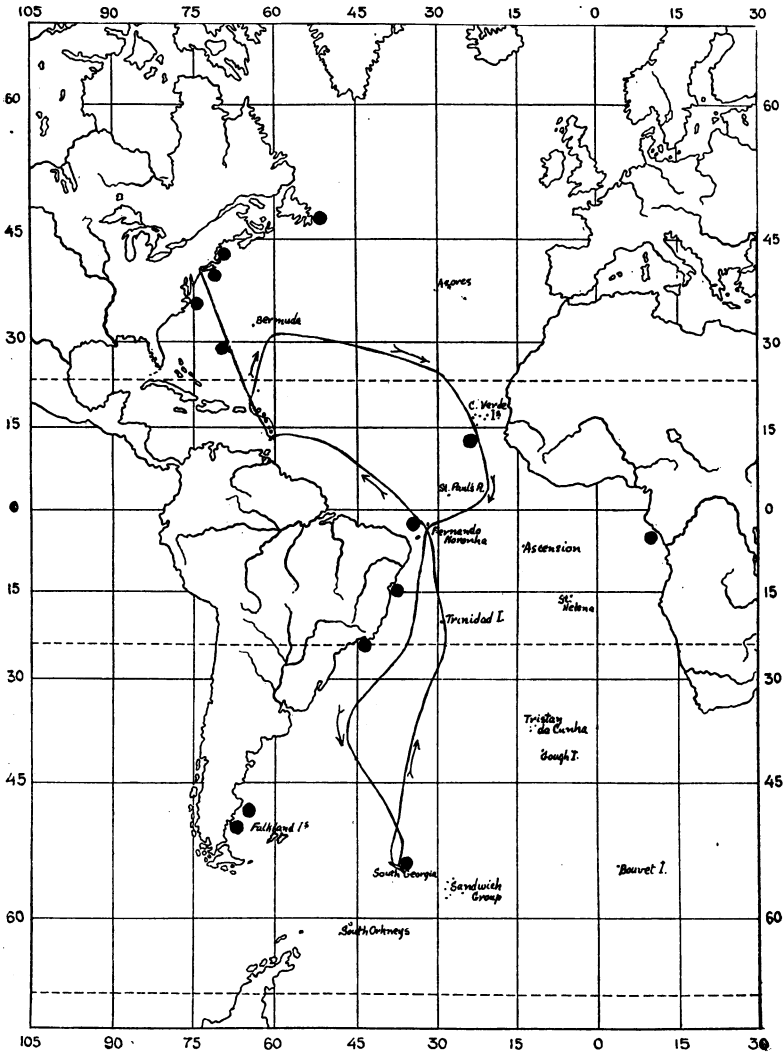


Fig. 6. Base map of the Atlantic showing the approximate course of the brig *Daisy* during the South Georgia Expedition of 1912-1913 and the collecting stations (designated by black dots) of the specimens of *Oceanites* used in the preparation of this paper.

no examples of *Oceanites*. During the interim I had travelled from the southern Antilles northward over the course stated above, and eastward across the Atlantic.

Quiet weather, even long, monotonous calms, characterized the sub-tropical summer of our North Atlantic cruise, so that conditions were favorable for pelagic observations; but, although I spent many hours at the masthead of the whaleship and noted other birds, including two species of Tubinares, I saw no Wilson's petrels until we met them late in September, as southward-bound autumn migrants, south of the Cape Verdes. Here, on Sept. 23, in the latitude given above, I shot three specimens and saw others.

From this date forward, throughout the course of the South Georgia Expedition, Wilson's petrel was noted almost daily. The remarkable record of observed migration, with exact oceanic positions, is summarized in Table IV. For a period of sixty-three days on the southward journey, *Oceanites* was recorded on all but two. During fifty-five days on the northward trip, the species was not observed on a total of fifteen days, but these were well scattered through the entire period. Between Barbados and New York, in May 1913, the birds were again seen almost daily. The extent of this single established record of continuous migration covers, therefore, 90 degrees of latitude, and the breadth of the tropical Atlantic. It should prove beyond all doubt that the *Oceanites* of the North and South Atlantic is one and the same.

The following pelagic notes are drawn largely from my field journal. The latitude and longitude of the numerous records have been omitted, but may be determined by comparing the dates with those in Table IV.

On May 26, 1912, the day after the steamer had left New York, about a hundred Wilson's petrels pursued us until dark. During the second day they dwindled off to a dozen, but next morning they were with us in countless numbers. As far as the eye could reach they stretched astern, coursing back and forth, dipping and rising with the undulations of the sea, crossing and recrossing our wake, but never wandering more than a few hundred feet on either side. When they turned, their wing tips sometimes cut the water; only rarely would a bird rise as high as the horizon and stand out for an instant against the sky. Fully half the time they glided on rigid wings, and even when they beat the wings it was in a gentle and leisurely manner; yet we were making fourteen knots an hour. The petrels, with their zig-zagging and circling, flew at least three times as far.

The main front of this black-and-white army kept itself about twenty yards astern but two or three individuals repeatedly flew alongside so closely that they almost brushed the rail, going ahead as far as the broken

water at the bow and then dropping behind. The high-browed heads were drawn in close to the breast, the bills pointing slightly downward. The feet, with webs closed, extended straight out beyond the tail. Whenever a bit of food was cast over from the steamer, or whirled from beneath the screws, the petrels, with spread tails, and feet "pumping" together, descended one in the track of another and hopped and danced merrily on the very top of the insubstantial ocean. As the vessel drew away from such a hungry group — a flurry of long, raised, fanning wings and white-banded bodies — they looked not like birds, but rather like flocking butterflies. They probably overlooked nothing edible in their course, so thoroughly did they scour about, and whenever one dropped to enjoy its find the others congregated at the signal. Frequently they fell back out of sight while feeding.

By sunset each day the ranks of the petrels were greatly thinned out and by half past seven o'clock, at the latest, even the most persevering had dropped behind. On the calm evening of the third day at sea I actually saw the last few birds drop onto the ocean. In the morning they rarely overtook us before eight o'clock. How did they find us again? Certainly not as Mosely (1892) says, by "tracing the ship up again in the early morning by the trail of *débris* left in its wake." If the petrels rested from eight o'clock in the evening until three next morning, we would have gained a hundred miles. And, considering the rapid dissipation of the refuse from a steamer, particularly when the Gulf Stream is crossed, there would be no trail that even a bird could follow. It is possible that the petrels located us by merely continuing a straight course. There is the perhaps more likely alternative that we were followed not by the same band for the whole trip, but by new ones made up each morning of roving birds. I have presented evidence (1914), however, to show that in the South Atlantic our whaling brig was sometimes pursued by the same individual *Tubinares* for days together.

After noting the petrels near Culebra, there comes a break in my journal of the species until autumn, in the eastern Atlantic. Much of what follows is taken verbatim from my notebook, without even a change of tense.

Sept. 23, 1912. Excessively hot and calm. At 8 A.M. several Wilson's petrels were seen, so I lowered the dory and shot three, along with a specimen of *Stercorarius parasiticus*. The petrels were about all day, feeding wherever there was a "slick" upon the surface. They did not come near the brig. Their "walking on the water," as I observed it, is not strictly a walking or running — one foot after the other — but rather a two-footed hopping or pattering, both webs coming down together as they spring along the surface.

The last sentence expresses my entire experience as regards the "walking" of *Oceanites*. Portrayers of birds, from Audubon to Fuertes, have drawn this petrel with the legs in an alternating, or truly running position, and the much used term "walking on the water" surely gives a mental picture of foot-after-foot progression. In 1907 I first noticed that Wilson's petrels feeding in New York Harbor did not "walk" in the expected manner, although they often "stood" on the water. Since then I have been partic-

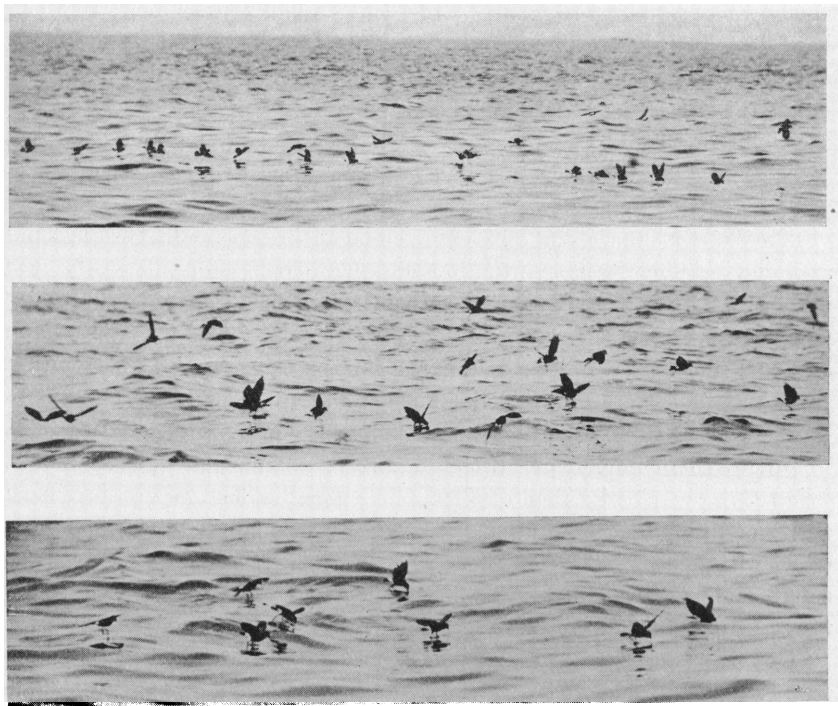


Fig. 7. *Oceanites* feeding in the Lower Bay of New York, a quarter mile northwest of the extreme point of Sandy Hook, N. J., in early August, 1915. Photographs by Howard H. Cleaves.

ularly keen to observe this point, but I have never yet seen one "walk" or "run." It is of interest that Mr. Cleaves' photographs of Wilson's petrels, including a reel of cinematograph scenes, show the birds in every attitude of "hop, skip, and jump," but never progressing foot after foot.

Negative evidence is, of course, seldom conclusive, but if it be true that *Oceanites* never "walks," possibly *Thalassidroma* does. The original "walking" story is that of Dampier (1703), and it doubtless refers to birds

of one of the two genera named above, or to *Oceanodroma*. He wrote (Voy. III, pt. 1, p. 97): "As they fly . . . they pat the Water alternately with their Feet, as if they walkt upon it; tho' still upon the Wing. And from hence the Seamen give them the name of Petrels,¹ in allusion to St. Peter's walking upon the Lake of Gennesareth."

Sept. 24. Calm. Six Wilson's petrels seen. They did not come near the almost motionless brig, but flew about singly.

Sept. 27. Wilson's petrels seen in company with *Oceanodroma leucorhoa* and a race of *Æstelata mollis*. Elsewhere (Auk, 1915, pp. 171-172) I have described the striking difference in the usual style of flight of *Oceanites* and *Oceanodroma*. The latter "flies with rapid, 'leaping' strokes, quite unlike the alternations of gliding and synchronous flutters which characterize the flight of *Oceanites*. An observer who has once had the good fortune of watching the two species together can thereafter distinguish them almost as far away as the birds can be seen" (Murphy, loc. cit.).

The Wilson's petrels are difficult to see against water ruffled by the wind, and they seldom rise above the horizon of a person standing on the deck of a ship. They therefore often rush into one's field of vision and, quite unexpected, appear a few yards away after the observer has been vainly scanning the water in the distance. During calms, when the ocean is silvery, the birds are silhouetted against it and are visible from afar.

Sept. 30. Rainy morning, with lightning; no birds in sight. The weather cleared early, and petrels appeared about nine o'clock. They followed more closely than heretofore, coming under our stern to feed, and even flying forward around the bow. Occasionally I heard them utter a low, rasping note. During the forenoon two of them settled on the water astern and remained there with wings folded for some time. Possibly they were a mated pair affected by the approach of the breeding season.

Oct. 1. None was with us in the morning, but four birds accompanied our whaleboats back to the brig, after the boats had pursued a distant school of sperm whales. The petrels then remained near us for the remainder of the day. Sometimes, when flying low, they would strike backward against the water a dozen times or more with both feet.

Oct. 7. A dark day, with brisk, southwesterly winds and frequent

¹ This also raises the moot question of the source of the name "petrel," which was informally discussed at the November, 1917, meeting of the American Ornithologists' Union. In the present spelling, Dampier's use of the word constitutes its first printed appearance in any language (cf. Murray's Engl. Dict.). Flawes, however, in his Account of a Voyage to Nova Zembla, 1676 (Vol. I, 1694, p. 181) reports that he "Saw many Pitterals about the Ship." This earliest orthography suggests that the name may be derived from the fact that birds of the group "pitter-patter" on the water, which is just what *Oceanites* does. The spellings "petrel" and "peterel" were perhaps made *à posteriori* to fit the popular tradition that Dampier cites.

showers. Wilson's petrels have been with us daily since Sept. 29, but now they are present in legions. We are followed by a veritable cloud of them, and they come so near that, as I sit in the whaleboat lashed across the *Daisy's* stern, I can almost touch some of them with my hand. They skip along the surface as they approach, giving a vigorous kick on the lee side with both feet whenever they touch the water. When they "stand" to feed, the wings are held rigidly and they face the wind; the potential momentum necessary to keep them from being blown away is furnished by the webs, the legs sinking to the heel as they work backward in unison.

Usually silent, they have peeped and chattered considerably to-day — sounds not unlike those made by a nestful of young chickadees when the parent arrives with food. I have been feeding the petrels small bits of pork fat, upon which they swoop voraciously, making a graceful rise to check their course before alighting, and then kicking spray over one another in their eagerness to secure the unusual dainties. I purposely cut off several pieces of fat too large for the birds to swallow readily, and the petrel that captured one would be pursued by his complaining fellows, who besieged him whenever he stood over his tidbit and tried to bolt it. One piece of fat that I cast over had so much of the heavy skin attached that it sank. Three or four petrels had gathered as it fell, but the food was a foot under water before they reached the spot. While I was preparing to throw over another piece without rind, I was astonished to see several birds bob up from the depths, one of them holding the sunken morsal in its bill. Upon experimenting further, I found that they dived most skilfully to a depth of several times their length, leaping forth dry and light-winged from the water into the air.

Apparently the diving powers of some species of Mother Carey's chicken have been noted before, for Newman, in 'Montagu's Dictionary of British Birds' argues circumstantially to the contrary. "We believe," he writes, "the assertion that this bird is expert in diving to be without foundation; the form and levity, too (from having a large proportion of feather, like the Gulls), should alike render them incapable of immersion. They have not the form for pursuing their prey under water, nor do they appear to possess the means of diving; it is from the surface of the sea that they collect their sustenance." All of which shows how far astray deductive reasoning may lead the unwary.

Oct. 8. By 8:30 A.M., four or five of *Oceanites* had gathered in our wake. The numbers soon increased to several dozen, which remained through the day. The water was rather choppy, and the petrels did not skip from crest to crest of the waves, but followed the swell, and pattered in the troughs as much as on the tops.

Instead of wearying toward the close of their day-long flight, they became doubly active about sunset. For the most part they ceased to hunt for food; instead they dashed hither and thither, ecstatically shooting upward almost as high as the mast, then plunging down at great speed, passing often within a yard of my head, as barn swallows do about their nests. I have little doubt that this extraordinary exuberance was correlated with physiological changes due to the near approach of the breeding season.

About six o'clock they deserted the brig for a few minutes in order to flit about a school of jumping skip-jacks (*Carangidae*), showing that they were still interested in satisfying their appetites. They accompanied us until after dark; I made out the last one just before seven o'clock.

Oct. 9. The petrels took a half holiday. They were plentiful during the morning, but we saw none after noon.

Oct. 10. On this never to be forgotten day, when for nine hours I toiled in a thirty-foot New Bedford whaleboat "fast" to a harpooned and extraordinarily active sperm whale, a whimsical incident occurred. Many Wilson's petrels were feeding over the same area of ocean with numbers of whales. While we were in the midst of a school of whales, it chanced that a petrel dropped to the water to dance and feed just as a whale rose to breathe. The whale shot up suddenly, and the bird, pattering on the sea, happened to be at the precise spot where the whale's blowhole broke the surface. The petrel was literally blown from the nostril of the leviathan and was projected several feet into the air by the blast of steaming breath.

On Oct. 14, 1912, the *Daisy* crossed the equator in longitude 28° W. My observations on the migrant *Oceanites* in the southern hemisphere have already been published in a general ornithological diary in *The Auk* (1914). From the latter article a number of the following notes are drawn.

Oct. 17. A small flock of *Oceanites* followed us in a rather desultory fashion. They did not approach near to the stern. These birds seem to gain confidence with numbers, for when in large flocks they often fly very close. In general, the rougher the sea the more petrels we have about us and the closer they fly to the ship.

Often, as they patter along for some distance on set, slightly depressed wings, they resemble small scurrying quadrupeds. When flying rapidly, and suddenly perceiving food, they sometimes stop their headway by flopping down as though wounded and striking their breasts upon the surface of the water. Perhaps it is this habit which gave rise to the old tradition that the smaller petrels obtain part of their sustenance by skimming the water with the feathers of the breast, and so collecting the oily surface film. Mudie, in 'The Feathered Tribes of the British Islands' (1844), writes that the storm petrels "dash along until they have loaded their

feathers, and then they pause upon the wave and remove the oil with their bills."

Nov. 3. Strong, southwesterly winds, swinging by west towards the north and increasing in violence throughout the day. In the stiff breeze I noticed that the Wilson's petrels always *faced* the wind, diagonally if not directly, with extended, motionless wings, whenever they pattered upon the water. During the afternoon we were running before the wind, and the pursuing birds always wheeled and turned away from our stern before descending to feed. While they were flying with the wind, on the other hand, they kept quite clear of the water.

The greatest numbers of *Oceanites* observed at any time during the entire voyage were seen Nov. 9, in latitude $36^{\circ} 46'$ S., and Nov. 18, in $48^{\circ} 39'$ S. The first date was during relatively calm weather; the second was marked by a terrific southwesterly gale. During both of these days the Wilson's petrels about the ship numbered thousands.

My reasons for believing that identical individuals of this species sometimes followed our vessel for periods aggregating many days, are mainly those of analogy. I have already recorded (Birds of the South Atlantic, 1914) how two groups of sooty albatrosses (*Phaebetria*), one of them including a bird which had a readily recognizable peculiarity of plumage, followed our whaleship for four or more days at a time. Single birds of smaller species often associated with the flocks of *Oceanites* in our wake. On Nov. 4, in latitude $33^{\circ} 28'$ S., an example of *Fregetta grallaria* joined the Wilson's petrels. From that date until Nov. 19, in latitude 50° S., I saw never more than one bird of this species, but for periods as long as three days continuously one was always within sight. Therefore I am strongly inclined toward the belief that the *Fregetta* noted at such times was indeed one identical individual, and that the flock of *Oceanites* with which it consorted was likewise composed mostly of the same birds day after day.

Although Wilson's petrels followed us northward from South Georgia, March 15 to May 8, 1913, as may be seen from the entries in the table of records, I made few new observations on the habits of the birds. During a calm on April 19, just south of the equator, I lowered a dory and collected a small series. By throwing grease on the water I attracted many of the petrels close to my boat, and I noticed that two or more of them were one-legged. In Long Island waters I have also seen Wilson's petrels minus a leg, and Mr. Cleaves has observed others during his motion picture work in New York Harbor. Such birds seem to be not in the least incapacitated.

Mr. Beck secured his series at Bahia, latitude 13° S., in approximately the same season as that of my last pelagic collecting. He had come to that

city from Rio Janeiro at the end of February, before the migration period of Wilson's petrel, and had not seen a single bird on the trip; but from April 15 to May 1, 1916 he found them plentiful off Bahia, feeding in the tidal streaks from a half mile to ten miles offshore, flying about independently rather than flocking, and often resting on the water during the calm mid-day. The birds that he collected were, as previously noted, all juvenals, which are doubtless more given to sitting on the water than are the adults.

The fact that all of Allen and Dexter's birds (Mus. Comp. Zool.), collected at Rio Janeiro in May, as well as the single June specimen from the African coast, are likewise juvenals, whereas all my spring specimens taken far offshore are fully adult, suggests that the young of *Oceanites* may follow the coast-lines of the southern continents during their first northward migration. This hypothesis would account for the apparent segregation as regards age, and would not be out of harmony with known facts in the life history of many other species of birds. That the adults, on the other hand, do not preferably migrate along the conformation of land masses is known from abundant data, of which the records in this paper are a part. The naturalists of the *Scotia* (Clarke, 1913a) found the species in numbers in the vicinity of Gough Island, south of the Tristan Group, in April 1904, the season of northward migration. This locality lies about as far from a continent as it is possible to go in the South Atlantic.

Where the majority of the young spend the first northern summer is not known. Certainly they constitute only a small fraction of the birds occurring along the coast of the eastern United States; otherwise the series of skins in American ornithological collections would not consist so overwhelmingly of adults. The juvenal specimen which was taken off the equatorial African coast on June 20 shows that not all the young birds pass across the tropics, even though examples have been obtained as far north as Newfoundland.

Of equal uncertainty is the whereabouts of the first-year birds during the northern winter, or breeding season. The fact that the young undergo no molt until after they have left the coast of the United States, and probably not until their second summer, tends to confirm an inference drawn from examination of breeding birds from South Georgia, namely, that the yearlings do not breed. Perhaps, therefore, they spend their entire first year at sea, a supposition which would explain the occurrence of *Oceanites* in the tropical Atlantic during November (cf. Salvin, 1896) and other winter months.

As regards the adults of *Oceanites*, the meager facts available indicate that all, or most of them, penetrate far into the North Temperate Atlantic during the summer months, and spend the lull between the ebb and flow of the long migration chiefly in the western part of that ocean, between the

latitudes of Bermuda and Greenland. It is surely significant that I saw no examples of so widespread and conspicuous a bird, during the *Daisy's* long transatlantic cruise, south of the thirtieth parallel of north latitude in the months of July, August, and part of September, especially as my experience is in accord with the observations and conclusions of other naturalists, notably Dr. Glover M. Allen and Mr. John Treadwell Nichols. The former authority (1905) writes of birds of this species seen during a voyage to the Bahamas:

Petrels were seen from the first morning out of New York [June 24, 1904] until we had crossed the Gulf Stream off Hatteras. During this time large flocks of from thirty to fifty birds were occasionally seen, while a few were almost constantly observed flying zig-zag back and forth over the steamer's wake some hundred yards or more astern. After entering upon the Gulf Stream and the warmer waters to the south, only one or two single birds were seen, the last being in about lat. 28° N. Cory, while cruising among the Bahamas at an earlier time of the year, found petrels abundant at a short distance off the coast, which might indicate that the birds were at that time passing through the latitude of the Bahamas and by July, when we made our trip, the main flight had passed still farther to the northward. On our return voyage, July 28-31, the first petrels, three or four in number, were observed after crossing the Gulf Stream off Hatteras Light, but they did not become common until we were within some 300 or 400 miles of Sandy Hook.

Mr. Nichols has kindly supplied me with the following note in manuscript:

In the western North Atlantic in summer the Wilson's petrel seems to occur on the continental shelf, and out across the Gulf Stream to its eastern edge, and to be little more than a straggler further east on the deep, currentless, central area. It thus is not common about Bermuda.

In August 1906, sailing E. S. E. from New York, it was constantly present to about lat. 38° N., long. 68° W. (Aug. 10), where the last few birds were seen. On the previous day, in 40° N., and 70° W., they had been common and the following day, in 38° N., 64° W., they were gone. Again, in 1914, crossing the Gulf Stream diagonally S. S. E., at a time when the species was common in New York Harbor, a few were seen as far out as about 35° N. 72° W. (July 5) and none further. Returning later over the same course we picked them up at about 37° N., 72° 30' W. (Aug. 9). In 1909, bound east, Mother Carey's chickens, which I have every reason to believe were this species, were common at about 41° N., 55° W. (May 14), and few, if any, were seen further east.

The species is known to be rather rare in the vicinity of the British Isles, while it is abundant in midsummer in the Gulf of St. Lawrence, on the Grand Banks, and along the Labrador coast. It has been recorded from Hudson's Strait in September, and it is likely that some birds wander northward into Baffin's Bay. If so, the pelagic range extends as far north of the equator as the breeding grounds lie south of it.

NOTES ON THE BREEDING OCEANITES OF SOUTH GEORGIA

Lönnberg (1906) records, on the authority of Sörling's observations, that Wilson's petrel occurs at South Georgia during all of the southern summer, disappearing about the end of March. The birds had not yet returned when Sörling departed from the island early in October 1905. The dates of arrival and departure for the South Orkneys, seven degrees of latitude farther south, are given by Clarke (1913) as Nov. 11 and March 23, respectively.

The *Daisy* reached South Georgia on Nov. 23, 1912, at which time *Oceanites* was already common in the fiords, and enormously abundant on the whaling banks forty miles offshore. On Dec. 1, just at dusk, great flocks were seen feeding in King Edward Cove, Cumberland Bay. Thereafter we found them in the bays wherever we went and, although I failed, in spite of patient search, to discover a nest, many of the birds shot were undoubtedly "hot off the egg," having bare brood-patches in addition to enlarged testes or ovaries.

At the Bay of Isles, near the northwestern end of South Georgia, the crew of the *Daisy* engaged extensively in sea elephant hunting, with the result that quantities of blubber lay soaking in the water alongside the vessel much of the time. This attracted flocks of *Oceanites*, especially during gales, when groups estimated to comprise as many as six hundred birds often foraged for globules of oil washed out of the soaking blubber.

Over the headlands and tussock flats along the Bay of Isles, the birds were frequently seen flying back and forth like martins, but I never spied one in the act of alighting at its nesting site. On the morning of Feb. 1, I watched a single bird for a quarter of an hour while it dashed to and fro and up and down before a steep, rocky bank near the bay. It flew precisely as though it were hawking winged insects, which was, of course, very unlikely. For several minutes it was chased in all its gyrations by a pipit (*Anthus antarcticus*), the latter trying vainly to keep close behind it. Finally it flew off without disclosing the nesting site, if indeed it were in the neighborhood.

A most interesting point about *Oceanites* at South Georgia is a fact of an ecologic nature, namely, that this species, practically alone among the smaller water birds, enjoys absolute immunity from the aggressiveness of the skua (*Catharacta*). Lönnberg has recorded this before but my observations of the actual conditions were none the less a source of considerable surprise to me. The skua is to most of the birds, large or small, a wanton and relentless ogre. It is forever watching for neglected young of pen-

guins, cormorants, and even albatrosses; it attacks at sight the endemic teal, the diving petrel, and the *Prion*. To the last two species, it is such a terrible foe that they dare not show themselves in the fiords or over the land between daylight and dark; nevertheless, the skuas succeed in capturing so many of them that their dismembered carcasses strew the ground over their subterranean colonies. But *Oceanites* flies about with impunity in broad daylight. I have seen one almost brush a skua with its wing as the latter bird stood on a rock in the kelp fields, and both species sometimes fed together when stormy weather had washed away pieces of seal blubber from the supply floating alongside our brig.

Why does the skua ignore this petrel? It is surely as conspicuous as the diver (*Pelecanoides*) and seemingly less difficult to capture than the fleet-winged *Prion*. The protective character cannot be in an offensive taste, for the skua is quite ready to pounce upon and devour a dead or disabled *Oceanites*. Possibly, however, its body affords too small a morsel to warrant any effort on the skua's part. It is noteworthy that the latter grants a like immunity to one other still smaller bird, the pipit (*Anthus*).

Wilson's petrels were present in apparently undiminished numbers when we left South Georgia on March 15, 1913. As the *Daisy* stood to sea from Possession Bay, I had occasion to make a trip in a whaleboat to a neighboring whaling station for the purpose of posting mail. Shortly after sunset we started on a ten-mile pull to the brig offshore, and, as soon as we were well out from the land, our boat was continually in the midst of innumerable small Tubinares flocking over the quiet sea. *Oceanites* made up a considerable proportion of these birds, which fluttered all about us. Their indistinct forms kept flashing above the skyline, but their myriad numbers were revealed still more by a chorus of twitterings and the soft unbroken sound of winnowing quills.

At this season the northward migration had commenced, for, as related above, the petrels accompanied the *Daisy* on her voyage towards home.

NOTES ON SUMMER VISITANTS NEAR NEW YORK

Wilson's petrels are variably common in the Lower Bay of New York and in the waters about Long Island, including the Sound, from early May until September. Their presence close inshore is very irregular, but in August 1907, for instance, they entered New York Harbor in conspicuous numbers and during the first week of August 1915, when they were notoriously abundant at many points near New York, Chapman (1916) saw twenty or more in the Hudson River opposite 130th Street. Earlier in the

same summer, I had noticed numbers of them near the western end of Long Island Sound. On Aug. 18, 1916, I saw one feeding in the Great South Bay off Babylon, Long Island. At other times I have seen birds fly into the inlet of Jamaica Bay, and several observers have reported them inside Fire Island Inlet (cf. Nichols, Murphy, and Griscom, 1917). In June and July their molted flight feathers, recognizable from the persistent Tubinarine odor no less than from their appearance, are often much in evidence along the drift-lines of the south shore of Long Island.

On Aug. 4, 1915, I witnessed a remarkable flight on the south coast, near Montauk Point. A heavy, southeasterly storm, with much rain, had raged all morning of this day. During the afternoon the wind veered to the south, and a huge surf battered the coast in many lines of breakers. At four o'clock, Mr. Francis Harper and I saw an interminable line of Wilson's petrels flying eastward near shore, skimming along the troughs in the midst of curling waves. They frequently stopped to feed, and some of them flew within sixty yards of the beach. We shot three that came within range while we stood with the surge washing over our feet, and the wind quickly whisked their bodies ashore. The stream of petrels, all making towards the east, extended offshore as far as we could see; at times scores of them must have been passing us every minute. By five o'clock, the main body of this flight had gone by, for thereafter we saw only a few stragglers.

The three birds collected on this occasion were rather thin, unlike the plump specimens taken at South Georgian breeding grounds. The testes of the two males were minute and slightly pigmented.

Four days later, Aug. 8, we collected additional specimens from a launch off Montauk Point, and found that the petrels were utterly indifferent to the report of a gun and that it was easy to decoy them within camera range by allowing the dead bodies of two or three to float upon the water.

FOOD OF OCEANITES

Statements regarding the food of the smaller petrels have usually been of a very general nature. The fact that these birds eat oil and fat wherever they are available is no indication that they rely upon, or often find, such substances on the open ocean. Wilson's petrel is, of course, readily attracted around a boat by oil, grease, or ground fish thrown on the water, and Mr. Cleaves used cod-liver oil as bait in obtaining some of his unusual photographs. I have seen them feed upon putrescent fish and the fly maggots washed out of it. Usually they deal with food in small particles, but I have

watched a bird in New York Bay feeding upon a large chunk of refuse — “standing” on the water, with quivering wings held high, while it tugged and pulled at the food as a robin might pull at a worm.

Stomachs examined at South Georgia contained chiefly blubber or scraps from the whaling stations or sealing vessels, food supplies produced, therefore, through the agency of man. The birds have been seen, however, feeding in flocks about the carcass of a dead whale at sea, picking up small bits of carrion dropped from the beaks of *Macronectes* and other large species. Long Island birds that I have dissected have had only greenish slime in their stomachs, and the label of a one-legged Long Island specimen in the American Museum Collection states “Contents of stomach very fine sea weed, green and grass-like.”

At sea, Wilson’s petrels profit by the destructive work of schools of predaceous fish, as noted in my narrative. Probably this habit accounts for the frequent loss of a leg; a barracuta might readily snip off one or both feet while a petrel was engaged in gathering scraps from the slaughter. Birds that lose both feet never live to tell the tale, but some of those less seriously maimed evidently recover.

The stomach contents of three Wilson’s petrels collected south of the Cape Verdes in September 1912, consists of six otoliths of small fishes, a large assortment of crystalline lenses apparently from the eyes of small fishes, traces of algæ and minute crustaceans, some cinders of volcanic ash, and what appear to be Dipterid eggs. The last may have been laid upon the stomachs on shipboard after they had been removed from the bodies. Probably such small forms of life as make up the remainder of this list constitute the bulk of the petrels’ food during their pelagic wanderings.

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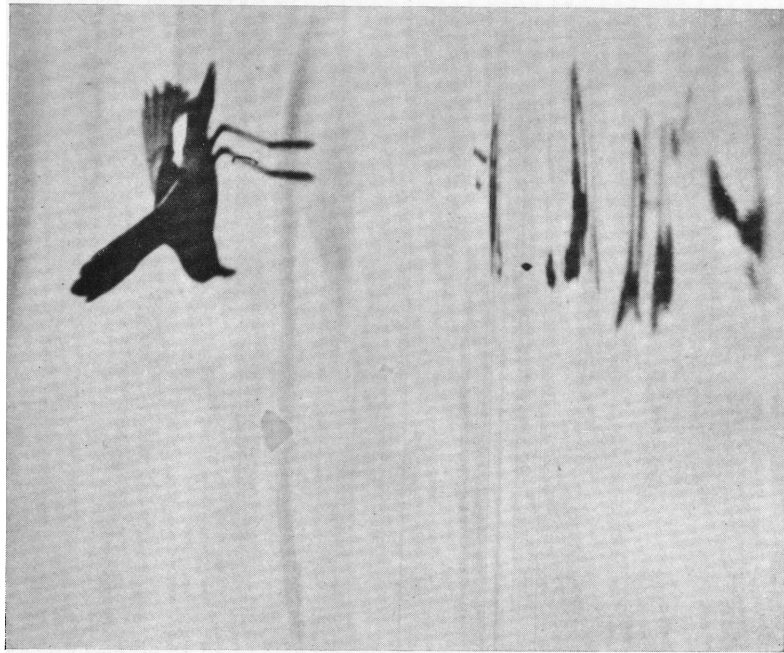


Fig. 1. *Oceanites* hovering above the water, Lower Bay of New York, Aug. 9, 1914.

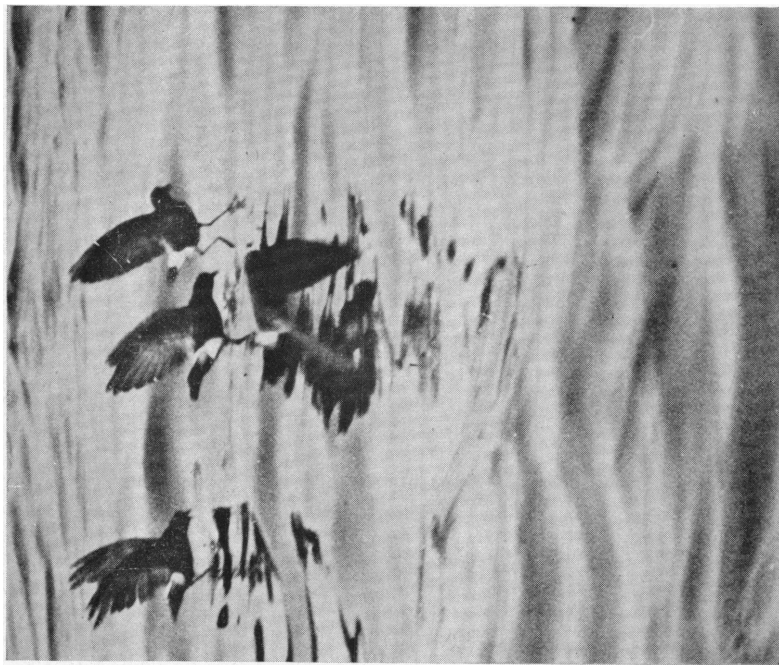
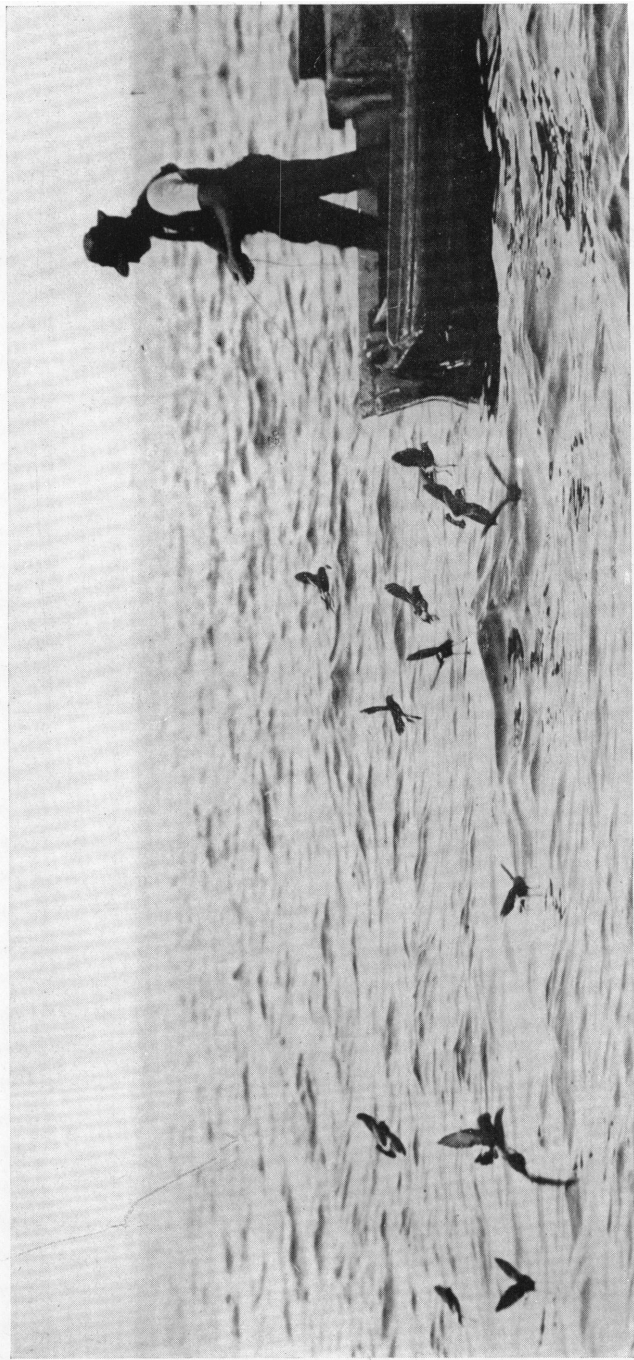
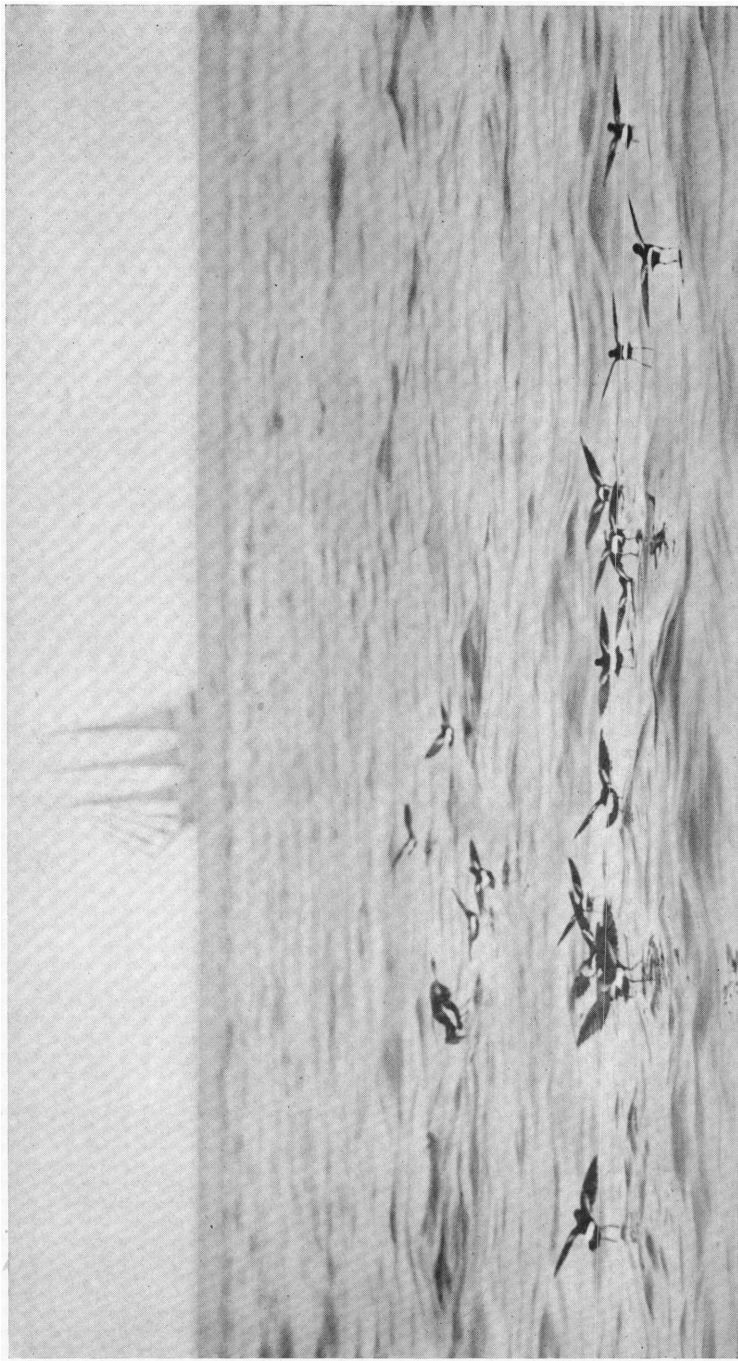


Fig. 2. *Oceanites*, Lower Bay of New York, early August, 1915. At least two of this trio have completed the molt of the remiges. In the petrel at the left, the new quills have not yet grown to normal proportions.

Both photographs by Howard H. Cleaves



A flock of *Oceanites* attracted by the "chum" (ground menhaden) of a blue-fisherman, New York Bay, early August, 1915. The bird in the background is carrying a piece of fish in its bill. Photograph by Howard H. Cleaves.



A flock of *Oceanites* skipping along the surface of New York Bay, Aug. 9, 1914. Photograph by Howard H. Cleaves.

