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THE PRESENT STATUS OF THE DOUBLE-CRESTED CORMORANT ON THE COAST OF MAINE¹

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Plates 19-22

GREAT changes in the distribution and abundance of certain sea birds of the islands on the coast of Maine have taken place in recent years. For example, the first records of the nesting of the Great Black-backed Gull, *Larus marinus*, were made on some of the more eastern islands as recently as 1931. Today this gull is abundant and nests on many islands along the entire coast line from the Bay of Fundy to the Isles of Shoals and beyond. The Herring Gull, *Larus argentatus smithsonianus*, likewise has so greatly increased in numbers that the U. S. Fish and Wildlife Service has been forced to take definite steps in controlling this bird which at the turn of the century was threatened with extermination. Other species have experienced similar changes but none have been more spectacular than the extraordinary comeback of the Double-crested Cormorant, *Phalacrocorax auritus auritus*, commonly known on our coast as the "Shag."

The first accounts of the cormorants on the New England coast are to be found in the writings of Captain John Smith (1616) who visited this region in 1614. Later, others, including William Wood (1634), Thomas Morton (1637), and John Josselyn (1674), indicated that the cormorants were breeding here in large numbers 300 years ago. For reasons that are not clear, the cormorant was completely exterminated as a breeding bird on the Maine coast by the nineteenth century. Everett Smith (1883) wrote of the Double-crested Cormorant as follows: "None breed on the coast of Maine, although some are here all summer. These are chiefly immature birds which keep together in flocks and habitually resort to the same ledges each night to roost."

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DOUBLE-CRESTED CORMORANT.—THE MARBLEHEAD COLONY ON JULY 5, 1944. THERE WERE AN ESTIMATED 2000 YOUNG IN THE ENTIRE COLONY, MOST OF WHICH WERE IN NEARLY COMPLETED JUVENAL PLUMAGE. A FEW WERE ABLE TO FLY.

Records of an attempt of this bird to reestablish itself as a nesting bird on the Maine coast are contained in an article written by Ora W. Knight (1896). On July 2, 1895, he visited Black Horse Ledge, off Isle Au Haut, where he found two nests with three eggs, one nest with a single egg, and other nests in process of construction. He writes further: "Mr. Charles K. Reed informs me that in June 1892 and 1893 he took sets of the Double-crested Cormorant eggs near Isle Au Haut, and beyond doubt he visited the same colony of birds." In another paper, Knight (1900) mentions visiting Black Horse Ledge on June 23, 1896, as follows: "We found a number of Shags on the ledge, but only two nests were to be found. One of these was incomplete and the other showed the imprint of three eggs, and as we afterwards learned that other collectors had been there, the eggs undoubtedly taken by them. . . . Owing to the attentions of collectors it is somewhat doubtful if this species continues to breed many more years along the Maine coast, as the only breeding colony I have any knowledge of is on the point of extermination." That this attempt of the cormorants was quickly extinguished is borne out by visits of other naturalists to the ledge in subsequent years. Black Horse Ledge was even deserted as a roosting place of the cormorants before 1907.

Mr. A. H. Norton made annual visits all along the coast during the years from 1902 to 1923 and, although many cormorants were found roosting on various ledges and islands, not one was found to be nesting. About 1925 the Cormorants started nesting again and in a surprisingly short time firmly established themselves as breeding birds on the coast. In 1931, Mr. A. H. Norton and Robert P. Allen (1931) found the following breeding colonies: Old Man Island, 1,000 adults; Pulpit Rock, 100 adults; Spoon Ledge, 40 adults; Marblehead Rock, 600 adults; and Old Hump Ledge, 8 adults.

In 1935, Howard L. Mendall published his comprehensive paper on the Homelife and Economic Status of the Double-crested Cormorant. In this report he includes the colonies listed by Norton and Allen and states that in 1935 the Marblehead colony had increased to 700 birds and the Old Hump Ledge colony to 400 birds. He also reported 78 nesting birds on Crescent Ledge in 1934, but this colony was abandoned in 1935.

During the past three years it has been my good fortune to serve as a Collaborator with the U. S. Fish and Wildlife Service in connection with the Herring Gull Control Project. I wish to express my gratitude to Mr. S. B. Locke, Regional Director, who made it possible for me to have this exceptionally fine opportunity to study the sea-bird

colonies of the entire Maine coast and to record the changes that are taking place. This paper is concerned primarily with an account of the recent increase and present status of the Double-crested Cormorant but other species will be considered in subsequent reports.

In 1935, there were but six known Cormorant colonies and only one of these, Old Hump Ledge in Muscongus Bay, was west of Penobscot Bay. In 1943, we found prosperous colonies along the entire coast from Old Man Island, our most eastern sea bird colony, near Grand Manan Channel, New Brunswick, Canada, to Duck Island, Isles of Shoals just inside the New Hampshire State boundary off Portsmouth.

The chief objective of the U. S. Fish and Wildlife trips was to visit gull-inhabited islands; the cormorant colonies were incidental—hence some of the latter probably were missed, but even so, 27 colonies were visited which contained a total of 9,118 nests representing that many pairs of birds. Furthermore, since each year the time of visiting the islands on which the cormorants were nesting was comparatively early in the season, the last ten days of May and the first three weeks of June, the numbers of nests were probably smaller than they would be at the height of the nesting season. A very conservative estimate of the number of adult Double-crested Cormorants nesting along the Maine coast in 1943 is 10,000 pairs or 20,000 individuals. There are at least 5,000 non-breeding birds which roosted on the numerous ledges and islands all along the coast, making a total population of 25,000 cormorants. The numbers have now increased to the point where many complaints are being made against this bird by the fishing industry for its alleged depredations on fish. A movement is on foot in this state to pass legislation taking the cormorant off the protected list. If an unbiased investigation does prove the birds are doing a real damage, it would seem advisable to have the matter of control placed under the direct supervision of the state or federal departments rather than to allow the indiscriminate shooting of the birds by irresponsible persons. The latter course would tend to undo much of our work of conservation and it would prove to be disastrous to other sea birds such as the Eider Duck which nests on many of the same islands inhabited by the cormorants.

The fishermen probably have sound grounds for their complaints although their statements are sometimes exaggerated. There seems to be some question as to the reported damage by the cormorant. H. L. Mendall (1935), who conducted studies on the economic status of the cormorant in Maine, states: "The charge that the Cormorants

are detrimental to the fishing industry are shown to be largely unfounded, the greater part of the bird's food being made up of forms which are of little or no use to the fishing industry. In some cases, the birds are a benefit through their fondness for undesirable fish."

The cormorant, unfortunately, was not included in the list of migratory non-game birds protected by the Migratory-bird Treaty Act and Regulations ratified in 1916. The protection of this bird in Maine comes under the jurisdiction of the State Department of Inland Fisheries and Game.

To present the status of the Double-crested Cormorant on the Maine coast, all of the present existing colonies known to me are listed in order beginning with the most eastern one situated on Old Man Island and proceeding from east to west and south to the Maine-New Hampshire state boundary line. To assist the reader in finding the islands on maps, the approximate latitude and longitude are given. A brief description of the islands and a historical account of the cormorants, especially during the past three years, are also included.

It will be seen that not only have the number of colonies increased, but the populations in 1943 were often doubled or tripled and in a few cases were more than four times the numbers present in 1941. This increase in the numbers of cormorants and the extension of their breeding range are not peculiar to the coast of Maine. Dr. Harrison Lewis (1942) reports that the Double-crested Cormorants are on the increase along the north shore of the Gulf of St. Lawrence. On June 11, 1942, Harold S. Peters (1942) found a colony of 100 nests at Cape Tryon, Prince Edward Island, Canada, which constitutes the first record of these birds nesting on that island.

In Massachusetts, Baird, Brewer and Ridgway (1884) stated: "It is believed once to have been resident on the northern shores of Massachusetts, but long since to have been driven away." Today this bird has again established itself as a nesting species on that part of the New England coast. Joseph A. Hagar (1941) discovered a colony of 53 pairs of Double-crested Cormorants breeding at Shag Rocks near Boston Light at the entrance of Boston Harbor, on August 5, 1940. According to Mr. Hagar, the birds were nesting there as early as 1937. This is the first recent nesting record for Massachusetts. On June 28, 1942, Frances L. Burnett (1942) found two nests, one empty and the other with four eggs, at Egg Rock, off Manchester, Massachusetts. The following year on June 19, Burnett (1943) reported finding four nests with eggs and young at the same place.

The Double-crested Cormorant has been reported in increasing numbers, during the summer, along the Rhode Island and Connecticut shores. If the present tendency of the extension of the nesting range prevails, it may be reasonably expected that the birds will be found nesting in that region before many years elapse.

The European or Common Cormorant, *Phalacrocorax carbo*, is the species found on our coast during the winter. I have seen a few of them during the nesting season in eastern Maine, and A. D. Cruickshank (1938) has found them as far west as Muscongus Bay during the summer months. On May 30, 1939, Harold S. Peters (1940) found one-fourth of the adult birds of a colony of 212 occupied nests, situated ten miles north of Antigonish, Nova Scotia, to be *Phalacrocorax carbo*. According to Peters, the European Cormorants probably invaded the Antigonish colony in 1938. As yet I have no evidence of their nesting in New England, but since there is a possibility that *P. carbo* will continue to extend its breeding range, it is important that we be on the watch for its nesting on the islands of the Maine coast.

Old Man Island; 44° 37.1' N., 67° 14.2' W.

Old Man Island, which lies southeast of the entrance to Little Machias Bay, supports the most eastern of the important Maine seabird colonies. It is a high, rugged island with precipitous rocky shores making a landing difficult when a rough sea prevails. The top surface is covered with a reddish-brown peaty soil which supports a considerable number of spruce trees. Most of the trees are now dead, some are still standing but the majority have been blown down by the storms of recent years, making a tangled network of jagged stumps, trunks, and broken limbs. In the few open spaces there is a luxuriant growth of grass, weeds, vines, wild parsnips, and many smaller plants.

On April 19, 1923, A. H. Norton reported ten Double-crested Cormorants roosting on the island, but at that time none of them were nesting. Just when the birds started nesting on Old Man Island is not known but they had probably established themselves as a nesting colony about 1925 or soon thereafter. R. P. Allen and A. H. Norton estimated 1,000 Cormorants, 4,000 Herring Gulls, and a few Eider Ducks as nesting there on June 24-26, 1931. The cormorants had built one to seven nests to a tree, all over the island, but none of the nests were on the ground. Many of the nests contained eggs but others had freshly hatched young and a few contained nestlings in advanced stages of development.

When I visited the island on June 6, 1943, there were 333 occupied

nests, but the greater number of them (218) were built on the barren rocks or on the ground of the cleared places and others upon or among the fallen tree trunks. Only 115 nests were placed in the dead trees that were still standing. The nests contained one or two eggs, some had three, and only five contained sets of four; and none had five. There were no young and all of the eggs examined were fresh or else incubation had advanced but a few days. The state of the eggs and the large number of nests in early stages of construction clearly indicated that the colony had not reached the height of its nesting activity. Since most of the colonies along the western part of the Maine coast had young, some in advanced stages at this date, it is probable that this colony had been molested by human visitors. Counts and estimates of the numbers of adult birds indicated that there were more than 1,000 cormorants in the Old Man Island colony in 1943. In addition to the cormorants, there were about 4,000 Herring Gulls, eight pairs of Black-backed Gulls, and 25 pairs of Eider Ducks nesting on the island.

The Brothers Island; 44° 33.4' N., 67° 26.5' W.

These two high, picturesque islands, connected by a low, rocky isthmus, stand out boldly overlooking the Atlantic. The tops of the 100-foot knolls command an excellent view of the numerous islands guarding the entrances of Machias and Englishman's bays. The islands are well turfed, providing grazing for a number of sheep. These islands were once heavily wooded with coniferous trees, but today there are only a few small spruces struggling for existence at the northern edge of the larger island. There are nearly perpendicular rocky precipices along the sea at the eastern end of the island which provide nesting sites for Ravens and on the talus slopes below there are many Black Guillemots.

On June 13, 1941, the cormorants were found nesting for the first time. There were three nests with one egg each, two nests with two eggs, and one nest containing four eggs. On June 19, 1943, many cormorants were seen on the higher outcroppings of rock but no nests had been built by that time. There are 3,000 Herring Gulls and 50 pairs of Black-backed Gulls nesting on the island.

Pulpit Rock; 44° 33.2' N., 67° 28' W.

About a mile west of the Brothers stands barren Pulpit Rock with jagged pinnacles separated by deep, abrupt clefts. In 1903, Mr. A. H. Norton found cormorants roosting in considerable numbers, but none were nesting. None nested on these rocks from 1903 to 1923 although

the place was used by a large number of the birds as a roosting place each summer. The birds started nesting there some time between 1924 and 1931. In 1931, Norton and Allen reported finding 50 occupied nests and a total of about 500 birds. When I visited this rocky islet on June 19, 1943, there were approximately 100 nests and many non-breeding cormorants.

The Ladle; 44° 29' N., 67° 44.3' W.

South of Cape Split is a curiously shaped island which resembles an inverted ladle; hence the name. On the high dome the cormorants have roosted during the past three years. On June 8, 1943, they were nesting for the first time. On the exposed rocks of the northeast side there were three nests, one with one egg and two nests with three eggs each. There were also one empty nest and several nests in various stages of construction. On the opposite side of the dome there was another group of partially constructed nests. The Ladle offers an ideal nesting site for the cormorants; hence the year 1943 may mark the beginning of a large prosperous colony of the future.

Black Horse Island; 44° 1.7' N., 68° 34.6' W.

This dark colored, steep, rocky ledge is situated about one and one-half miles east of the large island of Isle Au Haut. The first record of the presence of nesting cormorants on this ledge is a statement by Chas. K. Reed that he took sets of Double-crested Cormorants' eggs near Isle Au Haut in June, 1892, and 1893. As this was the only known colony in that region, there is no doubt that the eggs were taken on Black Horse Island. Ora W. Knight (1900) found seven nests on narrow shelves near the top of the ledge on July 3, 1893. Three of the nests contained three eggs each, one nest contained a single egg, and the other three nests were empty. On July 2, 1895, he found two nests with three eggs each and one nest with one egg. When he visited the island on July 23, 1896, there were a considerable number of cormorants but only two nests; one was incomplete and the other showed the imprint of three eggs which he states had been taken previously, presumably by some collector. In June, 1899, a few birds were observed but there were no nests. William Dutcher (1901) visited Black Horse Island in 1900 and he likewise saw a few cormorants but no nests. According to A. H. Norton, Black Horse Island was abandoned by the roosting cormorants in 1907. Just when the birds returned is not known, but there were no cormorants there up to 1931 as Mr. Norton made frequent visits up to that year. When I visited the island on June 12, 1942, there were several hun-

dred cormorants on the island and approximately 50 nests. On June 10, 1943, there were 75 nests and probably more were added after my visit. At the times of the above visits there were large numbers of cormorants roosting on White Horse Ledge which lies about a half mile northeast of Black Horse Ledge, but we could see no nests as we circled the ledge in our boat. According to H. L. Mendall (1936) there was a population of twenty-four breeding birds on White Horse Ledge in 1933.

Colt Head Island; 44° 15.6' N., 68° 50.5' W.

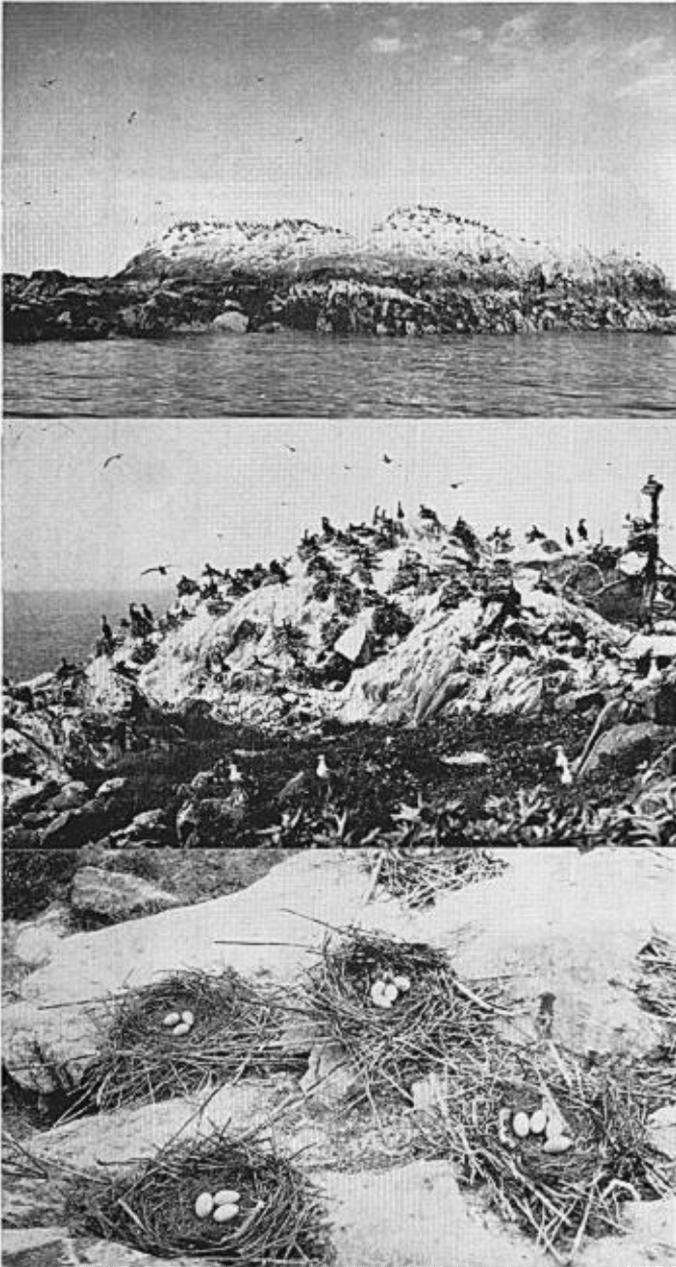
Colt Head Island, situated in East Penobscot Bay, is the site of one of the largest cormorant colonies on the Maine coast. On June 8, 1941, there were 680 nests of the cormorants, 265 of which were placed in dead spruce trees and 415 on the rocks or barren soil. There were also a considerable number of nests in various stages of construction. All of the occupied nests contained eggs and no young were seen at the time of this visit. From one vantage point I counted 950 adults swimming on the water where they had collected after leaving their nests.

On June 9, 1942, the progress of nesting had advanced over that prevailing on June 8 of the preceding year. At this time there were 1,253 nests of which 727 were placed in the dead trees and 526 were on the rocks or ground. The contents of 82 nests of a typical ground-nesting area were as follows: four nests with one, six nests with two, twenty-eight nests with three, thirty-six nests with four, and two nests with five eggs or young. There were also six nests under construction. In the sample of 82 nests, 20 contained pipped eggs, freshly hatched young, or young two or three days old. Some of the nests in the trees contained older young.

On June 3, 1943, the colony contained only 870 nests, of which 406 were in trees and 464 were on the rocks or ground. Many of the dead trees had fallen, and this accounts for the smaller proportion of nests in trees. There were no young at this time and the large number of broken eggs about the nests and dead adults that had been shot clearly indicated that the colony had been seriously disturbed. We learned later that several men had visited the island for the purpose of destroying this populous colony because of alleged damage to the fishing industry by the birds.

Spoon Ledge; 44° 12' N., 68° 49.8' W.

Spoon Ledge is situated in upper Penobscot Bay north of North Haven. It is a small, high, irregular rocky ledge. There are no trees or shrubs and only a very limited growth of grass and weeds



DOUBLE-CRESTED CORMORANT.—(*Top*) SPOON LEDGE, REPRESENTING A TYPICAL NESTING COLONY—JUNE 3, 1943. (*Middle*) A SECTION OF THE COLT HEAD ISLAND COLONY WHICH COMPRISED 1253 NESTS ON JUNE 9, 1942. HERRING GULLS AND EIDER DUCKS WERE NESTING IN THE FOREGROUND. (*Bottom*) NEST AND FOUR EGGS; WESTERN BROWN COW ISLAND, MAY 20, 1913.



DOUBLE-CRESTED CORMORANT.—(Top) WESTERN EGG ROCK COLONY, MAY 31, 1944. (Middle) NESTING CORMORANTS WITH EGGS ON PICTURESQUE OLD HUMP LEDGE, JUNE 1, 1944. (Bottom) A GROUP OF CORMORANT NESTS OF THE PUMPKIN ISLAND COLONY, MAY 29, 1943.

in a few isolated spots. The higher portions of the rock are white from the excrement of the birds, making it a conspicuous landmark among the many islands of that part of the bay.

The first report of the cormorants breeding on this ledge was in 1931 when Norton and Allen reported a population of 40 nesting cormorants, and D. Berolzheimer (1932) found 34 in the same year.

On June 7, 1933, I visited the island with Mr. Joseph Stickney, Supervisor of Wardens, State of Maine, and Mr. A. C. Shelton of Boston. At that time we found 75 nests with eggs or young. In one nest the young were about a week old. There were also a number of nests in various stages of construction. I visited the island again the following year with T. Gilbert Pearson and others, on May 26 and 27, and made a complete census of the nests and their contents as follows:

	<i>Nests</i>	<i>Eggs</i>
Nests under construction	12	—
Nests with eggs: One	4	4
Two	11	22
Three	37	111
Four	73	292
Five	5	25
	—	—
<i>Total</i>	142	454

On June 8, 1941, a census revealed that the population of the colony was practically the same as it was in 1934. At that time there were 145 nests containing about the same relative number of eggs. A census made on June 10, 1942, revealed that the colony had increased to 225 nests with the following contents:

	<i>Nests</i>	<i>Eggs and young</i>
Nests under construction	8	—
Nests with eggs: One	14	14
Two	16	32
Three	66	198
Four	38	152
Five	3	15
Nests with young: One	15	15
Two	37	74
Three	24	72
Four	4	16
	—	—
<i>Total</i>	225	588

On June 3, 1943, Spoon Ledge, which started with a population of 40 cormorants in 1931, now contained 728 nests representing a

population of 1,456 nesting birds. Including the non-breeding individuals and those not yet represented by nests, the total number of birds for this one colony approaches near the 2,000 mark.

Fisherman's Island; 44° 2.5' N., 69° 2.4' W.

Fisherman's Island is situated about two miles off Ash Point, south-east of Rockland. It is a large, high island, well turfed with a rank growth of grass and small herbaceous plants. There are no trees or shrubs but there are several dense patches of red raspberry vines. This island is primarily a Herring Gull colony. There are also 25 pairs of Black-backed Gulls, 12 pairs of Eider Ducks, and several pairs of Black Guillemots nesting there.

On my first visit to the island, June 7, 1935, there were no cormorants nesting but numbers were seen flying by on their way to Marblehead Island to the southward. During the following four years the high, rocky point at the northern end of the island was used as a roosting place. The birds nested for the first time in 1940 when there were about a dozen nests. On June 8, 1941, there were 45 nests as follows: seven nests in stages of construction, six with one, ten with two, 19 with three, and three with four eggs. In 1942 there were 100 nests and on June 1, 1943, the colony had increased to 265 nests or nearly six times the number present in 1941. A census of the contents of the 265 nests is as follows:

	<i>Nests</i>	<i>Eggs and young</i>
Nests empty or under construction	13	—
Nests with eggs or young: One	16	16
Two	46	92
Three	137	411
Four	52	208
Five	1	5
	—	—
<i>Total</i>	265	732

Of the above 265 nests, 12 contained young ranging from freshly hatched chicks to some four or five days old. Most of the nests are on a rocky outcrop of the highest part of the island where all of the nests were located in 1940-1942. In 1943 there were three new groups located on the soil at lower elevations of the island. This great influx of nesting birds is probably a contribution from nearby Marblehead Island.

Marblehead Island; 44° 2.1' N., 69° 2.8' W.

Marblehead is a small, almost conical, rocky ledge situated about a half mile south of Fisherman's Island. There is no vegetation and

it is completely taken over by the cormorants except for a few Herring Gulls and Black Guillemots which persist in nesting there. It is a picturesque colony, with nests placed on numerous terraces right up to the summit of the rock. This is one of the older colonies and it is not known when the birds started nesting there, but when Norton and Allen visited the ledge in 1931 it was already a well established colony with a population of 600 breeding adults. According to Mendall (1936), who made his life history studies on this island, the numbers were the same in 1933 but increased to 700 in 1934 and 1935. On June 1, 1943, Mr. J. Gashwiler and myself counted 793 nests which represent a population of more than double that reported by Mendall in 1934-1935. Time did not permit taking a complete census, but a sample of 177 nests of a typical section of the colony contained the following: three nests under construction, five nests with one, 34 nests with two, 83 nests with three, and 52 nests with four eggs or young. Of the above sample of 177 nests, 59 contained young ranging from those freshly hatched to some approximately ten days old.

Crescent Island; 44° 1.3' N., 69° 2.2' W.

Crescent Island is situated in lower West Penobscot Bay about one and one-half miles south of Fisherman's Island. According to Norton and Allen, it was merely a roosting place for the cormorants in 1931. In 1934, Mendall (1936) found 78 breeding birds there but they deserted the island the following year. In 1943, the birds were again nesting and from our boat we estimated that there were at least 100 nests.

Yellow Ridge; 43° 58.8' N., 69° 6.8' W.

This rocky island, situated in Muscle Ridge Channel, was visited by Norton and Allen in 1931, but they make no mention of cormorants roosting or nesting there. On May 31, 1943, from our boat I estimated a colony of about 150 nests. Because of the heavy sea we were unable to land on this ledge or on Crescent Island mentioned above.

Metinic Green Island; 43° 57.8' N., 69° 8.2' W.

This island is situated south of Metinic Island. In addition to its large population of Herring Gulls, it now also supports a large, prosperous cormorant colony. The island is well turfed with grass and there are numerous patches of weeds and raspberry vines but no trees or shrubs. There were no cormorants on this island from 1931 to 1936. Mr. Jack Perkins of the U. S. Fish and Wildlife Service reported finding a large colony on June 7, 1942, but he made no

count or estimate of the numbers. On May 31, 1943, we counted 932 nests which contained the following:

	<i>Nests</i>	<i>Eggs or young</i>
Nests empty or under construction	58	—
Nests with eggs or young: One	37	37
Two	108	216
Three	438	1314
Four	288	1152
Five	3	15
	—	—
<i>Total</i>	932	2734

Among the 932 nests, 57 contained young ranging in age from those just hatched to others about eight days old. Most of the nests were built on the ground but some of them were on the exposed rocks near the sea wall.

Metinic Green Island, if undisturbed, is destined to become the largest cormorant colony on the Maine coast. At the height of the nesting season there is probably a breeding population of 2,000 individuals, and on this large island there is an abundance of room for future expansion. Only the number of nests found on Colt Head Island in 1942 (1,253 nests) exceeds the number found on Metinic Green in 1943.

Hay Ledge; 43° 54.6' N., 69° 14' W.

This island is south of Martinsville near the Brothers Islands. On May 31, 1943, there were about 200 cormorants roosting on the island. We were unable to land, but from Brothers Islands we could see at least a dozen nests on the higher outcroppings of rock. As far as I have been able to ascertain, this is the first year that the cormorants nested on this ledge.

Little Egg Rock; 43° 51.4' N., 69° 20.5' W.

This island lies in the southeastern part of Muscongus Bay. When we passed this island on May 31, 1943, it was inhabited by a large number of cormorants but we were unable to make a census. Fortunately, members of the National Audubon Nature Camp have made careful counts of the numbers of birds. From 1936 to 1941 the numbers of nesting pairs were 300, 300, 374, 464, 455, and 488, respectively.

Old Hump Ledge; 43° 52.6' N., 69° 21.5' W.

Old Hump Ledge is situated in Muscongus Bay a little less than two miles northwest of Little Egg Rock. On July 12, 1931, Norton and Allen reported seeing 150 cormorants, including a few *Phalacrocorax carbo*. There were four occupied nests of the Double-crested

Cormorant which mark the beginning of this nesting colony. H. L. Mendall (1936) reported a population of 200 nesting cormorants in 1933, 350 in 1934, and 400 in 1935. The representatives of the National Audubon Nature Camp counted 135, 188, 264, 331, 337, 367, and 371 nesting pairs for the years 1936 to 1942, respectively.

Long Ledge; 43° 53.3' N., 69° 22' W.

Long Ledge is one of a group of small rocky ledges situated about a mile northwest of Old Hump Ledge. Allen and Norton found 60 cormorants roosting on this ledge in 1931. I saw 50 to 100 of the birds roosting there in 1941, 1942, and 1943, but at the time of the visits there were no nests. However, in 1943, several adults were observed to be carrying and playing with sticks such as are used in nest building and it may be only a matter of time until a nesting colony will be established.

Shark Island; 43° 50.8' N., 69° 21.5' W.

Shark Island is the outermost island of the Muscongus Bay group, situated about two miles due south of Old Hump Ledge. It is a barren, rocky island with just a few scant bunches of grass and low-growing weeds on the narrow plateau of the central portion. There were no cormorants nesting on Shark Island when Norton and Allen visited the island on July 12, 1931. The counts made by the National Audubon Society Nature Camp are 142, 142, 367, 548, 524, and 540 nesting pairs of cormorants for the years 1936 to 1941, respectively.

On May 31, 1943, we counted 905 nests—nearly double the number found by the National Audubon Society, indicating a tremendous increase in the Shark Island colony in the last year. A conservative estimate places the colony at 2,000 individuals at the height of the nesting season. This colony is a close second to the one on Metinic Green from the standpoint of the number of cormorants. At the time of our visit on May 31, 1943, there were no young. A sample census of all the nests in a typical area comprising 110 nests revealed the following contents: two nests empty, five with one, 22 with two, 48 with three, 32 with four, and one nest with five eggs. In the 110 nests there were 330 eggs or an average of three eggs per nest, which is representative of the entire colony.

Western Egg Rock; 43° 52.7' N., 69° 25' W.

Western Egg Rock is situated in the western part of lower Muscongus Bay, about three miles east of New Harbor, Maine. It is a low, heavily turfed island with a rank growth of grass interspersed with wild parsnips, clover, nettles, and dense patches of raspberries

and wild roses. There is much debris along the shores and a high sea wall of rocks and boulders. There were no cormorants nesting on this island in 1931-1932, although a few were found roosting there. In 1936, the National Audubon Society Nature Camp reported 40 pairs of nesting birds, which apparently mark the beginning of this colony although a few may have nested there prior to 1936. The National Audubon Camp also reported 91, 107, 149, 138, 249, and 250 nesting pairs for the years 1937 to 1942, respectively.

On May 30, 1943, we found the main colony established among the giant boulders and slabs of rock and among the debris cast up by the storms on the southwest side of the island. There were also two smaller groups about 150 yards apart on the extreme western side of the island. A complete census of the contents of the 614 nests found at that time is as follows:

	<i>Nests</i>	<i>Eggs</i>
Nests empty or in stages of construction	62	—
Nests containing eggs: One	47	47
Two	110	220
Three	251	753
Four	141	564
Five	3	15
<i>Total</i>	614	1599

White Islands; 43° 47.5' N., 69° 34.6' W.

The White Islands are situated due south of the mouth of the Damariscotta River and southeast of Ocean Point, Maine. There are two islands of which the northern one is occupied by the cormorants and Herring Gulls. A large part of this island is covered with a dense, luxuriant vegetation: beach plum thickets, numerous large patches of nettles, yarrow, dandelions, parsnips, and other herbaceous plants. There are also heavily turfed areas of grass, but the margin of the island is barren and rocky. There are about 30 standing dead spruce trees and many fallen and partially decayed tree trunks and jagged stumps.

On July 13, 1931, Norton and Allen found 600 Herring Gulls breeding on the northern island but there were no cormorants and there were none when I visited the island on June 6, 1935.

On June 4, 1941, there were 187 cormorant nests, all of which were placed in the 55 dead spruce trees which were standing that year. All of the nests that could be examined contained eggs. Five eggs taken from that many nests were fresh or with incubation only slightly advanced. There were considerable numbers of cormorants roosting

on the rocky margins of the island as we approached, but there were no nests on the rocks or on the ground.

On June 6, 1942, Jack Perkins found an increase over the number of nests found the previous year, with a group on the rocks in addition to those built in the dead trees.

When I visited the island on May 30, 1943, there was a total of 474 cormorant nests even at that early date. Of the 474 nests, only 218 were built in the remaining 30 dead spruce trees and 256 were on the rocks, the barren ground, or else on the fallen tree trunks. It was impracticable to include in the census the nests located in the dead trees, because of their precarious positions, but the 256 nests in accessible places on the ground and rocks or the fallen tree trunks contained 784 eggs distributed as follows:

	<i>Nests</i>	<i>Eggs</i>
Empty nests or nests under construction	16	—
Nests with eggs: One	7	7
Two	27	54
Three	102	306
Four	103	412
Five	1	5
<i>Total</i>	256	784

None of the nests contained young at the time of the census, May 30, 1943, but some of the eggs were in well advanced stages of incubation.

Pumpkin Island; 43° 45.2' N., 69° 35' W.

Pumpkin Island is situated about three miles south of the White Islands and a mile and one-half east of the southern tip of Damariscove Island. It is a high, rocky island and there are no trees but the higher parts of the island are turfed with grass and small weeds. On the rocky extensions and numerous reefs, much of which is covered at high tide, is a flourishing colony of seals. We counted 50 adults and six pups from one vantage point, but there are probably a hundred individuals in the entire herd.

Norton and Allen found 300 Herring Gulls and some Leach's Petrels nesting on the island on July 13, 1931, but there were no cormorants at that time. According to Mr. Joseph Fiset, the cormorants first appeared on the island in 1936 when there were about a dozen nests built and occupied that season.

When I visited the island on June 4, 1941, there were 489 nests which were disposed in four nearly equal groups well separated from one another. The nests of the group established on the highest eleva-

tion contained young ranging from a day to ten days old. Since the incubation of the cormorant is 25 days, this one group must have started nesting the last week of April. The other three groups had nests which contained eggs, most of which were in their early stages of incubation. Jack Perkins reported the colony flourishing when he visited Pumpkin Island on June 6, 1942. There were well advanced young in some of the nests at that time.

On May 29, 1943, there were 873 nests; the colony had practically doubled its numbers since my previous visit on June 4, 1941. There were no young in any of the nests at the time of this visit. A complete census of the 873 nests is as follows:

	<i>Nests</i>	<i>Eggs</i>
Empty nests or nests under construction	88	---
Nests with eggs: One	35	35
Two	92	184
Three	315	945
Four	340	1360
Five	3	15
	---	---
<i>Total</i>	873	2539

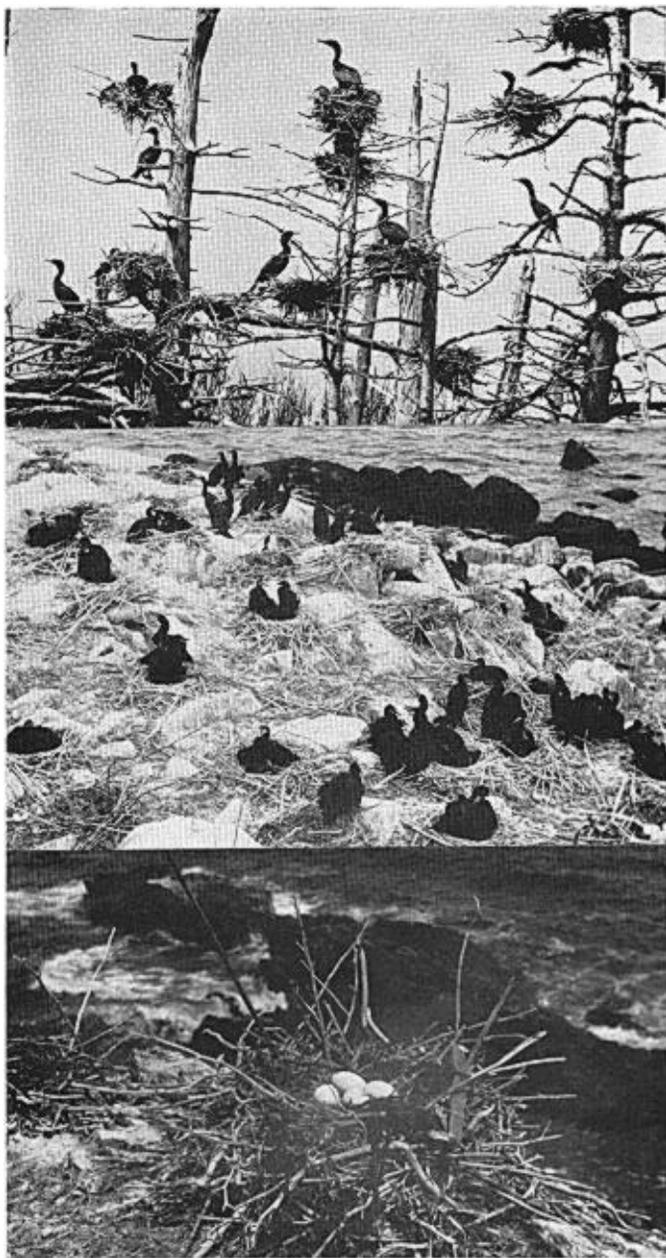
When Mr. Guy Gashwiler visited the island on June 17, 1943, many of the cormorant eggs had hatched and a few of the young were old enough to have acquired well-developed feather papillae.

In addition to the cormorants the island supports a population of 2,800 Herring Gulls. There were eight nests of the Black-backed Gulls and several Black Guillemots were seen offshore, but lack of time prevented us from discovering their nests.

Heron Islands; 43° 43.2' N., 69° 48.3' W.

The Heron Islands are situated midway between the mouth of the Kennebec River and Small Point. There is in reality but one island that is cut by two deep clefts dividing it into three distinct parts. It is covered over with turf but there are prominent outcroppings of rock. On the northern section there is a small group of dead spruces which are rapidly disappearing. Today there are only a half dozen of the trees that have managed to weather the storms and to resist decay.

There were no cormorants on the island in 1931. In 1932 and 1933, cormorants roosted on the island but none of them nested. On June 5, 1935, I found 25 nests in the dead spruces of the northern section and 12 on a large rocky outcrop of the southern section. By 1941, the spruces were no longer suitable for nesting sites and all of the cormorants moved to the treeless southern section. On June 4,



DOUBLE-CRESTED CORMORANT.—(Top) NESTING IN DEAD SPRUCES OF NORTHERN WHITE ISLAND, MAY 30, 1943. (Middle) FOUR OF THE 265 NESTS ON FISHERMAN'S ISLAND, JUNE 1, 1943. (Bottom) A SECTION OF THE MARBLEHEAD ISLAND COLONY, JUNE 15, 1944. A FEW NESTS CONTAINED EGGS BUT MOST HELD YOUNG IN ADVANCED STAGES OF DEVELOPMENT.

1941, there were 77 nests with the following contents: 29 nests were empty or under construction, 11 contained one egg, 17 contained two eggs, 12 contained three, and eight nests contained four eggs each. There was one Herring Gull nest containing one egg of the gull and two eggs of the cormorant which were being incubated by the cormorant.

When we visited the island on June 1, 1942, there was abundant evidence that the colony had been seriously molested. There were several Herring Gulls and cormorants that had been shot and a number of the cormorant nests were torn apart and the eggs broken. In spite of these depredations there were 61 nests, 49 of which contained eggs.

On May 28, 1943, there were 244 cormorant nests, all on the southern section of the island, as follows:

	<i>Nests</i>	<i>Eggs</i>
Empty nests or nests under construction	49	—
Nests with eggs: One	21	21
Two	38	76
Three	78	234
Four	57	228
Five	1	5
	—	—
<i>Total</i>	244	564

There were no young on May 28, but when the island was visited on June 16 the number of nests had increased to about 300, of which only a few were incomplete or empty. There were many young, some of them with the juvenal plumage well developed. In addition to the cormorants there were 3,000 Herring Gulls and 38 Black-backed Gulls nesting on the island in 1943.

White Bull Island; 43° 43.1' N., 69° 55.5' W.

White Bull is one of the outer islands of the eastern end of Casco Bay. It is a rocky island with bold, abrupt shores which make landings in rough weather extremely difficult. The vegetation is limited to a small area containing beach plum, blue grass, ragweed, yarrow, shepherd's-purse, and similar plants. There are no trees or large shrubs.

There were no cormorants on White Bull during 1931-1935. A varying number of the birds used it as a roosting place during the seasons 1936 to 1938, but none nested at that time. On June 4, 1941, we found that about 50 pairs of cormorants had established a nesting colony. On June 1, 1942, there were 99 nests in the colony which contained the following: 31 nests under construction, nine with one,

11 with two, 23 with three, and 25 with four eggs each—a total of 200 eggs.

On June 14, 1943, there were 209 nests or about double the number in the colony during the preceding year. The contents of the 209 nests were as follows:

	<i>Nests</i>	<i>Eggs and young</i>
Empty nests or nests under construction	7	—
Nests with eggs or young: One	8	8
Two	25	50
Three	82	246
Four	87	348
	—	—
<i>Total</i>	209	652

Of the above 209 nests, 33 contained one or more young, the majority of them just hatched or only a few days old. In addition to the cormorants, this island supports a Herring Gull population of nearly 2,000. Twelve Black-backed Gulls also use the island as a nesting place.

West Brown Cow Island; 43° 41.8' N., 70° 4.6' W.

West Brown Cow is one of the outer islands of middle Casco Bay, between Jewell and Eagle islands. It is a relatively high, rocky islet and like White Bull Island it is difficult to land there except in calm weather. The vegetation is extremely scant—just a few tufts of grass and low-lying plants. There are a few dead stubs of small trees still standing among the cormorant nests. The framework of a geodetic survey marker was still standing on the highest portion of the island in 1943 which serves well in identifying the island.

The cormorants had established a small colony on the island when we landed there on June 2, 1942. As far as I know, this constitutes the first record of their nesting on West Brown Cow. The contents of the 42 nests were as follows: Nests under construction 15, six nests with one, three with two, eight with three, and ten with four eggs each. At the time of our visit to the island on May 20, 1943, there were 152 nests—more than three times the number in 1942, although it was nearly two weeks earlier in the season. The contents of the nests were as follows:

	<i>Nests</i>	<i>Eggs</i>
Nests under construction	62	---
Nests with eggs: One	18	18
Two	17	34
Three	31	93
Four	21	84
Five	3	15
	---	---
<i>Total</i>	152	244

Outer Green Island; 43° 39' N., 70° 7.5' W.

Outer Green Island lies in the outer southern portion of Casco Bay, about three miles east of Peaks Island in Portland Harbor. It is a high island with a somewhat level plateau which is well turfed with a rank growth of grass and herbaceous plants. In a central depression filled with rich soil there are thick patches of nettles and shrubs growing about four feet high. There are several prominent rocky outcrops and barren areas which are occupied by the cormorants.

Cormorants have roosted on Outer Green for a number of years, but as far as I have been able to determine, the first record of their nesting was made when we visited the island on June 2, 1942. At that time the nests were in two nearly equal groups, one comprising 25 nests at the southern end and one of 26 nests on a rocky outcrop near the center of the island. All of the nests contained eggs.

When we visited the colony on May 20, 1943, most of the nests were built on the top of the high ledges at the southeastern side of the island. At the extreme southern end we saw about 35 adult cormorants roosting and a small nucleus of 14 nests, 11 in a state of construction, two nests with one egg, and one nest with two eggs. There were 231 nests in the main colony with contents as follows:

	<i>Nests</i>	<i>Eggs</i>
Nests under construction	43	---
Nests with eggs: One	14	14
Two	21	42
Three	38	114
Four	102	408
Five	13	65
	---	---
<i>Total</i>	231	643

Considering the fact that our visit in 1943 was nearly two weeks earlier than the year before, the counts reveal that this colony had increased its size to five times in the course of one year. From one vantage point on the island I counted 535 adult cormorants on the water or flying near the surface.

In addition to the cormorants there is a population of 2,200 Herring Gulls and 20 Black-backed Gulls nesting on the island. In the tall weeds and shrubs in the central depression we saw a female Chewink, a male Bobolink, a male Northern Yellow-throat, a Field Sparrow, and five Savannah Sparrows. Some of the above birds—at least the Savannah Sparrows—were nesting, but we did not have the time to hunt the nests.

Junk-of-Pork; 43° 38.9' N., 70° 7.4' W.

Junk-of-Pork lies southeast of, and near to, Outer Green Island. At very low tides a rocky reef connects the two islands. It is a very abrupt, rocky island surrounded by nearly perpendicular walls 30 to 40 feet high. There is practically no vegetation on the flat top which is covered by a deep incrustation formed chiefly from the excrement of the sea birds. As in the case of Outer Green Island, the cormorants used *Junk-of-Pork* as a roosting place during the summer months, even many years before Outer Green was used for that purpose. I have no record of the year when the birds first nested there but when we visited the island on June 2, 1942, there was a well-established colony consisting of 88 nests containing 319 eggs and 11 young.

	<i>Nests</i>	<i>Eggs and young</i>
Empty nests	1	—
Nests with eggs or young: One	1	1
Two	3	6
Three	18	54
Four	56	224
Five	9	45
	—	—
<i>Total</i>	88	330

Apparently, nesting activities started earlier in the season than at most of the other colonies, for on June 2 most of the sets were complete, no nests were in stages of construction, and there were 11 young. Nesting must have been under way during the latter part of April. There were 30 nests of the Herring Gull, most of which were placed among the nests of the cormorants. Even in these close quarters the two species seemed to exist in harmony.

Bluff Island; 43° 30.5' N., 70° 19.2' W.

Bluff Island is situated in Saco Bay, three miles east of Old Orchard Beach and one and one-half miles south of Prout's Neck. It is a large, dome-shaped island which is turfed over with a very rank growth of timothy grass. There are no trees or shrubs but along the

inner margins of the sea wall there are masses of tall weeds and herbaceous plants.

On the northeastern end of the island there is a rocky headland on which a number of cormorants roosted during the seasons of 1940 and 1941, but none of them nested until 1942. On May 29, 1942, there were about 50 cormorants roosting on the headland and a small group of 13 nests in various stages of construction—one nest with two fresh eggs. On June 23, 1942, all 14 nests contained eggs. A year later, on May 23, 1943, the colony had increased in size to 62 nests with contents as follows:

	<i>Nests</i>	<i>Eggs</i>
Nests under construction	26	—
Nests with eggs: One	9	9
Two	11	22
Three	7	21
Four	8	32
Five	1	5
	—	—
<i>Total</i>	62	89

In the early part of the present century, Bluff Island was a Common Tern colony, but since that time the terns have been completely replaced by gulls. Today it is one of the largest Herring Gull colonies on the coast, providing nesting sites for 5,800 individuals. There are also several Black-backed Gulls breeding on the island.

Eagle Island; 43° 28.8' N., 70° 21.6' W.

Eagle Island is situated a mile and a quarter east of Ferry Beach, Saco, Maine, and about a mile north of Ram Island. It is a small but high island with bold outcroppings of rock cut by deep, abrupt clefts. There is a very striking exposed dyke that has withstood erosion and stands out prominently like an immense man-made wall. There are extensive rocky reefs on one side of the island that serve as a breeding place for a considerable number of seals. On June 29, 1942, we counted 78 adult seals and found five newly born pups on the rocks as we went ashore. The high, jagged rocks at the eastern end of the island have served as a roosting place for the cormorants but none of them nested up to 1942. We were unable to make a landing on the island when we visited the region on May 23, 1943, because of the rough sea, but as we circled the island in the motorboat we counted 75 adult cormorants on the rocks and with the aid of binoculars we could see at least a dozen nests, establishing the first nesting record for this island.

Duck Island; 43° .3' N., 70° 36.3' W.

Duck Island is the most northern member of the Isles of Shoals group and is situated about eight miles southeast of Portsmouth, New Hampshire. It is about a mile north of Appledore Island which also lies on the Maine side of the Maine-New Hampshire state boundary line.

Duck Island is turfed over but there are numerous and conspicuous outcroppings of rocks. In some of the depressions there are fresh water pools surrounded by tall, rank grass and weeds. There are also several patches of raspberries but no trees or shrubs. When we visited the island on May 26, 1942, there were about 50 cormorants perched on neighboring Shag Rock, a ledge off the southeastern end of the island. According to Dean Jackson, Director of the University of New Hampshire Biological Station, Isles of Shoals, cormorants have roosted on Shag Rock each summer for a long period of years but he had never known them to nest there. The name of the ledge may have originated from the fact that it was a gathering place for shags.

When Mr. Jay Gashwiler of the U. S. Fish and Wildlife Service visited Duck Island on June 19, 1943, he reported two groups of nesting cormorants established on rocky elevations protruding above the general level of Duck Island. The two sites were about 200 feet apart. There were eight nests at the northern site and ten at the southern location. Several of the nests were in process of construction and others contained fresh eggs. This is the first year they have nested in that region. Duck Island is the most southern and western colony of cormorants in Maine and with the establishment of this colony in 1943 it can be said that the cormorant is present as a nesting species along the entire coast of Maine. As previously stated, the cormorant has also recently extended its nesting range to the coast of Massachusetts.

The underlying biological and ecological factors which have determined this unprecedented increase of the cormorant in the course of a few years while previously it remained dormant as a nesting species on the New England coast for so many years, presents an interesting problem.

Since this paper was written and submitted, visits were made to most of the Maine colonies of cormorants during the season of 1944. The number of nesting cormorants has increased in the majority of the colonies since 1943 as shown in the following condensed table giving the number of nests counted during each of the two years. This year (1944) we found a colony of 157 cormorant nests on Robinson Rock, 44° 9.7' N., 68° 58.7' W. and there were 32 occupied nests

on Downfall Island, 44° 10.8' N., 68° 58.7' W., the first time these birds have nested there. We also have reports from reliable sources that there are now well-established colonies of cormorants on Green Ledge, 44° 4' N., 68° 55.3' W., Medric Rock, 44° 3.8' N., 68° 56' W., and the Hay Islands, 44° 1' N., 68° 47.8' W. If we include the latter, we now have 32 known cormorant colonies on the coast of Maine with well over 10,000 pairs of nesting birds. There are probably other colonies which have thus far escaped our attention.

In the following table, the order of the islands is the same as that presented in the text. To assist the reader in locating the various islands, the names of the U. S. Geological Survey quadrangles are also given.

U. S. G. S. Quadrangle	Islands	Number of nests	
		1943	1944
CUTLER	Old Man Island	333	350
MACHIAS	Brothers Islands	6	— ¹
	Pulpit Rock	100 ²	155
GREAT WASS ISLAND	The Ladle	10	— ¹
DEER ISLE	Black Horse Island	75	— ³
CASTINE	Colt Head Island	870	825
VINAL HAVEN	Spoon Ledge	728	565
	Robinson Rock	—	157
	Downfall Island	—	32
ROCKLAND	Fisherman's Island	265	518
	Marblehead Island	793	805
	Crescent Ledge	100 ²	150
TENANTS HARBOR	Yellow Ridge	150 ²	175
	Metinic Green Island	932	1014
	Hay Ledge	12	220
MONHEGAN	Little Egg Rock	500 ²	434
	Old Hump Ledge	400 ²	513
	Shark Island	905	932
	Western Egg Rock	614	746
BOOTHBAY	White Islands	474	522
	Pumpkin Island	873	— ³
SMALL POINT	Heron Islands	244	398
	White Bull Island	209	482
CASCO BAY	West Brown Cow Island	152	— ³
	Outer Green Island	231	— ³
	Junk-of-Pork Island	150	— ³
PORTLAND	Bluff Island	62	158
BIDDEFORD	Eagle Island	12	— ³
PORTSMOUTH	Duck Island,		
	Isles of Shoals	18	37

¹ Cormorants present but no nests at the time of visit in 1944.

² Estimated.

³ Not visited in 1944.

Because of the increase in the number of complaints of damage, especially by the weir fishermen of eastern Maine, the U. S. Fish and Wildlife Service, through an agreement with the Maine Department of Inland Fisheries and Game, has undertaken the task of controlling the cormorants, beginning this past season (1944). The eggs were sprayed with an oil emulsion to prevent hatching—a method found successful in the control of the Herring Gull. It is expected that these measures will be continued. No effort is being made to exterminate the cormorants but it is merely an effort to check the tremendous increase of these birds and to reduce their numbers until they no longer prove to be a serious menace to the weir fishermen. The U. S. Fish and Wildlife Service has adopted an effective but humane method of control which has the distinct advantage of not interfering with other species of birds such as the American Eiders which nest on many of the same islands occupied by nesting cormorants.

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Brunswick

Maine

THE RACES OF THE SOLITARY SANDPIPER

BY BOARDMAN CONOVER

WHILE it has been known for some time that there are two races of the Solitary Sandpiper, *Tringa solitaria*, there has always been confusion, not only as to the ranges and breeding areas of the two forms, but also as to the characters separating them. In fact, Swarth (Condor, 37: 199, 1935), after examining a series from Atlin, British Columbia, expressed disbelief in the so-called western race *cinnamomea*, taking issue with Taverner and Sutton (Ann. Car. Mus., 28: 38, 1934) who had identified six specimens from Churchill, Manitoba, as be-