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RECOVERIES OF BANDED LEACH'S PETRELS¹

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The Leach's Petrel (*Oceanodroma leucorhoa leucorhoa* (Vieillot)) nests on isolated islands, usually those located well out to sea that are difficult to visit and where landings may be hazardous when rough seas prevail. In nesting the petrel digs a long burrow, which facilitates the task of capturing the adults, but it requires a bander of unusual enthusiasm and energy to excavate a large number of the nests. For these reasons comparatively few petrels, only about 4,000, have been banded, but from these we have 116 recoveries which are the basis of this preliminary report. I am indebted to Frederick C. Lincoln of the U. S. Fish and Wildlife Service and to various cooperators for permission to use their records.

Leach's Petrel is a common nesting species on certain islands of the Grand Manan Archipelago, Bay of Fundy, New Brunswick, Canada, and on islands along the coast of Maine. In the Bay of Fundy region petrels have been banded on Kent, Southern Green, Outer Wood and Machias Seal islands. Kent, a member of a group generally designated as Three Islands, is the site of the Bowdoin Scientific Station. It is located about six miles southeast of Seal Cove, Grand Manan. Southern Green Island is one and a half miles directly north and Outer Wood Island is three miles northwest of Kent Island. Machias Seal Island, the site of a lighthouse station, lies well out to sea about ten miles southwest of Southern Head Light, Grand Manan.

Kent Island has a diversity of conditions of terrain varying from open grassed areas and swamps to others grown up with a thick growth of virgin spruce. A few of the petrel burrows are in the open areas and in places littered with fallen dead spruces at the southern end,

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Fig. 1 Leach's Petrel one day old



Fig. 2 Leach's Petrel twenty days old.



Fig. 3 Leach's Petrel thirty days old.

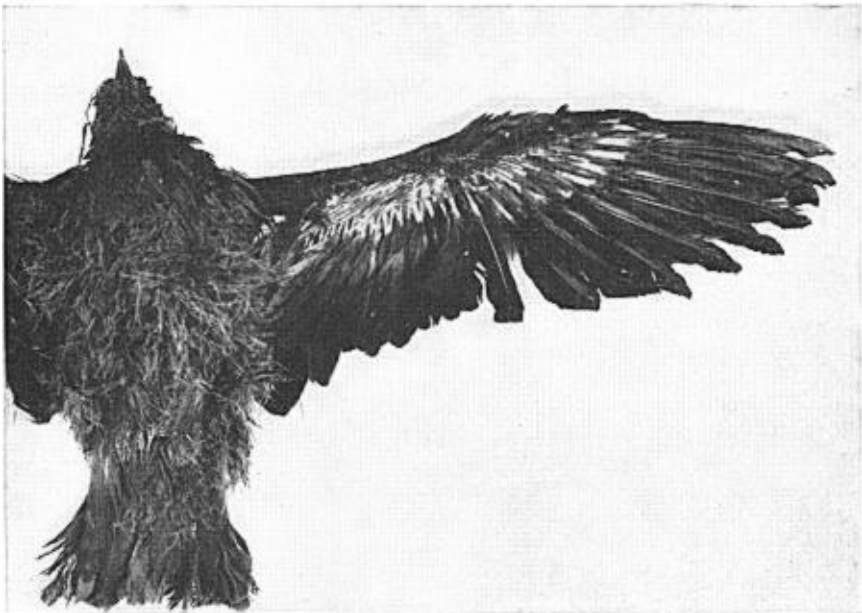


Fig. 4 Leach's Petrel 55 days old. Wings spread to show the partially unsheathed primaries. This bird would not have normally left the nest until three weeks later.

but the vast majority are to be found in the peaty soil of the spruce forest floor of the northern end of the two-mile island. Burrows that have their entrances at the bases of the trees, especially when they tunnel under the tree or its larger roots, are difficult and often impossible to excavate successfully. The burrows away from the trees are but a few inches deep and run parallel to the surface of the ground where it is a simpler task to extricate the birds. Most of the burrows are more than an arm's length, one nest was four and a half feet from the entrance of the burrow, and some are bent in their course so that it requires the making of a secondary opening to reach the nest. After the bird was returned the artificial opening was carefully sealed with masses of soil well supported by suitably sized spruce limbs and twigs. If proper care is taken this operation never seriously disturbs the birds. Kent Island is also the home of 30,000 pairs of Herring Gulls (*Larus argentatus smithsonianus* Coues), 1,000 pairs of Eiders (*Somateria mollissima dresseri* Sharpe), hundreds of Black Guillemots (*Cepphus grylle grylle* (Linnaeus)), many Black-backed Gulls (*Larus marinus* Linnaeus) and other birds.

On Southern Green Island there are no trees or shrubs and the whole of the interior is covered with a thick turf with minor rock outcroppings. Here the petrels dig down eight to ten inches before paralleling the surface of the ground. The burrows being smaller than the arm of the average man it is necessary to cut away the firm turf with a knife or forcibly pry the opening to larger dimensions with the use of a rigid pole. The majority of the nests are on the higher ground and many of the entrances are on the side of knolls or elevations which provide better drainage during heavy rains. Herring Gulls nest on the interior of the island, and among the giant rocks and boulders of the sea wall there are an unusually large number of nesting Black Guillemots.

Outer Wood Island presents conditions somewhat similar to those present on Kent Island, but a larger percentage of the burrows are in open situations. The soil is peaty, loose and friable and hence the birds are more easily excavated than those on Southern Green Island. There is a lifesaving station and several buildings belonging to fishermen on Wood Island. Like Kent Island it is also the nesting place of Herring Gulls, Eiders and Guillemots.

Machias Seal is a small rocky ledge with a limited amount of rocky soil. On this island many of the petrel burrows are tunneled under slabs of rock lying on the ground. Machias Seal is also of special interest because of its flourishing colony of Puffins (*Fratercula arctica arctica* (Linnaeus)) and Arctic Terns (*Sterna paradisea* Pontoppidan).

During the past fourteen years (1932-1946) 2,025 Leach's Petrels have been banded on the four islands, but the work has been spasmodic and irregular. The most intensive work was done by Mr. F. B. Whitman, Jr., who banded 476 petrels in 1934 and 475 in 1935. Mr.

Whitman's initial banding has been the chief source of the longevity records included in this report.

Mr. D. R. Griffin, while securing petrels for his homing experiments in 1938 (Griffin, 1940), banded 394 petrels on Kent and 162 on Outer Wood Island. Mr. Griffin also obtained sixteen recoveries of birds previously banded by others. In 1946, with the help of members of the Bowdoin Scientific Station and especially Professor Lawrence B. Chapman of M.I.T., a total of 379 birds were banded and 21 recoveries obtained. Mr. Ernest Joy, the resident warden, banded a total of 133 young birds during September of 1944, 1945 and 1946.

Table I is a complete summary of the petrels banded in the Bay of Fundy region.

TABLE I
NUMBERS OF LEACH'S PETRELS BANDED ON ISLANDS IN THE
GRAND MANAN ARCHIPELAGO 1932-1946.

Island	Year	Young	Adults	Totals	Recoveries of birds banded on dates indicated
Kent Island	1932	0	2	2	
	1934	0	166	166	9
	1935	0	18	18	3
	1936	1	1	2	1
	1937	0	28	28	8
	1938	0	394	394	16
	1939	0	2	2	
	1943	2	4	6	3
	1944	26	8	34	
	1945	50	0	50	
	1946	57	157	214	
		136	780	916	40
Southern Green Island	1934	10	212	222	5
	1935	2	126	128	
	1946	0	107	107	
		12	445	457	5
Outer Wood Island	1934	62	26	88	1
	1935	13	167	180	8
	1938	0	162	162	
	1946	0	57	57	
		75	412	487	9
Machias Seal Island	1932	0	9	9	
	1935	0	149	149	1
	1937	0	6	6	
	1946	0	1	1	
		0	165	165	1
Totals		223	1802	2025	55

Of the 2,025 petrels banded on the four islands in the Bay of Fundy there are 55 recoveries. All of these were recovered on the same island where they were originally banded with the exception of one bird. Number 35-124018, banded as an adult by F. B. Whitman, Jr., on Machias Seal Island on July 23, 1935, was recovered from a nesting burrow on Outer Wood Island by C. S. Brand on August 12, 1938. All with the exception of one bird were recovered from their nesting burrows. Number 36-144478, banded as an adult on Kent Island by D. R. Griffin on August 19, 1938, was caught in the hand by Howard Cleaves when it was blinded by his powerful flood lights used for night photography at Kent Island on July 27, 1946. All of the recoveries were of birds banded as adults except one. Number 34-26791, banded as a nestling at Kent Island on August 1, 1943, was recovered from a nest containing an egg at Kent Island on July 6, 1946, when it was three years old.

PETRELS BANDED ON THE MAINE COAST

Leach's Petrels have been banded at Great Duck, Little Duck and Little Green Islands. A few have also been banded on Eastern and Western Egg Rocks.

Great Duck, located south of Mt. Desert Island, approximately $44^{\circ} 15' N.$ $68^{\circ} 15' W.$, is a spruce-covered island, but there is a large cleared area around the lighthouse at the southern end. Many of the petrels nest in this grassed area, but the burrows of many others are in the peaty soil of the forest floor where conditions are similar to those already described for Kent Island. This island is easily accessible and since more than 1,700 petrels have been banded there, many more than on any other one island, it offers an unusual opportunity for obtaining petrel returns in the future. I banded ten petrels on Great Duck Island during June, 1922, which are probably the first to be banded there. Dr. Olin S. Pettingill, Jr., banded 50 adults during July 8-17, 1929. From these there have been four recoveries: one 1 year, one 5 years and two 6 years after banding.

An adult petrel, A-167762, banded by R. H. Denison, July 17, 1930, was recovered by Packard and Eliot on July 21, 1931. An adult, B-165682, banded by Randolph Jenks on July 30, 1932, was recovered by H. P. Bailey on July 29, 1934. The most extensive banding operations on Great Duck Island were carried out by Henry P. Bailey, who banded 656 adults and 913 young, a total of 1,572 during the years 1932-1936. I am indebted to Mr. Horace Groskin for the records placed in his care after Mr. Bailey's death. From the birds banded by Mr. Bailey we have 48 recoveries: 32 (2 banded as nestlings), 1 year; eight, 2 years; four (2 banded as nestlings), 3 years; three, 4 years, and one, 8 years after banding. Mr. Joseph Cadbury banded 81 petrels at Great Duck Island on August 6, 1942, but as yet there have been no recoveries.

An adult petrel, B-168533, banded at Little Duck Island, located north of Great Duck Island, on August 5, 1931, was recovered from a burrow on the same island on July 16, 1932, by B. W. McPheters.

Mr. Joseph M. Cadbury banded 101 adults and 24 nestlings, a total of 125 petrels on Little Green Island during the years 1931-1941 inclusive. Little Green Island is a low-lying treeless island located well out to sea southwest of Rockland, Maine, at approximately 43° 54.8'N., 69° 2'W. Until 1941 this island was inhabited by a colony of Laughing Gulls (*Larus atricilla* Linnaeus) (Gross 1945). Mr. Cadbury has obtained 6 recoveries as follows: five, 1 year and one 2 years after banding. In addition one nestling 38-108890 banded July 5, 1938 was found dead in its burrow on June 21, 1940. Since this bird probably never left the island it is not included in the list of recoveries. There is a total of 61 recoveries of Leach's Petrels that have been banded on the Maine Coast as follows: Great Duck Island 54, Little Duck Island 1 and Little Green Island 6.

One of the peculiar and interesting features of the petrel recoveries is that every one of them was made at the nesting colonies, all of living birds. Since petrels are pelagic birds and habitually fly over the ocean rather than the land it is not surprising that not a single individual has been recovered away from the breeding islands and reported.

LONGEVITY

The number of recoveries thus far obtained are not sufficient to determine the life expectancy of Leach's Petrel. All of the 116 recoveries in Table II were of living birds which were released and have more years to live. It is obvious that the number of recoveries is dependent on the number of burrows excavated and the ages will depend on the years when the excavations are made.

TABLE II
RECOVERIES
Number of Recoveries

Years Elapsed	Bay of Fundy	Maine Coast	Totals
1	10	40	50
2	1	10	11
3	13	4	17
4	7	3	10
5	0	1	1
6	3	2	5
7	2	0	2
8	13	1	14
9	2	0	2
11	2	0	2
12	2	0	2
Totals	55	61	116

The summary of the recoveries shown in the above Table II, especially those obtained of birds in the Bay of Fundy indicate that the petrel lives to an age much greater than most of us had supposed. Twenty-seven of the petrels, all banded as adults, were recovered after six or more years had elapsed from the time of banding. All of these birds were at least one year old when banded. It is significant that fourteen of the petrels were recovered after eight years had elapsed and were at least nine years old. This would indicate that many petrels live to be nine to ten years of age or more. Some birds live longer as shown by two birds recovered eleven years and two twelve years after banding, the latter were at least thirteen years old.

It is truly remarkable that such seemingly delicate small birds survive for so many years when one considers the hazards and vicissitudes they must encounter during the long migratory journeys over the great expanses of the ocean to say nothing of the many sorties at sea in quest of food for themselves and young during the long nesting season.

In the following Table III are the details of the banding and recovery records of twenty-seven petrels recovered six or more years after banding and hence all seven or more years of age.

TABLE III
DETAILS OF THE MORE IMPORTANT LONGEVITY RECORDS

<i>Six Years</i>				
Kent Island				
Band Numbers	Banded by	Date Banded	Recovered by	Date Recovered
34-124827	D. R. Griffin	7/13, '38	R. Tufts & H. Peters	6/17, '44
36-144455	" " "	7/17, '38	A. O. Gross	7/17, '44
37-165827	" " "	6/24, '38	" " "	7/17, '44
Great Duck Island				
A-340828	O. S. Pettingill, Jr.	7/17, '29	H. P. Bailey	7/30, '35
A-340832	" " "	7/17, '29	" " "	7/30, '35
<i>Seven Years</i>				
Kent Island				
34-233003	F. B. Whitman, Jr.	7/20, '34	Ernest Joy	7/27, '41
37-138132	N. Pillsbury	7/21, '37	R. Tufts & H. Peters	6/17, '44
<i>Eight Years</i>				
Kent Island				
34-124827	D. R. Griffin	7/13, '38	A. O. Gross	7/13, '46
34-124923	" " "	7/8, '38	" " "	7/6, '46
34-124987	" " "	7/10, '38	" " "	7/6, '46
36-144402	" " "	7/16, '38	L. B. Chapman	7/14, '46
36-144478	" " "	7/19, '38	Howard Cleaves	7/27, '46

36-144500	" "	"	7/19, '38	A. O. Gross	7/20, '46
36-144521	" "	"	7/20, '38	" " "	7/6, '46
36-144522	" "	"	7/20, '38	" " "	7/6, '46
36-144526	" "	"	7/20, '38	Albert Barnes	7/21, '46
36-144542	" "	"	7/21, '38	" "	7/21, '46
37-165803	" "	"	6/23, '38	A. O. Gross	7/6, '46
37-165871	" "	"	6/29, '38	" " "	7/6, '46
37-165833	" "	"	6/25, '38	" " "	7/13, '46
Great Duck Island					
34-144601	H. P. Bailey		7/24, '34	J. M. Cadbury	8/6, '42
<i>Nine Years</i>					
Kent Island					
37-138107	N. Pillsbury		7/19, '37	A. O. Gross	7/6, '46
37-138111	" "		7/19, '37	" " "	7/6, '46
<i>Eleven Years</i>					
Outer Wood Island					
35-124061	F. B. Whitman, Jr.		7/31, '35	Coleman Green, Jr.	7/7, '46
35-124087	" "	" "	7/31, '35	L. B. Chapman	7/19, '46
<i>Twelve Years</i>					
Southern Green Island					
34-124527	F. B. Whitman, Jr.		7/5, '34	A. O. Gross	7/11, '46
34-124598	" "	" "	7/5, '34	Albert Barnes	7/11, '46

Since the foregoing table was compiled the following record has been received. Leach's Petrel 36-101694 banded as an adult on Great Duck Island by H. P. Bailey on July 27, 1936 was reported by Charles S. Hubert as being killed by a dog at Great Duck Island on July 4, 1946. This bird was at least 11 years old as it was an adult when banded.

PETRELS BANDED AS NESTLINGS

Of the 1,116 Leach's Petrels banded as nestlings there are five recoveries as shown in the following table.

TABLE IV
RECOVERIES OF NESTLING PETRELS

Great Duck Island					
Band Number	Banded by	Date Banded	Recovered by	Date Recovered	Age
B-190263	H. P. Bailey	7/18, '32	H. P. Bailey	8/1, '35	3
C-144498	" " "	8/17, '32	" " "	7/26, '35	3
35-126609	" " "	7/28, '35	" " "	7/27, '36	1
35-132037	" " "	8/19, '35	" " "	7/27, '36	1
Kent Island					
34-26794	A. O. Gross	8/1, '43	A. O. Gross	7/6, '46	3

The above five recoveries were made on the same island where they were originally banded. These records indicate that the young as well as the adults return to the same islands. It is not to be implied that the young always return to the islands where they were reared, but as yet we have no recoveries to show that the young go to other islands to breed.

Number 34-26794 banded on Kent Island was incubating an egg at the time it was recovered and hence was sexually mature at three years of age. Two birds recovered by H. P. Bailey on Great Duck Island were also three years old when recovered and presumably they were nesting. However, Mr. Bailey recovered two birds banded as nestlings when they were only one year old. Mr. Bailey's records were turned over to Mr. Horace Groskin after his death. Mr. Groskin found 22 records of recoveries, including the two mentioned above, that had not been reported to the U. S. Fish and Wildlife Service. According to Mr. Groskin there is nothing in Mr. Bailey's notes to indicate whether or not the two one year old birds were breeding. This must be admitted as a possibility since the birds were retrieved from nesting burrows. We may assume that Leach's Petrel is sexually mature when one year old until it is proven to the contrary.

GENERAL OBSERVATIONS AT KENT ISLAND

The petrels arrive at Kent Island about the second week of May. Their arrival is dramatically heralded by their characteristic calls and notes as they come flying in from the sea under the protection of the darkness of night. The following records of the first petrels heard were made by Mr. Ernest Joy, naturalist warden, of the Bowdoin Scientific Station. The first petrel song heard in 1938 was May 12; 1939, May 9; 1940, May 10; 1945, May 8, and in 1946, May 12. After their arrival dates there is a nightly chorus of these birds that continues throughout the season.

Evidences of digging by the petrel may be found soon after their arrival. In 1945, the first petrel to be found digging was on May 11. It is the male which is concerned with the digging of the nesting burrow (Gross, 1935) and presumably the males are the first to arrive. After the burrow is completed the courtship activities take place in the nesting bowl and at the beginning of the nesting season it is a common experience to find both birds present before the egg is laid. I have never found two birds in a burrow after the egg had been deposited. In 1946 Mr. Joy found a mating pair in a nest on May 21 and eight days later on May 29 one of the birds was incubating an egg. Both the male and female take their turns at incubation. By the daily examination of a series of burrows it was found an exchange of birds takes place every two to five days. Apparently each bird remains on the nest until relieved by the mate. Birds arriving from the sea have their gullets

and stomachs gorged with food, a supply that evidently sustains them for the duration of their turn at incubation.

I have never seen a petrel at the island during the day except those forcibly removed from a nest, and this in spite of the enormous numbers nesting on Kent Island. The petrels are most active on a dark night and especially when very dense fog prevails. Although a few calls may be heard soon after it becomes dark the performance does not reach its peak until after midnight, usually between two and three o'clock in the morning. If you are in the midst of their burrows at this time you can hear the queer notes of the myriads of birds as they arrive from their foraging at sea. The calls are answered by similar calls by their mates in the burrows. By placing your ear on the ground directly above a bird on its subterranean nest the calls of a single individual can be singled out and during the time the mate is serenading as many as twenty calls are uttered every minute. These calls are kept up, but with diminishing intensity, until about an hour before the first light of dawn; then all activity ceases until the following night. Last summer (1946) Mr. Howard Cleaves was at the island making motion pictures at night with the use of powerful flood lights. When these lights were turned on in the midst of the colony it revealed the great numbers of petrels that were fluttering and dashing back and forth like so many bats among the *Usnea* festooned spruces. It gave one an impression of being in a weird Stygian forest.

The incubation period of Leach's Petrel has never been accurately determined but we do have several records where hatching occurred in excess of forty days after the egg was discovered. Unfortunately in all of these cases the date on which the egg was laid was not known.

On July 6, 1946 with the assistance of members of the station 52 adults were taken from 49 nests for banding. In 33 of the nests there was an egg (one egg comprises a complete set) and in sixteen nests the birds were present but the egg had not been laid. There were mating pairs in three of the 49 nesting burrows. The first young of the year was found on July 11th in a burrow on Southern Green island. This young had just hatched and fragments of egg shells were still in the nest. At this time, out of 21 adults banded, 19 had an egg, one nest was empty (egg not yet laid) and the other contained the young mentioned above. On Kent Island the first, a newly hatched young, was found on July 13, 1946, the second was discovered on July 20th. By the first week of August numbers of downy young may be found but there is also some evidence of digging and a few freshly excavated burrows at this date. These probably represented second attempts at nesting after a failure of the first.

After the young moult their down and acquire the juvenile plumage they are left alone in the nest during the day. They are regularly fed by the adults who venture to the island only at night. Mr. Joy in band-

ing 57 fledglings on September 16-18 did not find a single adult in the burrows excavated. The same was true in 1944 and 1945. Mr. Joy reports that the nesting cavity of the burrows is lined with the thick down that adheres to the damp soil when it is moulted by the young. This down may serve as an insulating material against the dampness and cold which sometimes prevails late in the season. The last young leave in November. In 1945 four (the youngest petrels Mr. Joy could find) were visited daily to determine the dates of leaving. One left on November 15, two on November 18 and the last disappeared during the night of November 19th. In 1946 in another similar series one left November 18, one November 21 and the last to leave remained until the night of November 27, a record late date. Many burrows were examined but no young were discovered after November 19, 1945 and after November 27, 1946.

On September 16, 1946 Mr. Joy while banding fledglings found most of them in advanced stages and all large enough to band except one which was only two or three days old. This young was banded on October 18 when 34 or 35 days old. Later this nest was visited daily until it left the nest on November 27, 1946 at the age of approximately 75 days. Since incubation is at least of 40 days duration it requires nearly four months for a pair of petrels to produce a single young capable of an independent existence. It seems remarkable that the petrel is able to maintain its numbers much less to increase its population. Should the death rate suddenly increase because of the prevalence of more enemies, disease or other causes it might be doomed. Our longevity records indicate that the petrel is a long lived bird and since they are probably sexually mature after one year, this long procreative period is a most important factor in the survival of the species.

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