

BIRD-BANDING

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NOTES ON BANDING BIRDS IN ANTARCTICA, AND ON THE ADELIE PENGUIN COLONIES OF THE ROSS SEA SECTOR

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In November 1955 I flew to Panama to catch the USS *Glacier* (AGB-4) as she transited the Canal on her way to Antarctica. Assigned to Operation Deep Freeze I as official Air Force observer, I was also authorized to collect zoological specimens for the U.S. National Museum and to band birds for the Fish and Wildlife Service, both strictly "on an opportunity basis." This meant that bird work must not in any way interfere with the primary objectives of the Operation—to establish the U.S. bases at McMurdo Sound and at Little America for the forthcoming International Geophysical Year (IGY) of 1957-1958—or with my own primary mission for the U.S. Air Force.

In the short 3 weeks between my unexpected assignment to the Operation and my flight to the ship, little planning for ornithological work was possible. I had barely time to assemble my collecting equipment and a stock of bands. The Patuxent office sent me 500 of each of the larger sizes of bands from #5 up, and 1,000 each of the smaller sizes. They also procured for me 100 of the tags used for marking seals in the Pribilofs and pliers for attaching them (these were flown from Alaska and reached me the day I left), and 100 smaller poultry wing tags and attaching pliers. Even this small amount of equipment, added to my clothing and cold weather gear, exceeded the generous extra weight allowance given me for the MATS flight to Panama, and to "make the weight" I had to jettison most of my ammunition before boarding the plane.

We entered the Ross Sea area at Scott Island on 15 December, and I spent the next 10 weeks carrying out my various assignments as the Operation's movements permitted between the Ross Ice Shelf, McMurdo Sound, and the Victoria Coast north to Cape Adare. Opportunities for bird work on a naval task force I learned are indeed limited. Seldom did any of the ships stop within reach of penguin colonies, and when they did bird study had too low a priority to be spared the transportation necessary to reach them. Nevertheless, thanks to a bit of luck and a fairly capable pair of legs, I managed to visit 5 of the 13 known Adelie Penguin colonies in the Ross Sea area, and to see 4 of the others from a distance. All told I was able to spend only 30 hours actually working in these colonies, during which I banded 500 Adelies (exhausting my size 9 bands), 84 Skuas, and 3 Giant Petrels, and put seal tags on the flippers of 87 more Adelies.

Since my return I have reviewed the literature on penguin banding—would that I had been able to do so before I went to Antarctica! It is widely scattered, much of it in publications of limited circulation and difficult to obtain. For that reason, and because my own observations are more pertinent in the light of what others have done, I present the following resume of previous efforts to mark penguins.

HISTORY OF PENGUIN MARKING

In his charming though fanciful tale, "Rik: the Story of a Penguin," Frank Debenham (1952: 77-95) describes how James Murray, the biologist on Shackleton's British Antarctic Expedition of 1907-09, assisted by geologist Raymond Priestley, marked a newly hatched Adelie chick in December 1908 at Cape Royds, McMurdo Sound, by nipping off "a tiny piece of claw and [putting] a tiny ring of celluloid on his leg." This enabled Priestley (according to the story) to recognize the bird when he found it 3 years later killed by an avalanche at Ridley Beach, Cape Adare, 500 miles away. Were this true, Murray and Priestley would have been the first to mark penguins, but Mr. Debenham has confessed to me (*in lit.*) that "this is the only part of the story which is fictional. . . . I had to have Rik ringed and rediscovered by Priestley because otherwise he couldn't have recognized him and the human interest in the story would have been lost."

Actually the first penguins ever banded were the 50 Gentoos (*Pygoscelis papua*) that L. Gain (1914: 501), zoologist of the Second French Antarctic Expedition, marked 28 December 1908 on islands off the Palmer Peninsula, by putting green celluloid bands on their tarsi. On 12 January 1909 in another colony near by, Gain banded 40 more Gentoos and 50 adult and 75 young Adelie Penguins (*Pygoscelis adeliae*). When Gain visited the same colonies the following breeding season, he found enough of the marked adults to determine that both species return to the same place to breed in successive years. As he found none of the young he had banded, he deduced "it appears that the young birds do not return to their birthplace and do not breed before two years old."

The next person to mark penguins for individual identification was G. Murray Levick, physician with Scott's northern party of 1911-12 and author of a now classic account of penguin behavior (1914). In his formal report on the Adelie Penguins at Ridley Beach (1915: 61) Levick writes: "With red paint I marked the breasts of a good many couples, renewing the paint as it faded, through the whole breeding season, and in every case the couples remained perfectly faithful to one another."

Field work on penguins then lagged for a quarter of a century, until L. E. Richdale began his monumental studies of the three New Zealand species in 1936. Richdale (1951: 47-54) was the first to report the difficulties in using the banding method on this group of birds, and the first to try to overcome them. He found, as have later workers, that tarsus-ringing is not entirely satisfactory with any of the Sphenisciformes, and is moderately successful only with the smaller species. Their tarsi are all exceedingly short, too short to accommodate a band of "standard" width. As most penguins either

walk or rest on the tarsus as well as on the phalanges, a tarsus band is subjected to abnormal wear, and often becomes so jammed and bent that it injures the leg. A band placed above the tarsus on the tibia, though less likely to hurt the bird, is so hidden by feathers it cannot be seen until the bird is examined in the hand.

In experimenting with several materials, types, and sizes of bands, Richdale soon discarded celluloid rings because they come off too easily. The heaviest aluminum bands he was able to procure (comparable to our size 9) he found serviceable on the tarsus for only 2 to 5 years. For a more permanent marking scheme he devised the technique of punching holes in the webs of the feet in recognizable patterns. These methods sufficed for Richdale's particular studies, which never involved large numbers of birds.

No one else tried to band or mark penguins until interest in the Antarctic revived at the end of World War II. Several groups of investigators then attacked the problem simultaneously in widely separated parts of the Antarctic and sub-Antarctic: J. D. Andrew, J. M. Roberts, W. J. L. Sladen, and B. Stonehouse of the Falkland Islands Dependencies Survey (FIDS) in the Palmer Peninsula region; J. Sapin-Jaloustre, J. Cendron, and J. Prevost with the French Antarctic Expeditions in Adelie Land; and M. C. Downes, A. M. Gwynn, and J. B. Sturrock with the Australian National Antarctic Research Expeditions (ANARE) at Heard and Macquarie Islands. For several years each of these groups worked independently, without knowledge of the accomplishments of the others. It is interesting to note how closely their efforts and their results parallel one another.

The postwar work started in February 1945 when G. J. Lockley, a FIDS biologist, banded 50 young Gentoos at Port Lockroy, Palmer Peninsula. In November 1946 Andrew (Andrew and Roberts, 1952: 540) banded 10 pairs of Adelies on their nests (which he also marked) at Hope Bay, also in the Palmer Peninsula. The Hope Bay colony was studied during the next two breeding seasons first by J. M. Roberts, then by W. J. L. Sladen. The results corroborated some of Gain's earlier findings, in that six pairs returned to lay at the identical sites the following year and four pairs the next. Unexpected was finding that several of the marked pairs had split up, one bird returning to the old nest with a new mate, its original partner returning to nest close by, also with a new mate.

All these birds were banded with rings made in the field of strips of sheet aluminum marked with a set of number punches, and fastened around the feathered tibia. Sladen at first tried Richdale's technique of tarsus-banding, but immediately shifted to the tibia when he found that bands on the tarsus abraded rapidly and injured the birds. Sladen (1952: 542) reports that Adelies banded on the tibia in 1946 "were still in excellent condition" when he recovered them in 1948. In January 1950 at Port Lockroy Sladen found one of the young Gentoos banded there in 1945: "The ring was in excellent condition and the number '47' could be clearly read."

Sladen brought with him in 1948 a new stock of numbered bands of a special aluminum alloy and marked "Inform FIDS Colonial Office

London." The size 6 used for penguins then was supplied in strips of 18 standard wire gage metal, $4\frac{1}{2}$ inches long and 12.5 mm. wide. The strips were trimmed to fit the particular bird and fastened by a clip over the ends. The inscription and reference number were duplicated inside the double bend of the clip as a safeguard against abrasion of the outer markings.

To identify penguins at a distance, Sladen experimented with paints and colored celluloid rings. He found painting highly successful for a single breeding season. Using a quick-drying cellulose aircraft paint developed for low temperature work, numbers painted on the back of the flipper where "the feathers are short, dense and usually clean . . . could be read after the bird had been at sea for ten days." "It was essential . . . to postpone painting if the flipper was wet or dirty. . . . Yellow was the best colour."

The colored celluloid rings gave poor results used on the legs. On the tarsus they injured the leg almost as badly as metal rings did; on the tibia they could not be seen. Placed on the base of the flipper, the ring was usually lost when the bird went to sea. Sladen reports them useful only for marking birds temporarily on the flipper when wet weather prevents painting, for marking fasting or molting adults (which stay out of the water), and for the larger chicks. Smaller chicks he identified with soft string tied to the flipper, which he loosened as the chick grew.

Sladen was the first to experiment with metal rings at the base of the flipper, where they are not subject to wear and are readily observable. He warns that attaching them requires meticulous care, but put on correctly they "rub only the short feathers at one place on the thin anterior edge of the flipper." He flipper-ringed some 530 birds in the 1950-51 season and followed some of these successfully throughout the nesting and molt. He informs me (*in lit.*) that some of these rings were reported still in good condition 3 years later.

Roberts and Sladen (1952: 540) also report the banding of some Emperor Penguins (*Aptenodytes forsteri*) in June 1949 by B. Stonehouse on the newly discovered breeding ground on Dion Island, Marguerite Bay, "but owing to lack of suitable material, the rings were only temporary."

The French started banding penguins in Adelie Land on the opposite side of the continent in February 1950. The first report of it published (Sapin-Jaloustre and Bourliere, 1951: 66) states only that Sapin-Jaloustre marked a number of adult and young Adelies with oil paints, which proved far more useful for identification during the season than metal or celluloid bands on the legs, and that just before leaving in January 1951 he experimented with metal bands on the flipper, which held great promise. Later Sapin-Jaloustre (1952-A: 81) gave a more detailed report on his activities during the 1950-1951 season. In February 1950 he marked 75 young Adelies (presumably on the tarsus, though he fails to say), but found "The regular aluminum bands are invisible on the adult's tarsus. Also many have caused accidents from compression, owing no doubt to the dorsal flexion of the foot, and had to be removed. A system of banding on the wing,

extremely visible, was tried, and so far appears to give excellent results. Taking into account the bands removed and birds killed by the dogs, 64 adults remained banded for later observation."

A photo accompanying this report shows an adult Adelie with an aluminum band clipped around the axillary part of the flipper in such a way that it is certain to interfere seriously with the bird's progress in the water.

This same report (p. 82) announces the exciting discovery of the large Emperor Penguin colony at Pointe Geologie and states: "70 Emperors and 10 young were banded with improvised means; 24 adults with aluminum bands made and marked at the base, all the bands which had been brought being much too small." In a later report (1952-B: 181) Sapin-Jaloustre gives the following breakdown of this banding, all birds banded on the right tarsus: Pointe Geologie 16 October 1950, 10 adults with aluminum bands marked AA to AJ, 9 young with celluloid bands, 40 adults with tarred waterproof cord knotted around the right tarsus; Port Martin 27 October 1950, 1 adult with aluminum; below Terra Nova Glacier 28 November 1950, 6 adults with aluminum.

When Sapin-Jaloustre left Adelie Land early in 1951, his place as physician and biologist at Port Martin was taken by his compatriot, Jean Cendron, who reports (1952: 50) the following banding during his year there: 20 adult Emperors wing-banded 1 June 1951 and about 75 more adults and 40 young wing-banded in September, all at Pointe Geologie; about 40 adults and 50 young Adelies wing-banded at Port Martin in February and March 1951. Between October 1951 and January 1952 he banded the 200 adult Adelies occupying 100 new marked nests, and states a "certain number" of the birds banded the previous year were found nesting, but the destruction of the birds by dogs interfered seriously with the study.

In the report of his study of the Adelie's molt that year, Cendron tells (1953: 79) of marking some 30 adults "on the upper breast with simple geometric figures in bright colors of quick-drying, water-resistant paint [made by the Duco company]. Each bird was thus easily recognizable as long as its breast and neck feathers had not fallen; to avoid losing a bird, at the start of the molt we placed at the base of the wing an aluminum band of the Paris Museum bearing an easily visible number. After we followed the entire molt of a bird, we killed it to determine its sex." Of the 30 birds originally marked, the study was completed on only 3.

The next year Cendron's place as surgeon to the French expedition was taken by Jean Prevost, who spent the winter of 1952 studying the Emperors at Pointe Geologie. In the expedition report for that year Prevost (1954: 16) comments on his banding: "The banding of Emperor Penguins was from the start a source of disappointment; the model of 'Museum' bands we had soon proved useless for our rookery studies. The very dense grouping of the birds made necessary a marking clear and visible at a distance. After a number of tries (painting the backs, strips of numbered plywood fixed to the flipper) a model of ring perfected on the spot with the help of Roger Vincent

gave us complete satisfaction." Some of Prevost's banding difficulties and his success in spite of them are described in the very readable account of that expedition by its leader (Marett, 1955). The 250 Emperors he marked were instrumental in obtaining for Prevost some of the most important and unexpected observations he made on the species' behavior and life history (1953 and 1955).

How well their flipper bands lasted, and what effect they may have had on the Adelies and the Emperors after they left the breeding grounds, the French ornithologists have not yet reported.

While the French were working in Adelie Land, the Australians were experimenting along similar lines at Heard Island, 2,500 miles to the westward. Chittleborough and Ealy (1950: 102) did the first banding there in 1949, and ringed some 4,000 birds of 10 species, but evidently had no bands suitable for penguins. M. C. Downes (1955: 1) started experimenting with the Gentoos, Rockhoppers (*Eudyptes crestatus*) and Macaronis (*E. chrysolophus*) there in 1951. He first tried ear tags used for marking sheep in Australia, aluminum strips 6.5 mm. wide and 1.4 mm. thick with rounded edges, which "were easily wrapped round the legs of penguins and remained in position by their own tension. In every recovery, however, the flesh beneath was found to be inflamed, and the use of these bands on the legs is not recommended."

Downes found punching combinations of differently shaped holes in the webs of the feet with a leather punch "to be a great success." He also tattooed the webs with a large pair of pliers fitted with sharp pins in the shape of figures or letters which "punctured the web . . . leaving behind sets of small holes into which a greasy dye was rubbed." When the birds were in a suitable position the tattoos were recognizable from a distance, and "two years later the punch marks were still easily visible but the tattooed figures could not be read unless the bird was handled."

In 1953 Gwynn (1955: 8) obtained flipper bands from Sladen to try at Heard Island, and Sturrock used them simultaneously at Macquarie. They proved unsatisfactory when used on Rockhoppers. Of seven tagged 1 May at Heard Island just before the birds left for the winter, only one was found later, at its nest the following November. "The hind web of the flipper was denuded to the bare skin right into the axilla but the skin was not broken, and the leading edge of the flipper was badly notched. The ring was removed."

The 330 Rockhoppers Sturrock flipper-banded at Macquarie that April "included almost the entire population of a small colony close to the A.N.A.R.E. Station. Finding the same difficulty as that experienced by the writer [Gwynn, *idem*] in fitting the clip in the axilla, Sturrock placed the clip on the outer (dorsal) aspect of the flipper, projecting vertically upwards. The result was disastrous. Only 35 birds appeared for the breeding season all showing serious abrasions around the base of the flipper. . . . A few with only slight abrasions returned with the main body, but there appeared to be a correlation between the severity of their injuries and the lateness of their return.

However, a further 147 returned for their moult in the following April, having missed the breeding season altogether."

A narrower band made of strip aluminum 6.5 mm. wide and strong enough to be overlapped without a clip gave slightly better results. Three of the six so tagged in May were recovered the following November; each showed notching on the anterior edge of the flipper and the axillary wear "is only seen after the long winter at sea, and it is possible that in pelagic species, such as the macaroni and rockhopper penguin, wear is worse than in those species which spend the intervals between fishing on land or on ice-floes. Sladen was working with species which probably spend much of their time at all seasons resting on the packice (Adelies)." Gwynn concludes "flipper banding is eminently suitable for a single season's work, but the technique requires further modification before it can be recommended as a method of marking for long-term research."

Of the difficulties reported by the Australians, Sladen has written me as follows: "The trouble with these flipper rings is that unless they are put on exactly right they are dangerous. Reading the Australian account, they seem to have put the clip on incorrectly, and *failed to bend it back* flush with the rest of the ring. A clip projecting into the axilla or anywhere else is bound to cause damage. Our new FIDS design and that of the Australians is of thicker metal with a simple overlap. We are experimenting with new methods and hope soon to publish the results, but one of the difficulties with antarctic work is the long time lag between time and result and publication."

BANDING ADELIE PENGUINS ON DEEP FREEZE I.

In addition to my supply of F&WS bands, as noted previously, I had with me 100 each of two sizes of tags that I hoped could be attached to penguin flippers and possibly solve the problem of marking these birds harmlessly, conspicuously, and permanently. These tags are manufactured in several sizes by the National Band and Tag Company of Newport, Kentucky, primarily for ear-marking livestock and wing-marking poultry. They consist of a flat strip of metal bent midway into a U-shape, with a pointed staple on one open end and a matching slot on the other. They are affixed with a special pair of pliers that forces the staple through the ear or wing and clamps its point fast in the opposing slot.

The larger tags, which I thought might do for Emperors, are the cattle ear tags the Fish and Wildlife Service has used so successfully on fur seal flippers in the Pribilofs. Made of $\frac{3}{8}$ " x $3\frac{3}{8}$ " strips of a hard, 20-gage, Monel nickel-copper alloy, when locked into place they are $1\frac{1}{2}$ " long with a $\frac{3}{8}$ " gap between the sides. For the smaller Adelies the Banding Office obtained for me the "Jiffy" tags made for wing-tagging poultry. These are of softer metal, $\frac{3}{16}$ " wide, and when closed are $\frac{3}{4}$ " long with a $\frac{3}{16}$ " slot for the wing.

My first opportunity to test this equipment came 18 December when *Glacier* stopped for 2 days in the heavy bay ice of McMurdo Sound, about $2\frac{1}{2}$ miles offshore of the southernmost of the three Adelie colonies just inside Cape Bird (no. 12 on map, p. 17). The Adelies

in this colony were incubating very closely, and their eggs were just hatching. Almost every bird I looked under had either newly hatched young or eggs just pipping. The oldest young I saw appeared to be no more than 4 or 5 days old.

From the time they lay their eggs in mid-November the Adelies almost never leave their nests uncovered until the chicks are 12 to 14 days old. Both sexes share the incubation in turn through the 32- to 34-day incubation period (Sladen, 1955), each bird incubating for 10 to 14 days at a time, and neither leaves the nest until relieved by its mate. The reason for this is twofold, first for warmth (temperatures during my visit ranged from 12° to 35° F.), second and even more essential, to protect the eggs and young from the ever-watchful predatory Skuas.

As you walk among the nesting Adelies, the brooding birds express their resentment by squawking at your approach, but do not budge until you get within reach of their bills. Then, without moving their bodies from the nest, they twist their necks to peck at you, and desist the moment you step out of range. In every group, however, are usually a few adults that have not mated, or who have lost their eggs, but are still guarding the territories they established weeks before. These birds make things rather uncomfortable for the intruder. They rush at you fiercely as you near their sterile territory, bite your legs as far up as they can reach (they nip sharply enough to hurt through several layers of clothing), and bang your shins with rapid, drumming blows of their flippers, which can also be surprisingly painful.

As soon as I had familiarized myself somewhat with the colony and its inhabitants, I started tagging and banding. Having no way to mark permanently the nests of the birds I handled, I restricted these operations to the two clusters of nests on the extreme southern periphery of the colony. In the smaller southeasternmost group I wing-tagged 53 nesting adults. In the larger knot of nests marking the southwest corner of the colony at the edge of the bank above the shore, I banded 500 adults on the right tibia.

The wing tags, it seemed to me, would be least likely to injure the birds or to interfere with their swimming powers if affixed to the trailing (posterior) edge of the flipper slightly outboard of the mid-point, where a bone- and muscle-free spot extends inward about an inch from the edge. It takes a bit of experimenting and practice to locate this spot, but a tag can be clipped through the flipper there with ease, and apparently without causing the bird any discomfort.

Not a single one of the penguins I tagged showed any evidence of being hurt by the process. None flinched in the slightest as the point bit through the flesh, or gave any other sign of noticing it. Unlike many land birds whose first reaction on being released after banding is to fly to a nearby branch and pick at the band, none of the penguins I tagged paid any attention to the clip in its wing. The moment I released it, each bird immediately settled back on its nest and resumed incubating contentedly and unconcernedly.

I first tried the small "Jiffy" poultry tags but, contrary to expectations, they proved much too small for the Adelies. They fit the flipper

so tightly when locked into place that they are almost certain to interfere with the molt. Secondly they are so inconspicuous that they are not likely to be noticed if the bird is more than a few yards away. Lastly they do not open widely enough to be slipped into place easily against the grain of the small but very stiff feathers covering the flipper. With much trouble and fiddling I did manage to get three of them locked in place, ruining 10 tags in the process, before I concluded they are just not suitable.

I next experimented with the seal tags. While not perfect for the Adelies, they can be used with more success than the "Jiffy" tags. They should be quite suitable for Emperors, on which unfortunately I did not have a chance to try them. The slot allows ample room for the molt, and for the Adelies it could possibly be a trifle shallower. The tag shows up well at a distance, but if it were slightly wider, say by $\frac{1}{8}$ " , it would be even more conspicuous and would accommodate a larger legend, easier to read without picking up the bird. Its main fault for use with Adelies is its length; were it $\frac{1}{4}$ " to $\frac{5}{16}$ " shorter it would fit more snugly. If affixed to allow the ideal space of about $\frac{1}{8}$ " to $\frac{1}{4}$ " between the end of the slot and the edge of the flipper, the staple is likely to strike a blood vessel or one of the phalanges. Even a small bone will deflect the point of the staple so it misses the locking slot. Tags so twisted cannot be repaired in the field and must be discarded.

In tagging the 50-bird sample I ruined 10 tags, a few by striking bone, most by not having the clip squarely in the jaws of the pliers before pressing the point home. Squeezing the Monel clip into place takes quite a bit of strength and is difficult to do with one hand. Pliers with better leverage to give more jaw pressure would facilitate the task for the lone operator who must hold the bird in one hand while tagging it with the other.

In 5 of the 50 birds I punctured a small blood vessel, which bled enough in the few minutes before clotting stopped the flow to stain a spot an inch or two in diameter on their white waistcoats. Neither the bleeding birds nor their companions paid the slightest attention to the disfigurement. None of the remaining 45 birds bled a drop.

After tagging the 50, which I decided was enough for an experimental sample, I turned to conventional leg banding. Here I found, as others had before me, that an Adelie's tarsus is indeed far too short to accommodate the width of our bands. Furthermore, the tarsus has a pad on its posterior side like those on the toes. So I placed the bands above the joint at the base of the tibia where, though the band is partly hidden by feathers, the size 9 fits just about right. Size 8 is too small.

I soon worked out a practicable method of handling these strong, heavy birds. The adult Adelie weighs between 10 and 15 pounds, depending on how long it has been fasting, and is far too strong and lively for a lone bander to pick up and hold under one arm while he bands with the other, as one does a gull or a duck. The easiest way is not to pick the brooding birds up at all, but to hold them down and band or tag them right on the nest: Approach the

bird from the front, place the left knee on the ground at the left side of its head and lower the left forearm firmly on its shoulder, being careful to avoid pressing the middle or lower back which might crush eggs or young. This keeps the bird's head with its sharp beak out of damaging distance behind your elbow, and leaves your left hand free to hold the flipper or leg still while you tag or band it with your right.

At first the banding went slowly, and took a full minute or more per bird, but as facility with the technique improved, so did the speed. Not counting the time spent opening bands, I put the last 200 bands on in a few minutes less than 2 hours. However, the next time I band for any length of time in an Adelie colony, I hope to be wearing hip length boots or coveralls well lined with crumpled newspaper to absorb the hammering of the flippers, and a heavy leather glove with long gauntlets tied above the elbow on my left arm to soften the pinching of the sharp beaks. I carried the bruises, bites, and scratches from that one day's work on both legs and on my left forearm for a good 2 weeks. Fun though it is to work with Adelies, their defensive capabilities are not to be underestimated when handling them in quantity at close quarters.

I kept my 40 remaining seal tags hoping to try them on Emperors, but the few that straggled over the ice into McMurdo Sound that season were rounded up as fast as they appeared for the Washington Zoo. (Of the 20-odd Emperors that started the voyage back, the three that survived it all died of respiratory infections within a week after reaching the zoo.) I encountered no other Emperors I could get my hands on elsewhere in my travels so, when chance offered on 26 January, I used the tags to mark a sample of Adelies in the southernmost penguin colony known, adjoining Shackleton's famous hut at Cape Royds (no. 13 on map, p. 17).

Here I again tagged only adults, but that late in the season with the chicks well grown, the comparatively few adults present were not occupying definite territories. While they were doubtless members of the Cape Royds population, there is no assurance that the birds I tagged had nested at the southern edge of the colony where I caught them. They were very active, and not nearly as easy to catch or to handle as the incubating birds had been. Fortunately I had an enthusiastic and willing machinist's mate, one Mike Flannigan of Jersey City, to help me and, with a dip net to pick up the birds, we used up the remaining tags in about an hour. Six of the 40 tags bent out of shape or blunted while being attached, so the Cape Royds sample is 34, all tagged as were those at Cape Bird, on the trailing edge of the right flipper.

I hope someone based at Hut Point with the Navy and IGY parties to be there during the next two breeding seasons will find time to spare from geophysical observations and be able to travel to Cape Royds and Cape Bird (20 and 42 miles distant respectively), to see how many of these marked birds have survived, and what effect if any the tags have had on their flippers.

BANDING SKUAS

An active program of banding Skuas (*Catharacta skua*, known to all antarctic hands as "skuagulls") is certain to yield more important and spectacular results than banding any of the other five species of birds that breed in Antarctica. Four of these species, the Emperor and Adelie Penguins, the Antarctic Petrel (*Thalassoica antarctica*), and the Snowy Petrel (*Pagodroma nivea*) seldom move north of the pack ice and, until the Antarctic is far more densely peopled, have little chance of being recovered away from their breeding grounds. Though Wilson's Petrel (*Oceanites oceanicus*) migrates long distances into northern seas, it is a small bird that remains far at sea there and seldom falls into human hands. It would be difficult to band enough of them in Antarctica to assure any chances of recovery.

The Skuas of the Antarctic, however, can be banded easily in fair quantities, and they wander northward during the antarctic winter to waters and shores where they come frequently into contact with mankind. They present a number of distributional, systematic, and behavior problems that warrant further study, and only through banding them on their breeding grounds can the movements and moot relationships of the several recognized forms to one another be determined.

Practically no two recent authors agree in their systematic treatment of the forms of the bipolar genus *Catharacta*. Some regard its antarctic representatives as specifically distinct from the Great Skua of the North Atlantic. As none of the morphologically distinguishable forms has as yet been proved to breed sympatrically with any other, the conservative view is to regard the genus as monotypic, and its single species, *C. skua*, to be divisible into at least four acceptable subspecies, *skua*, *chilensis*, *lönnerbergi*, and *maccormicki*. Banding evidence of their movements based on breeding ground banding will help greatly to clarify their relationships.

C. s. maccormicki is a common breeding bird throughout coastal Antarctica, and frequently strays far inland. Skuas soon gather around human activities in the antarctic summer looking for food, and will stay for some time wherever anything edible seems obtainable. They are fairly tame and bold, and present no problem to the experienced bird trapper who has material for traps, nets, or snares handy, a supply of bait, and time to devote to catching them. Where seals are plentiful for bait, trapping Skuas in quantity, say 20 or so at a time, should be simple with any type of throw net. The easiest and most profitable place to band them is at their nests.

Single pairs of Skuas nest in widely scattered places, on almost any islet or headland near open water. One isolated pair was nesting on the scree under Observation Hill at Hut Point when the Seabees started building Williams Air Facility there. The birds were successful despite the bustle of human activity near-by, and I banded their two young when they were almost ready to fly on January 30th. These are undoubtedly the two southernmost birds banded to date (77° 53' S.), a record I hope will soon be broken.

Wherever food is plentiful enough, Skuas nest in loose, colonial fashion. I will be greatly surprised if a number of pairs do not nest next December near the garbage dump of Williams Air Facility. The most abundant and unailing sources of Skua food in the Antarctic, however, are the Adelie Penguin colonies. Every Adelie colony in the Ross Sea area has Skuas parasitic upon it. They nest around its fringes, usually in the ratio of about 1 pair of Skuas to 100 or so pairs of penguins. Though this ratio may vary somewhat from place to place, nevertheless the number of Skuas attendant on an Adelie colony is often a rough index to the size of the Adelie population, and is much easier to count.

The Skuas nest somewhat later than the Adelies, and usually lay just as the Adelie eggs start to hatch. On 18 December at the Cape Bird colony, many of the some 175-200 Skua nests in the vicinity contained only the first of their standard clutch of two eggs. Twenty days later on January 7 at Cape Royds, only three young had hatched in the 18 Skua nests I found there. As I could find neither eggs nor young in the territories being guarded by six more pairs of Skuas near Shackleton's hut, I feel sure their nests were destroyed by some of the many Deep Freeze I visitors to the famous site. Everybody loves the Adelies and hates the Skuas for preying on them. Likewise the uninitiated resent the Skuas' habit of dive-bombing intruders on their territory. So they feel quite justified in breaking up any Skua nest they find, despite strict Task Force orders forbidding them to molest any indigenous wildlife.

When I reached Cape Royds again 26 January, I was pleased to find all three of the young I had banded 19 days before, now more than half grown. I found only 7 other young (which I banded of course), and one nest containing two eggs and six with a single egg still being incubated. As the single-egg nests had no young near-by, they were probably renestings of pairs whose eggs had been destroyed earlier. Their chances of maturing chicks were doomed to failure. When not interfered with, some young Skuas are on the wing by the end of January, and all that are going to survive are flying by the end of February. The freeze-up starts in earnest March 1.

Nesting Skuas, while remarkably tame compared to nesting gulls elsewhere in the world, are not as tame as the penguins, which will not leave their nests when approached. A nesting Skua sits quietly until you are within about 50 feet. Then it starts to cackle in alarm—"ha-ha-ha-ha-ha." When you walk within 25 feet the incubating bird gets up, still cackling, stalks uncertainly away from the nest, and is usually joined at once by its mate who has been sitting a few yards off. The two birds walk stiffly and hesitatingly away, cackling the while, and raise their wings uneasily, the signal they are about to fly. Taking wing they circle about and, as you reach the nest, dive threateningly at you, veering off within a foot or so of your head. Of the dozens of Skuas that swooped at me, however, not a single one actually struck me.

At Cape Bird I had no way of catching adult Skuas, but before I went to Cape Royds 7 January I was able to borrow from a hydrogra-

pher friend aboard *Glacier* the ideal implement for the purpose, a "Dura-Flote" net. This net has an ample 2-inch mesh bag on a light, circular, duralumin frame 2 feet in diameter with a 4-foot duralumin handle. Armed with this weapon, I approached the first nest warily. On the first bird's first pass at me I swung the net and took it right out of the air, and a few moments later its persistent mate. In the scant 2 hours I had there before the helicopter came to take me back to the ship, I caught both adults on three nests and one of the pair on three more, nine birds in all.

I soon found individual birds differ in their boldness. The boldest are those whose eggs are just hatching, or who have newly hatched young in the nest. These zoom at you time after time, and come within 2 or 3 feet of your head. They are deceptively quick and, unless you swing the net fast and time the swing just right, will brake suddenly "with all flaps down" and soar up over it. A miss makes them more cautious. The surest way to catch them I found was to crouch down beside the nest with the net behind me and, as the bird swooped, to straighten up into its path at the last possible moment and swing at the same time. (And it's lots of fun, believe me!)

The Skuas' loyalty is strongest evidently to their territory. They lose their ferocity as the chicks grow and wander away from the nest. When I visited the colony at Edisto Acres (no. 4) on 12 February, the young Skuas there were well grown, some of them on the wing. I caught and banded 52 of the young, but only 10 of the adults zoomed close enough for me to net them. When I stood over a chick, or even held it up squealing in distress, the parents usually made a half-hearted pass or two, veering off at 10 or 15 feet, and then more or less lost interest. When on 18 February I finally got ashore on the largest Adelle colony in the Ross Sea area, the tremendous one on Ross Island west of Cape Crozier (no. 9), most of the penguins had left, the young Skuas were almost all flying, the adults kept their distance, and I couldn't catch a single bird.

My Skua banding for the season totalled 19 adults and 64 young, 83 in all. With enough time at the right time in the larger colonies, it should be possible to band Skuas by the hundred, perhaps by the thousand at the Cape Crozier breeding ground. They will take a size 6 band, but a size 7A is a better fit.

BANDING GIANT PETRELS

The only other birds I was able to band on Deep Freeze I were three Giant Petrels (*Macronectes giganteus*) I caught at Edisto Acres. The Giant Petrel is an unlovely bird, not as graceful as the albatrosses in flight, and even more awkward and ungainly on land. Close at hand it has an unpleasant, almost vulturine aspect, and I like the sailors' names of "Nelly" or "Stinker" for it; the latter inelegance is particularly fitting.

The Giant Petrel is not known to nest on the mainland of Antarctica in the Ross Sea sector, but small numbers visit the more northerly Adelle colonies in summer to share the pillaging with the Skuas. As we skirted Ridley Beach in a landing craft trying in vain to effect a landing through vicious surf kicked up by a 50-knot gale 9 February

(see p. 19), I counted 52 Nellies on the point just above the wave wash, 6 of them almost pure white, the rest dark. Ashore at Edisto Acres a week later, I found a dozen along the beach and a flock of 22 resting on the ice of the lagoon enclosed at its base. It was one of these rarities in late summer Antarctica, a calm day, and like the rest of the larger Tubinares, Giant Petrels have trouble taking wing without the help of a strong wind, especially when heavy with food. On the water they sometimes have to patter several hundred yards over the surface to get up flying speed. On land they lumber awkwardly ahead of you holding their wings outstretched but motionless, and often vomit their last meal in panic to "lighten ship."

The Nellies along the beach at Edisto Acres scrambled down into the water as I approached and quickly swam out of reach. Those on the lagoon ice couldn't find sanctuary as quickly. They waddled in a column to the steep talus at the base of the cliff behind the lagoon and climbed it laboriously to a precipitous spot. Then they turned and came swooping down past me as gravity increased their speed and their extended wings gained lifting power. I managed to run down three of these before they could get airborne. The rest were too fast for me.

Again with time and equipment—say a corral of netting to drive them into—and a bit of luck in the way of calm weather, these birds could be caught in some numbers for banding. And as the FIDS banding at the South Orkneys and Australian banding at Heard and Macquarie Islands have shown, a fairly high rate of recovery can be anticipated. Their possible circumpolar migration down the prevailing westerlies still wants further documenting and verification which only banding can supply. They take a size 8 band.

THE ROSS SEA ADELIE PENGUIN COLONIES

The saucy, impudent, inquisitive, and altogether fascinating Adelie Penguin is one of the most abundant birds in Antarctica. As such it is important as a reservoir of human survival food in that barren land which is just emerging from the ice age. Wise explorers of the past, no matter how well their expeditions were provisioned, established their bases near an Adelie colony when they could, the surest source of easily harvestable sustenance in time of emergency. Easy access to such a colony has given a welcome change of diet to many explorers, and on more than one occasion has been a decisive factor in their survival. It is unlikely that the Adelines will ever be of economic importance in any other way.

More than a century ago Ross suggested the possibility of shipping guano from these colonies to Australia (see p. 20). The depth of the guano beds under the Adelie colonies is unknown, but it is probably not very great. Many of the birds nest on steep slopes of bedrock where little guano can collect, and nobody has ever dug into the level sites below the permafrost, only a foot or two down. The deposits are undoubtedly high in nitrogen content, for there has been little bacterial action over the ages on the mass of excreta and innumerable penguin mummies of uncertain age, and on the rare days when the

temperature rises above freezing the stench of fresh ammonia is almost overpowering. But the deposits are so inextricably mixed with pebbles and boulders that they probably can never be mined profitably. So far this potential resource remains unexploited, and it is to be hoped nobody will ever be foolish enough to attempt it. The deposits could be worked only during the short summer when the birds are nesting—which of course would mean the end of the birds.

Esthetically and scientifically the Adelie is a priceless asset, an integral part of the antarctic scene whose presence would be sorely missed were the species not protected and maintained. For the ornithologist fortunate enough to be able to spend more than a few brief hours with them, the possibilities for research are unlimited, and the nesting birds' lack of fear of man makes them unbelievably easy to work with. Activities during the coming International Geophysical Year and, it is to be hoped, continued occupation of its station sites thereafter, will afford marvelous opportunities to increase our knowledge of these comparatively little-known birds.

The recent studies of Sladen, Sapin-Jaloustre, and others (see bibliography) have laid a fine groundwork for further investigations into the Adelie's biology, particularly its nesting habits and behavior. Much still needs to be done on its physiology, to explain its marvelous ability to fast for weeks at a time during the breeding season, and to regain its lost weight so rapidly. The species is an almost ideal subject for studies on the mechanics of adaptation of homoiothermic animals to cold.

One of the most promising fields for research on the Adelie, and one which so far has hardly been touched, is its demography. We know next to nothing of its individual life span, or of the rate of mortality in either the young (which all observers agree is very high) or the adults. With its low reproductive potential (one young per year for each breeding adult), the certainty that the species does not breed in its second summer and the strong probability that some individuals may not until their fourth or fifth, and the terrific observed mortality in the egg and nestling stages, the potential life span of the breeding adults must be very long, certainly longer than in any species we have yet been able to measure satisfactorily. A systematic banding or tagging program in a rookery convenient to one of the IGY sites over the next few years, particularly one that may be occupied on a permanent basis, could yield much information on these important aspects of the species' biology.

Its present abundance despite its low rate of recruitment shows the Adelie to be well adapted to its rigorous and forbidding environment. The ecological factors that govern its choice of nesting ground have not been satisfactorily determined. The Skua is its only enemy on land, other than man, and food is no problem for it anywhere within reach of Antarctica's krill-rich waters. The Adelie favors several types of terrain for its colonies, but despite statements in the literature to the effect that it occupies almost all the available sites, wide stretches of unoccupied ice-free coast appear quite suitable to its nesting needs. From the apparent antiquity of its known nesting sites, several of

which have been occupied more than a century, and the scant banding evidence, site tenacity is strong in the species. Whether or not this and other facets of its behavior pattern are so strongly ingrained they cannot change in case of need remains to be seen. Despite its abundance it does not seem to be increasing in numbers, and is apparently just maintaining a precarious state of balance which could easily be upset.

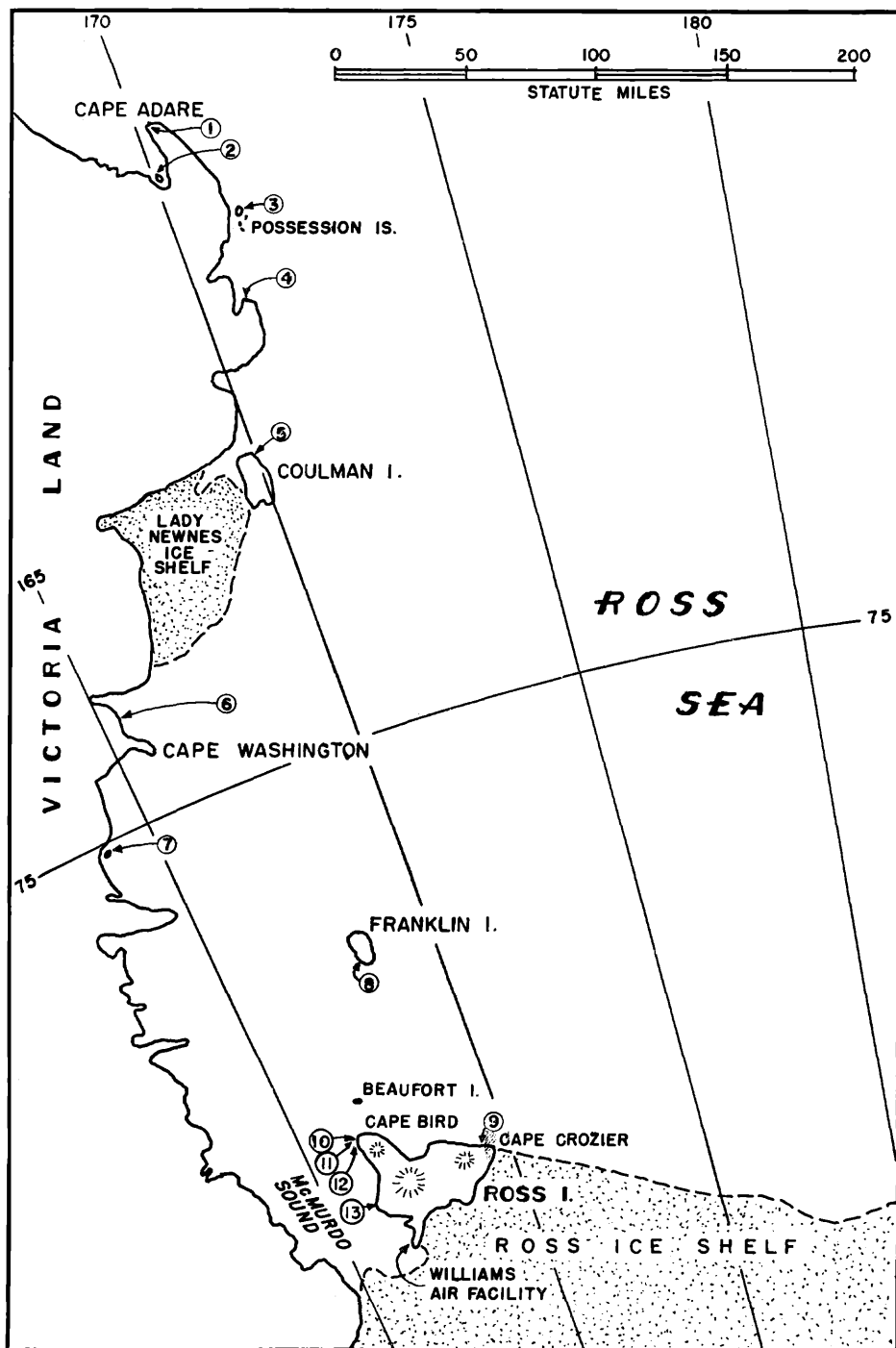
The Adelie's isolation in and beyond the antarctic pack ice has protected it from human interference until very recently, and so far man's depredations have affected it only locally. It is one of the few remaining colonial-nesting birds that probably exists throughout its range just about as it did centuries ago before man started sailing the seas and despoiling the world's wildlife. On all recent U. S. expeditions the Navy authorities have issued strict orders against the killing or interfering with any indigenous wildlife except by biologists in performance of their studies. (And these orders were well enforced on Deep Freeze I.) Unfortunately not all other nations have taken such precautions, and the vastly increased human occupation of Antarctica during the next few years is certain to entail increasing human interference with the Adelies at their nesting sites. It is therefore of greatest importance that as much as possible of the species' present status be put on record for future reference.

The first step is to list the known colonies and to assess their sizes. The accompanying map shows the location of 13 colonies reported in the Ross Sea area. These are described individually below, with the available information on the size of their populations. Quantitative data on these colonies are disappointingly few in the literature. Most reports describe them only in vague, general terms, such as "small," "tremendous," "countless thousands." These are little help in determining possible changes and trends over the years.

It is no trouble to count the birds present in a small Adelie colony, but to obtain a realistic estimate of the population of a large one is neither easy nor simple. To be significant, counts should be made during incubation or during the first fortnight after the young hatch. One of each pair of adults is then always at the nest, and seldom is more than one present, so a count of the adults is fairly representative of the number of pairs in a colony. When the young are 12 to 14 days old, both adults leave the nesting ground and return only at irregular intervals to feed their offspring, which by then have left the nest and gathered in "creches." Populations then can be estimated only by the size of the area the colony occupies. Such estimates are

ADELIE PENGUIN COLONIES IN THE ROSS SEA AREA

- | | | |
|---------------------|----------------------|----------------|
| 1. Ridley Beach | 6. Wood Bay | 10. Cape Bird |
| 2. Duke of York Id. | 7. Inexpressible Id. | 11. Cape Bird |
| 3. Svend Foyn Id. | 8. Franklin Id. | 12. Cape Bird |
| 4. Edisto Acres | 9. Cape Crozier | 13. Cape Royds |
| 5. Coulman Id. | | |



subject to considerable error, for Adelies seldom occupy any territory uniformly, but concentrate their nests a few feet apart in groups of 50 to 500 on the higher spots of ground where they are in less danger of meltwater flooding during a thaw.

I visited only two colonies, numbers 12 and 13, early enough for my counts to be significant. I estimated the population of colony 12 by counting the birds in several well-defined sectors, estimating the ratio of the counted sectors to all the territory occupied, and multiplying accordingly. The Cape Royds colony, no. 13, is small enough so that I could count all the adults fairly accurately from a convenient vantage point. My estimates for colonies 3, 4, and 9 which I visited in February after many if not most of the birds had left, and for numbers 1, 10, and 11 which I examined through binoculars from off shore, are frankly "educated guesses," based on the sizes of their guanoed areas compared to those at sites 12 and 13.

The ideal way to census the population of an Adelie colony is from photographs taken from the air, preferably in late November during the first fortnight of incubation before the females return to relieve the males, though good counts should be possible from pictures taken any time before the chicks are left alone early in January. No such pictures have as yet been taken, and I present the possibility as a worthwhile project for anyone having the opportunity to do so during the forthcoming operations.

1. Ridley Beach, Cape Adare, Victoria Land.

This colony has been visited more often and has had more written about it than any of the other 12 colonies in the area. C. E. Borchgrevink discovered it when he made the first landing on the Antarctic continent there in 1894, and he lived in the midst of it with the first expedition to winter on the continent from 1898 to 1900. His book (1901) describes the colony in general terms and contains some illuminating photographs of portions of it, but makes no estimate of its size.

Scott (1905: 133-137) made his first landing in Antarctica here from *Discovery* in January 1902, and noted it to be "the nesting-place of countless thousands of Adelie penguins." He adds "The hut [Borchgrevink's] is in very good condition, and in such a climate might well remain so for many years to come. Should some future explorers traverse this region, it is well to know that here they possess a retreat in case of emergency, as, although they may not find all the provisions in good condition, a fair proportion is likely to be found so, and at this spot there would always be an abundance of food in the shape of seals or penguins." He left a note in the hut which gave the crew of *Morning* when they landed there the following year the first information that *Discovery* had reached Antarctica.

True to Scott's prophecy, when his northern party under Lt. Campbell was unable to find a suitable base on the east coast of Victoria Land in 1911, they went to Ridley Beach, built a second hut, and wintered over. G. Murray Levick, the party's surgeon, made here the observations for his two classic reports on the Adelie (1914, 1915),

but neither he nor his companion, Priestley, who also describes the colony (1915), published any estimate of its size, other than stating it contained "countless thousands" of birds.

When the USS *Edisto* (AGB-2) visited Ridley Beach 9 and 10 February to investigate its possibilities as an IGY station site, 50-knot winds and a high surf made landing hazardous. On the 9th I accompanied the first landing party that skirted the entire beach just outside the breakers in an LCVP (Landing Craft, Vehicle, Personnel). It was almost impossible to see the top of the beach through the flying spindrift and, badly as I wanted to get ashore to the penguins, Skuas, and Giant Petrels there, I confess to feeling a bit relieved when the skipper decided not to risk a landing, and glad the decision was not mine to make. The next day *Edisto's* whaleboat tried to land, and was overturned by the surf just as it hit the beach. It was finally towed off by the LCVP, while its drenched crew were rescued by helicopter, a ticklish and risky maneuver in the high winds. Throughout this incident the ship was anchored a half mile off the beach, and I had to content myself with viewing the colony (and the two huts which are still standing, apparently in good condition) through the ship's long glass.

The Adelie's breeding season was about over, and only some 2,000 to 2,500 well-grown young and molting adults were still present, being harassed by Skuas and several score Giant Petrels. To judge from the guano deposits and the pictures in Borchgrevink's book, the colony has changed very little, if at all, in the 62 years since he first landed there. The Adelies occupy almost all the triangular foreland, three-quarters of a mile deep, that forms Ridley Beach, and their nests are scattered almost 1,000 feet up the cliff behind it as well, to the top of the first steep slope, just below Hansen's grave. (Nikolai Hansen was Borchgrevink's zoologist. He died of an intestinal ailment 14 October 1899, a half hour after the first Adelie of spring returned, and was buried where he wanted to be, overlooking this fabulous colony.)

The Ridley Beach colony is the second largest in the region. It supports at least 75,000, and perhaps more than 100,000 breeding pairs of Adelies.

2. Duke of York Island, Robertson Bay, Victoria Land.

The small colony at the foot of Robertson Bay some 30 miles south of Ridley Beach, in Crescent Bay on the north side of Duke of York Island, was first visited by the Borchgrevink wintering party in 1899. He makes no mention of it in his text, but shows a photograph of it (1901: 231). In 1912 Priestley (1915: 180) sent two men to examine it, who reported it still there, and to contain about 1,000 pairs of Adelies. *Edisto* did not sail within sight of this colony.

3. Svend Foyne Island, Possession Islands.

When Sir James Clark Ross (1847, Vol. I: 188-189) landed here 12 January 1841 to take possession of the region for his Queen, he "Landed

on a beach of large loose stones and stranded masses of ice. . . . We saw not the smallest appearance of vegetation, but inconceivable myriads of penguins completely and densely covered the whole surface of the island, along the ledges of the precipices, and even to the summits of the hills, attacking us vigorously as we waded through their ranks, and pecking at us with their sharp beaks, disputing possession; which, together with their loud, coarse notes, and the insupportable stench from the deep bed of guano, which had been formed for ages, and which may at some period be valuable to the agriculturalists of our Australian colonies, made us glad to get away again, after loading our boats with geological specimens and penguins."

Borchgrevink landed here in 1894, and again 3 February 1900. On the 1900 visit he found (1901: 257) "Very few penguins were left, but some skuagulls were still soaring about." His photograph of the snow-covered beach shows about 150 adults and full-grown young still present.

Edisto hove to a half mile off Svend Foyn late in the day 10 February. The long glass revealed only a few penguins scattered over the island, but the extensive guano deposits showed the colony still to be pretty much as it must have been when Ross landed there 115 years ago. High winds and a heavy sea thwarted our attempted landing, but I did get ashore 3 days later for a short time just after a 6-inch fall of fluffy snow had covered the ground. The only life present were a single group of 43 forlorn molting adult Adelies on the ice foot, 8 adult Skuas standing idly by, and a single young crabeater seal sound asleep in the snow.

It is apparently a large colony, but does not seem as extensive as the one at Ridley Beach. It is probably on the order of about 50,000 pairs.

4. *Edisto* Acres, Cape Hallett, Victoria Land.

On 11 February 1956 *Edisto* explored the bay opening up on the north side of Cape Hallett, apparently the first ship to do so. At the mouth of the bay, just inside the Cape, lies a flat, triangular foreland identical to but smaller than Ridley Beach. Here I was able to spend some 6 hours ashore while *Edisto's* crew established a cache of food and fuel and the Seabee engineers surveyed the beach for a possible emergency landing strip at IGY station site.

The guano deposits show the penguins occupy the outer two-thirds of the flat beach, an expanse of roughly 40 acres. An officer who went ashore at both places commented that the deposits here seemed much less continuous and uniform than those on the flat at Ridley Beach. Nor do the nests extend up the cliff here as they do at Ridley. The talus slope at the base of the cliff is occupied by Skuas, of which more than 100 pairs were still present. On the ice in the small lagoon enclosed against the talus by the foreland were a flock of 22 Giant Petrels (see p. 13) and a dozen sleeping Weddell and crabeater seals. On the beach snoozed a mammoth female sea elephant that had strayed far south of its usual range; when we disturbed her she opened her eyes, shed copious tears, and made very rude noises.

The penguins had long since left their nests, but two creches of young still remained on the nesting ground, one of 35 the other of 55 birds, still shedding the last of their nestling down. Just above the ice foot along the beach were eight more groups of Adelies, the smallest of 40 birds, the largest of 150, mostly molting adults, a few well-grown young among them. One knot of 55 bedraggled adults had climbed a hundred feet or so up the steep talus behind the beach to wait out their molt.

From the area the penguins occupy at Edisto Acres, and from the number of Skuas that breed there, the colony probably supports perhaps 25,000, certainly not more than 30,000 pairs of Adelies.

5. Coulman Island.

The only reference I have found to this colony is in Scott's narrative. Forced by an approaching gale 12 January 1902 to shelter *Discovery* under the lee of Coulman Island, Scott (1905: 143-144) comments as follows on the illusive nearness of land seen across antarctic waters: "So strong was this deception that the engines were eased when we were nearly two miles from the cliffs, under the impression that they were only a few hundred yards away; we only discovered our mistake when we saw a colony of penguins, and found that even with glasses it was impossible to distinguish the individuals." As Scott apparently approached the island from the northeast, the colony he saw must be on its eastern flank. I saw no sign of a penguin colony on its northern or western sides when on 11 February in clear weather *Edisto* sailed within 4 miles of the island while trying unsuccessfully to push through the strait between it and Lady Newnes Ice Shelf.

6. Wood Bay, Victoria Land.

When Borchgrevink sailed *Southern Cross* into Wood Bay 6 February 1900, he found on the south side of the bay some 20 miles in from Cape Washington (1901: 260-261) "a promontory almost free of ice and snow. . . . Towards the northwestern side . . . a small penguin colony was thriving, and as the young ones were not so far advanced as those few which were still left at Cape Adare when we departed [2 Feb.], they did not seem to have any immediate intentions of leaving their breeding-place. . . . It was remarkable how the pebbly peninsula on which we landed resembled that at Camp Ridley. On this beach, however, there were no penguins, but a great many skuas with nearly full-grown young ones. It is evident that this low ground from time to time gets swamped by waves started in the small cove to the south."

Scott reports seeing this colony on his way north in *Discovery* 21 February 1904 (1905: 372). To clear the pack in Wood Bay *Discovery* had to stand in "close along the southern shore, where we saw quantities of skuas, and one small Adelie penguin rookery, showing again how these birds take advantage of every landing place."

7. Inexpressible Island, Terra Nova Bay, Victoria Land.

Scott's northern party was put ashore here in February 1912 with 6 weeks of rations and supplies for a short geological exploration, and marooned when heavy ice prevented *Terra Nova* returning for them. The six men under Lt. Campbell spent the winter in a cave they hewed out of glacial ice, and sledged down to Hut Point and safety the following spring. It is one of the pluckiest exploits in the annals of polar exploration, overshadowed only by the tragic epic of Scott's polar party. In his typically understated account of the northern party's adventures, Priestley (1915: 217) reports the presence of a small Adelie colony at the end of Evan's Cove near the southern tip of Inexpressible Island. Most of the birds had left by the time they landed, but when the men realized their plight and started to gather food for the winter, the 120 penguins they were able to kill before the last Adelies left on 15 March were instrumental in carrying them through the winter. The party headed southward 1 October before the Adelies returned, but fortunately a few Emperors appeared to eke out their meager larder.

8. Franklin Island.

Borchgrevink (1901: 268) landed on the southwest side of Franklin Island 9 February 1900 on "a pebbly beach very much like the peninsula at Cape Adare. . . . There were very many penguins on the peninsula, many more than were left at Cape Adare when we said farewell to Camp Ridley." This is verified by his photographs on pages 278-280.

When Ross explored Franklin Island 27 January 1841 a high surf from the south kept his whaleboat away from the beach, and he made a precarious landing on the steep rock cliffs on its northeast side. In such weather as he encountered off the beach he may easily have overlooked its Adelie colony; at any rate he fails to mention it (1847: 215): "We observed that the white petrel had its nests on the ledges of the cliffs, as had also the rapacious skua gull; several seals were seen, and it is by no means improbable that the beach on which we in vain attempted to land may, at the proper season be one of their places of resort, or 'rookeries' as they are termed by the seal fishers."

The ships of Task Force 43 gave Franklin Island a wide berth. The nearest I came to it was when *Glacier* passed 15 miles south of it on her way to McMurdo. The weather was fine, but at that distance the low beach at the southwest corner remained below the horizon.

9. Cape Crozier, Ross Island.

Cape Crozier is so famous as the site of the first known Emperor Penguin breeding ground, found by the *Discovery* expedition on the sea ice below the Cape's junction with the Ross Ice Barrier, that the huge Adelie colony 2 miles west of the Cape on the northeast shores of Ross Island has received little notice, though it is by far the largest in the entire region.

Borchgrevink remarked its presence when he sailed by it in mid-February 1900 (1901: 276). Scott landed there 22 January 1902 and left a message on a post he set up "in the centre of the penguin rookery

on a small cliff overlooking the sea" where the relief expedition in *Morning* found it a year later (1905: 167). A number of sledging parties from both Scott expeditions visited the site, the last being the classic "Worst Journey in the World" (Cherry-Garrard, 1923) made by Wilson, Bowers, and Cherry-Garrard in June and July 1911 to solve the mystery of the winter breeding of the Emperor. Practically every vessel that has sailed to Ross Island since has passed within sight of the colony, which is so immense that nobody has ventured an estimate of its actual size, and very little has been written about it.

Glacier passed 7 miles abeam of the colony on her return to McMurdo 5 January, and one of her helicopters flew over it. Ornithology had too low a priority to secure a berth on this scouting trip, but the pilot reported to me that the Adelies were there "by the jillions." I had my best view of the site 18 February when I was fortunate enough to fly ashore with the team of surveyors, *Edisto's* helicopter landed in the center of the then deserted colony to shoot a "ground control" position observation. There were still about 1,000 Adelies in small groups along the beach and on the nearby snowbanks, most of them molting adults, a few young among them shedding the last of their down before taking to the water.

The colony consists of two sections separated by an ice-covered stretch of cliffs some 1,500 yards wide. The smaller eastern part occupies a low spot along the shore about a half mile long and extends inland almost a quarter mile. The western section spreads along a good mile and a half of the shore line and in places reaches a half mile inland up the slope at the base of Mt. Terror. The guanoed area is roughly about 500 acres in extent, and must support in the neighborhood of 250,000 pairs of birds.

10, 11, 12. Cape Bird, Ross Island.

These three colonies, which everyone who has sailed past Cape Bird into McMurdo Sound has seen, are indicated clearly on the map of the McMurdo Sound Region, No. IV in the Report on Surveys by the British Antarctic Expedition 1910-1913 (*Terra Nova*). The first colony (number 10) is 4 miles south of Cape Bird, the second and smallest is 2 miles farther south, the third and largest another 3 miles south of the second. *Glacier* came to rest in the thick bay ice about $2\frac{1}{2}$ miles offshore abeam of the southernmost colony (number 12) the morning of 18 December 1955. When I learned we were to remain there at least 12 hours, I lost no time hiking over the ice to it.

Colony 12 lies on a shelf of loose volcanic tuff more than a half mile in length; the nests begin at the brink of its steep scarp about 300 feet above the shore line, and extend another 500 feet up the gentle slope of the terrace behind it. The colony covers about 30 acres, and the most careful count I was able to make was 20,000 birds, with a margin of error of possibly 2,000 either way. As the eggs were just hatching and the adults were still incubating closely, this figure is probably only slightly higher than the number of pairs making up the colony.

Colony 10, to judge by its extent as viewed from several miles off shore, is about two-thirds the size of number 12, on the order of perhaps 12,000 pairs. Colony 11 judged by the same standards is much smaller and probably does not contain many more than 5,000 pairs.

13. Cape Royds, Ross Island.

This small colony is, next to the one at Ridley Beach, one of the best known in the Ross Sea area. Shackleton (1909) built his base just behind it and wintered there in 1908; his hut was occupied for short periods by parties from Scott's last expedition in 1911 and 1912, and by members of his own western party in 1916. Almost every published account of these expeditions contains descriptions and pictures of the colony, but no assessments of its extent or the size of its population have ever been published.

The southernmost colony known, it covers only a few acres. When I first visited it 7 January, many of the chicks were grown to the stage where they were no longer being brooded, and a steady procession of adults was parading back and forth between the colony and the near-by open leads on both sides of the point. From a knoll overlooking the colony I counted 1,850 adult Adelies, and there were fully as many more scattered over the neighboring ice. Around the periphery of the Adelie territory I found 18 Skua nests; 6 more pairs of Skuas had apparently established territories in which I was unable to find nests or young. I think the population of this Adelie colony is about 2,000 pairs.

I visited Cape Royds for the last time 20 February 1956, just before *Edisto* left McMurdo for New Zealand. The bay ice had gone out well beyond Cape Evans to the southward, and as our boat party scrambled ashore on the ice foot below the landing, a flock of 150 ragged molting Adelies squawked at us in annoyance. A quick tour of the point showed five more similar flocks around the rookery, and quite a few smaller groups straggled out along the ice foot on both shores. Of the some 800 birds I counted in the vicinity, less than a dozen were young of the year. These few were rather small, with down still clinging to the head and upper breast. The adults were the crumbiest, most bedraggled, moth-eaten birds I ever saw, and bad tempered as well. They showed almost as much disinclination to move as incubating birds do, and when I went near them many pecked at me and beat my legs with their flippers in furious anger before retreating a few feet. A far higher percentage of adults remained to molt here than at any of the other colonies we visited during the preceding 2 weeks.

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FEMALE EASTERN PURPLE FINCHES

By CHARLES H. BLAKE

In the last few years Mr. and Mrs. Parker C. Reed and myself have been able to make, in Lexington and Lincoln, Mass., more or less detailed observations on 41 banded Eastern Purple Finches (*Cardinalis p. purpureus*) which had certainly gone through at least two annual body molts, and possibly more, and which may reasonably be presumed to be females.

We are well aware of Magee's (1926) statement that some males of this species do not become fully red until the second postnuptial molt. On the other hand, we have seen intermediate plumage in a considerable number of birds which eventually proved to be males. These are mostly more strongly pink or ruddy than the birds here treated.

The ascertained number of molts is distributed as follows:

Molts	Birds
2	26
3	9
4	4
5	1
6	1

Some sort of numerical value may be assigned to four items of description: the grade of side streaking, grade of throat marking (Blake, 1955), number of streaks in under tail coverts, and wing length.

The average grade, both of side streaking and of throat marking, for 37 birds is 2.9. The side streaking bears about the same relation to that of first winter plumage as I have already made out. (Blake, 1955, p. 99). On the other hand the grade of the throat markings is a little lower than my previous figure (op. cit., p. 97). The