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ANTARCTIC ORNITHOLOGICAL STUDIES DURING THE IGY

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Exploration and research stimulated by the International Geophysical Year have been primarily concerned with the physical sciences. The United States National Committee for IGY and similar committees of other countries recognized, however, the unique opportunity for research in the life sciences in the remote polar regions. Because IGY personnel were encouraged to make such studies at Antarctica stations, it was my privilege to do ornithological work while serving as Scientific Leader at Wilkes Station during 1957-58.

None of the countries participating in the IGY employed ornithologists. Except for a zoologist and an ichthyologist assigned to the USSR Mirny Station, no full-time biologists of any type were at work in Antarctica. Fortunately, most stations had personnel with training in the biological sciences who were sufficiently interested to conduct studies incidental to their primary duties.

As we enter the post-IGY period, it is gratifying that the Polar Research Committee of the National Academy of Sciences has recognized a continuing need for Antarctic research in the life sciences. A Panel on Biology and Medical Science has been functioning as part of that Committee; on its recommendation, funds have been granted for ornithological work.

My purpose in this paper is to report ornithological studies conducted during the IGY at seven United States stations and, upon the basis of recent contact with foreign countries having Antarctica stations, to list their studies in this field.

In the fall of 1956, through the USNC-IGY, I initiated a study on the distribution and life history of the South Polar Skua *(Catharacta maccormicki)*. Relatively little has been known of the habits and movements of this most southerly of all birds, which in January, 1958, was observed by Sir Edmund Hillary within 80 miles of the South Pole.

The main phase of the study required the banding of a representative number of skuas. Eight nations, including Argentina, Australia, Japan, New Zealand, Norway, USSR, the United Kingdom, and the United States, participated in making this one of the most internationally cooperative bird studies ever conducted. The normal numbered metal bands were used and, for the first time, a 1½-inch-wide colored thermoplastic band also was used. A different color denoted each of eighteen banding stations in Antarctica. This enabled ready field

identification of the birds' migratory patterns, without requiring capturing the bird.

Banding of approximately 1,500 skuas at Antarctic stations has been reported thus far. Interesting returns already have been received from Australia on migrations to that continent, and from the Belgians, Russians, and Americans on skua movements within Antarctica.

Many life-history data on the skua have been obtained, covering nesting and other breeding habits, non-reproductive behavior, mortality, populations, and local and seasonal movements. Temperatures of incubating skua as well as Adelie Penguin *(Pygoscelis adeliae)* eggs were taken continuously for a nine-day period, using an electronic telemeter inside the eggs. Used for the first time in such research, this instrument transmitted a series of pips, or pulses, the rate of which was governed by changes of temperatures within the egg. A low-frequency radio receiver was "tuned in" on the broadcasting egg; pulses were then relayed into a Decade Counter and recorded by the observer. Pulses were calibrated with known temperatures. The penguin egg maintained an average temperature of 92.7° F., the skua 96.6° F. (Eklund and Charlton).

New techniques provided information on effect of color on other birds, and on daily and seasonal movements. Thirty Adelie Penguins were dyed yellow, while 180 skuas were dyed yellow, or scarlet, or were sprayed with one or a combination of colored enamels. Skua chicks were dyed in the eggs. The survival rate of colored versus unmarked chicks yielded interesting data on the effects of protective coloration. Marked skuas were flown to the South Pole Station for release in homing experiments.

Studies at United States stations included a survey of birds of the Windmill Islands in Vincennes Bay, site of the Wilkes Station. Seven species nest and four others occur in the area. During the survey, a detailed population study was made of the sixteen Adelie Penguin rookeries located on these islands. Forty-nine birds, representative of eleven species, were collected here for the United States National Museum.

Prior to the IGY, during the Antarctic summer of 1955-56, Austin (1957) banded more than 500 Adelie Penguins at Cape Bird and Cape Royds on Ross Island in McMurdo Sound, and at Cape Hallet in Victoria Land. He also banded some skuas and Giant Fulmars at these areas. At Cape Hallett, location of the joint United States-New Zealand IGY Station, we had to remove all Adelie Penguins from within a measured two-acre site needed for construction of the camp. We took 7,850 penguins from this area. This figure, when applied to the total 55 acres covered by the rookery, would indicate a population of over 215,000 birds.

Banding of skuas is being continued at the various stations. In addition, funds have been granted by the Polar Research Committee for an Adelie Penguin behavior study to be conducted at the Wilkes Station by Mr. Richard Penney, a University of Wisconsin graduate student. This station is to be taken over from the United States by Australia. Banding of the Giant Fulmar *(Macronectes giganteus)* will also be carried out there by Mr. Penney, Dr. W. J. L. Sladen of Johns

Hopkins University, and Australian personnel as a continuation of an extensive banding program of this species inaugurated in the late 1940's by Australia and the United Kingdom at sub-Antarctic Islands and Palmerland.

Through its Falkland Island Dependencies Survey (FIDS), the United Kingdom organized a banding project in 1947, and more than 7,200 birds of seventeen species in the Antarctic or sub-Antarctic have been banded through the 1956-57 nesting season at bases in Palmerland (Sladen and Tickell). Primary emphasis has been on penguin banding in behaviorism studies initiated by Sladen, and on Giant Petrel banding. More than 2,000 of the latter species have been "ringed" and this, together with similar work being done by the Australians at several sub-Antarctic islands, has shown a round-the-world movement by this large bird. Extensive banding of all species is being continued at FIDS bases to study local and seasonal movements, longevity, and life-history habits.

Another study is being carried out at a FIDS base by Mr. W. L. N. Tickell on the Life History and Behavior of the Dove Prion *(Pachyptila desolata)*. Observations were made during IGY on the life cycle of the Emperor Penguin *(Aptenodytes Forsteri)* at the British Base at Halley Bay in the Weddell Sea.

Ornithological work at Australian Antarctic bases during the IGY, in addition to skua banding, consisted primarily of Emperor Penguin mortality studies made by Dr. R. L. Willing, station doctor at Mawson. His findings were related to the population, topography and weather. Feeding habits were also studied.

In 1957-58 Australia's Davis Station workers mapped the distribution of breeding birds in the Vestfold Hills. During the Antarctic summer of 1958-59 the breeding habits of the Snow Petrel *(Pagodroma nivea)* are being studied at the Mawson Station. Australia's Giant Petrel banding program, which has yielded much interesting data on movements, is also continuing at Macquarie Island, an IGY station in the sub-Antarctic (Ingham).

Observations on the ecology of Adelie Penguins were made at the Japanese Syowa Station, and museum collections were obtained of local birds (Nagata).

A faunal inventory was carried out by Soviet IGY scientists on land and sea areas in the Antarctic and sub-Antarctic from 1955-58. More than 600 ornithological collections representative of eleven species were brought back, including 170 food-habit specimens, and 332 birds of all species were banded. Primary work was done by Syroechkovski, Korotkevich, Kirpichnikov and Macushok. Most of the work was conducted at Haswell Island, near their main base at Mirny, and at a satellite station in Bunger Hills (Lapina).

Materials collected are now being studied at institutions in the USSR. These include a comparative osteological examination of several penguin species, systematic work on the Emperor Penguin, and studies of the anatomy and functional morphology of various Antarctic bird species. Soviet ornithologists are preparing a monograph on the birds of Antarctica.

Syroechkovski (1957), zoologist at the Mirny Station during 1956-57, conducted detailed bio-geographical and ecological studies at Haswell Island. He prepared a zoo-geographic map on a scale of 1:50,000, showing species distribution on the island, and obtained data on populations, feeding habits, parasitism, and breeding behavior. Five zones in his bio-geographic studies included the Antarctic ice shield; lands isolated from the sea, such as the Bunger "oasis"; the "mature Antarctic oasis" or cold desert, having a connection with the sea; littoral islands; and sub-Antarctic islands.

The Soviets believe that a broad discussion of questions concerning birds of Antarctica is desirable, and suggest a symposium pertaining to the problems be held at an International Ornithological Congress. Such a discussion is needed.

Prior to IGY six Emperor Penguin rookeries had been located in Antarctica, and existence of another was suspected in the Weddell Sea area. The known rookeries included Cape Crozier in the McMurdo Sound area at longitude 169° E., the first ever discovered; the Dion Islet rookery off the west coast of Palmerland, south of Adelaide Island, where the British conducted the first detailed studies of the species; a rookery near Gaussberg in King Wilhelm II Land at longitude 89° E. reported by the Germans; the Point Geologie rookery in Adelie Land at longitude 140° E. which was studied by the French; the Haswell Island rookery at longitude 92° E. discovered by Mawson in 1915; and a rookery at Taylor Glacier on MacRobertson Coast at longitude 61° E. reported by the Australians in 1955 (Eklund). Known population figures for all these rookeries totaled less than 40,000 birds.

The Cape Crozier rookery, found in 1902 by Dr. Edward Wilson of the British National Antarctic Expedition, was visited by New Zealand scientists in September 1957 (Balham). It had shifted position somewhat from its original location on the sea ice and had about 1,000 adult birds, approximately five times the estimated population 50 years earlier.

During the IGY five new Emperor Penguin rookeries were discovered by the Australians, bringing to six the known number between longitudes 55° E. and 80° E. Two other rookeries were found in the Weddell Sea area at Halley Bay and Gould Bay, numbering 21,000 and 8,000 birds respectively. These discoveries confirmed earlier reports of the presence of breeding birds.

Another Emperor Penguin nesting area, with the largest population found to date, was discovered from a helicopter in December 1958 by Captain John Cadwalader of the United States Navy and Mr. John Dearborn, a biologist at Stanford University. Located approximately 250 miles north of McMurdo Sound at latitude 73° S., longitude 169° E., between Coulman Island and Lady Newness Shelf Ice, the rookery contained an estimated 50,000 birds. Known Emperor Penguin rookeries now number fourteen, with an estimated population of more than 135,000.

With official recognition of the life sciences by the International Council of Scientific Union's Special Committee on Antarctic Research (SCAR) in a continuing post-IGY Antarctic program, it is hoped that long-range ornithological studies can be conducted. Much remains to

be done in this region, and it is hoped that ornithologists will lend interest, support, and guidance to the program. This can be accomplished through the Polar Research Committee Panel on Biology and Medical Science of the National Academy of Sciences.

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GENERAL NOTES

Orientation of Gannets*.—The first real advance in the study of bird orientation was made after the Second World War, when Gustav Kramer of the Max Planck Institute at Wilhelmshaven in West Germany discovered that Starlings were able to choose a definite direction, using only the sun and no visible horizon. His later experiments showed that pigeons could be taught to feed at the same compass direction, regardless of time of day; then that the pigeon's "clock" could be shifted through several hours but could not be speeded up or slowed down. The birds "knew" there were twenty-four hours in a day; they would not subscribe to any longer or shorter working hours. Kramer's first publications were in German, but his work has been summarized in English (Kramer 1952, 1957).

A number of theories by which birds may use the sun to navigate have been proposed, presuming the birds can decide where they are and where their homing goal is. These controversial theories are perhaps best summarized in Matthews' (1955) *Bird Navigation*, and by Kramer (1957) (but see also Allen, 1956). Bird navigation, which assumes actual knowledge of location both of the wanderer and his home, differs from orientation which assumes only that the wanderer can establish definite compass directions, not that the bird knows where it is or where its home is.

For recent comprehensive reviews of homing experiments, before and after Kramer's first discovery, see Griffin (1952, 1955). One of Griffin's own experiments was to release Gannets *(Sula bassana)* near the center of Maine and to follow them with a light aeroplane. It was presumed that these Gannets were "looking" for home. The few birds he was able to follow for a considerable distance seemed to be using an expanding search pattern. An expanding search pattern starts from a point and extends out from it as a helix, keeping the same point as center.