

Change and Adjustment in Plant and Animal Communities

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The approach in this paper is from the standpoint of a systematic zoologist interested in vertebrate groups. The illustrations are taken, and the ecological factors emerge, from a study of birds. Admitting that the rate and degree of change in the total environment of any organism may be negligible in relation to the short term of a single individual life history, no study of distribution nor hypotheses of speciation and phylogeny can disregard the factor of environmental change. Some of the factors to be taken into account in varying degree are:—

- (a) Rates of growth, habits, and numerical status of other plants and animals in the area;
- (b) the trend of vegetational succession;
- (c) climatic changes and cycles; and
- (d) the geo-chronology of the area.

In the case of the last two, methods of assessment and evaluation are indirect, and it is not proposed in this short paper to deal with them. Consideration of the first two is, however, prompted by field study of problems of increase and decrease, extinction, and the nature of ecological barriers and isolating mechanisms. In particular, the significance of habits and temperament are considered as these are factors more readily assessed in birds than in most other animals.

(A) Subantarctic penguins of the genus *Eudyptes* (the so-called Crested Penguins) have been selected for an example because the environmental complex in which they can be studied during the breeding season is reduced to comparatively simple terms. The composition of the main feeding-areas and their distance from the breeding-islands is relatively unimportant in the month prior to nesting, when they feed little if at all, and a further period of fasting is spent ashore later in the season during the moult. It is quite possible that isolating mechanisms in the case of these birds have little relation to food preferences or food distribution. The presence of comparatively few competing organisms or predators on subantarctic islands also makes evaluation of environmental factors somewhat simpler. Adjacent breeding populations of the species *Eudyptes sclateri* occurring on Antipodes and Bounty Islands, just over one hundred miles apart, may be regarded as sharing much the same conditions of climate, food supply, and potential predators. The two populations,

however, possess slight but perceptible differences in behavioural reactions and secondary characters, such as the rate of growth and the development of the crest. The most significant observable difference in environment is to be found in the habits of the other birds with which their nesting-grounds are shared. At Antipodes Island the nests of *sclateri* are surrounded and out-numbered by the smaller penguin species, *E. cristatus*, a noisy and pugnacious bird. The reaction of both penguin species to the steady predation of their eggs and chicks by Skua gulls is a noisy demonstration, and this reaction can be provoked by the approach of human investigators. At the Bounty Islands, the barren, rocky nesting area of *sclateri* is shared only by mollymawks, *Diomedea salvini*. These birds, with a 7-ft. wing span and powerful hooked bills, as they sit on their built-up columns of nests, are by reason of this elevation not in very direct competition with penguins for space, and the two birds traffic without much mutual interference. The significant difference in the situation from Antipodes Island is that predatory skuas are restricted to small numbers and territory on the extreme outposts of these enormous bird colonies. It is clear that the powerful bill of the mollymawk is a much more effective deterrent to skuas than any number of squalling penguins, and the Bounty penguins secure almost total immunity. It is noticeable that their demeanour is different from that of the Antipodes birds, and their reactions lack the vigour that characterizes the latter. No opportunity has occurred for the examination of series of comparative measurements of birds from the two populations, but it is noticeable from photographs and observations made at the same time of year, that the crests of Antipodes birds are better developed at least at that time. To pursue the idea that an incipient isolating mechanism between the two populations can be found in this difference in demeanour would, of course, involve an examination of the further question as to whether behavioural reactions in this case have a genetic basis or are simply induced by the conditions. No answer is offered to this except the observation that tameness in birds has been considered to have a genetic basis and that in the example above cited the environmental conditions produced obviously strong conditioning factors, and that natural selection could be legitimately inferred.

Further field work on Crested Penguins involved comparison between *Eudyptes atratus* of the Snares and *E. pachyrhynchus* of Stewart Island and Fiordland. The former is remarkable for its tameness when ashore, where it nests in conspicuously exposed colonies in open spaces on the Snares. Less than one hundred miles to the north the somewhat similar *E. pachyrhynchus* skulks in shallows and selects caves and root cavities for its small colonies or solitary nesting sites. Both species inhabit the same general zone of feeding-grounds at sea, and there are not many observable differences in the physical environment. One of the most significant, perhaps, is the presence in the northern area of sandflies (Simuliidae). The reluctance of *E. pachyrhynchus* to remain in the open at least in daylight could be in large measure due to avoidance of sandfly attack. The species *atratus*, like all subantarctic Crested Penguins except *pachyrhynchus*, has exposed fleshy areas about the gape of the bill, and it is doubtful if they could survive in a sandfly area. At Solander Island, in the breeding area of *pachyrhynchus*, there are comparatively few sandflies and stray *atratus* have been recorded, but not elsewhere in the sandfly area. *E. pachyrhynchus* has only partial immunity by being well-feathered and sheathed, and it has been observed that its eyelids and feet are attacked by sandflies when it is compelled to linger in exposed situations. The comparative ecology of Crested Penguins is, of course, over-simplified by this treatment of them, but the point is made that, when the complex to be studied can be resolved to comparatively few essential elements, the significance of small elusive details of habit and structure can be better appreciated.

(B) Briefer treatment may be accorded some observations bearing on the changes observed over a period of 25 years in the bird fauna of small outlying islands in the Bay of Plenty and relating them to observed changes in the plant cover. The basic material for the comparison is taken from a descriptive and illustrated paper, (Sladden and Falla, 1927) which includes a description of the vegetation and a bird list of the small islet known as Ruamahua-iti in 1925. The condition described by B. Sladden mentioned the prevalence of *Carmichaelia williamsii*, which in the gullies was found associated with shrubby trees growing to a

height of from ten to fifteen feet, its association with *Phormium tenax* on the outskirts, and its spread to open meadow land in the form of dense, low-growing bushes. In the bird list the abundance of Fern Birds (*Bowdleria*) in the dense thicket is noted, and the fact that they were not observed in the tall scrub. Fern Birds are of weak flight and incapable of natural dispersal beyond the Alderman Group. The state of affairs described in 1925 is contrasted with observations made by B. Sladden, L. Bell, and the writer in February, 1950. Field notes and photographs made on the second visit compared with those made 25 years earlier show extensive replacement of meadow and of *Phormium-Carmichaelia* association by flourishing coastal scrub and light forest; in fact, there remain few of the open areas of 1925. In the compiling of the 1950 bird list many changes were noted, the most remarkable being the difficulty of finding Fern Birds. After careful search of some hours one specimen was seen in the unusual environment of tall tree-tops in a gully. The point is made that the marked change in this habitat has, of course, altered the balance of, amongst other things, the bird life or that part of it which is unable to leave the island, and that it is possible to envisage even rapid extinction when changes can occur so completely. It is considered that the point is not invalidated by the fact that the history of the Island is unknown and that the open meadow conditions of 1925 may have represented a stage of recovery from earlier burning. It is at least known that there had been no significant interference with the island in the period under consideration.

The above contribution as a whole is intended not as a re-statement of any of the fundamental and generally accepted principles of ecology, but as an illustration of method involving (a) the consideration of superficially trivial factors of behavioural reactions and small structural differences in evaluating environmental influences, and (b) the usefulness of fairly full notes and pictures in compiling floral and faunal lists, as their historical value may be greater than their immediate significance.

SLADDEN, B. and R. A. FALLA, 1927. *Alderman Islands*. N.Z.J.Sci.Tech. 9. 193-205, 282-290.