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# The Effects of the Eruption of 1961 on the Fauna of Tristan Da Cunha

D. E. Baird

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PART V. THE EFFECTS OF THE ERUPTION OF 1961  
ON THE FAUNA OF TRISTAN DA CUNHA

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1. SCOPE AND METHODS OF THE INVESTIGATION

Invertebrates were collected at thirty stations covering, as far as circumstances permitted, the principal habitat types of the island. The distribution of these stations is shown in figure 49. The time available at each station varied, so that care must be exercised in comparing the results. Collecting was in all cases by hand, and no quantitative sampling was attempted.

The most thorough collecting was carried out in the Stony Beach area (stations 23 to 28), at Cave Point and Hackel Hill (17 and 19), west of the Settlement (5), east of the new volcano (1 to 3) and at stations 7 and 12 in the highland zone. To assess the effect of the volcano a comparison may be made between the results of collecting:

(a) In the severely affected area very close to the new cone, which was covered with ash and showed maximum damage to the vegetation (stations 1 to 4, and 11).

(b) In the mildly affected coastal region in and around the Settlement itself, where the fauna was initially very similar to that in the area of maximum damage (stations 5 and 6).

(c) In the comparable but unaffected area between Stony Beach and Hackel Hill (stations 17 to 28) and at Sandy Point (stations 8 and 9).

(d) In the highland zone embracing the whole area of the Base and the Peak with more or less undamaged and natural vegetation (stations 7, 10, 12 to 15, and 29).

The collected material so far identified from these four groups of stations is listed in table 35.

In addition to this sampling of the invertebrate fauna, live traps were set for rats (*Rattus rattus*) in the Settlement area over a 7-day period. Virtually all other data were observational.

All zoological references necessary for the understanding of this account are given by Holdgate (Part III).

TABLE 35. THE DISTRIBUTION OF THE INVERTEBRATES TAKEN DURING THE EXPEDITION, TABULATED ACCORDING TO THE FOUR GROUPINGS OF COLLECTING STATIONS (SEE P. 425)

order and species	severely affected	mildly affected (coast)	unaffected coast	highland areas
<b>Collembola</b>				
<i>Hypogastrura delicatula</i> Lawrence	—	+	+	—
<i>Entomobrya multifasciata</i> Tullberg	—	+	+	+
<b>Hemiptera</b>				
<i>Aulacorthum solani</i> (Kalt)	—	+	+	+
<i>Cavariella aegopodii</i> (Scop.)	—	—	+	—
<b>Diptera</b>				
<i>Piophila casei</i> (L.)	+	+	+	+
<i>Dimicoenia tristanensis</i> Frey	+	+	+	+
<i>Fucellia maritima</i> Hal.	+	+	+	—
<i>Muscina stabulans</i> Fallen	—	—	—	+
<i>Lucilia sericata</i> Meigen	+	+	+	+
<i>Calliphora vomitoria</i> L.	+	+	+	+
<i>Leptocera</i> sp.	+	—	+	+
<i>Coenosia humilis</i> Meigen	—	+	+	—
<i>Scaptomyza</i> ( <i>Macrosaptomyza</i> ) <i>altissima</i> Frey	—	—	+	—
<b>Coleoptera</b>				
<i>Lanctes varius</i> (F.) <i>dacunhae</i> Brinck	—	—	+	+
<i>Cercyon depressus</i> Steph.	+	—	+	—
<i>Adalia flavomaculata</i> De Geer	—	+	+	+
<i>Harpalus agilis</i> Perringuey	—	+	+	—
<i>Pantomorus cervinus</i> (Boh.)	—	+	—	—
<i>Phlyctinus callosus</i> Boh.	—	+	+	—
<i>Tristanodes attai</i> Brinck	—	—	+	—
<i>Tristanodes</i> sp.cp. <i>craterophilus</i> Brinck	—	—	—	+
<i>Quedius mesomelinus</i> Marsham	—	—	+	+
<i>Oxytelus</i> sp.cp. <i>christophersenii</i> Brinck	—	—	+	+
<i>Leptacinus</i> sp.	—	—	+	—
<b>Lepidoptera</b>				
<i>Agrostis segetum</i> (Schifferrmüller)	—	+	+	+
<i>Dimorphinoctua cunhaensis</i> Viette	—	—	—	+
<i>Peridroma porphyrea</i> (Schifferrmüller)	—	+	—	—
<i>Protoleucania exoul</i> (Walker)	—	+	—	—
<i>Mocis punctularis</i> (Hübner)	—	+	—	—
<b>Araneida</b>				
<i>Steatoda</i> sp.a.	—	+	—	—
<i>Steatoda</i> sp.b.	—	—	+	—
<i>Achaearanea tepidariorum</i> (C.L.K.)	—	+	—	—
<i>Teutana grossa</i> (C.L.K.)	—	—	+	—
<i>Tegenaria domestica</i> (Cl.)	—	+	+	—
<i>Philodromus</i> sp.	—	—	+	—
Linyphiidae: sp. 1	+	+	—	—
sp. 2	—	+	+	—
sp. 3	—	—	—	+
sp. 4	—	—	—	+
sp. 5	—	—	+	—
<i>Ostearius melanopygius</i> (O.P.C.)	—	+	—	—

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TABLE 35 (cont.)

order and species	severely affected	mildly affected (coast)	unaffected coast	highland areas
Acarina				
<i>Pergamasus</i> sp.	—	—	+	—
<i>Argas</i> sp.	—	+	—	—
<i>Linopodes</i> sp.	—	—	—	+
Ostracoda				
<i>Cypridopsis</i> sp.	—	—	+	—
Amphipoda				
<i>Orchestia platensis</i> Kroyer	—	+	+	—
Isopoda				
<i>Porcellio scaber</i> Latreille	—	+	+	+
Chilopoda				
<i>Lamyctes fulvicornis</i> Meinert	—	—	+	—
<i>Lithobius melanops</i> Newport	+	+	+	—
<i>Lithobius</i> sp.	—	—	—	+
<i>Necrophlocophagus longicornis</i>	—	+	—	—
Diplopoda				
<i>Cylindroiulus latestriatus</i> (Curtis)	—	—	+	+
Oligochaeta				
<i>Fridericia</i> sp.	—	+	—	—
Lumbricidae	+	+	+	+
	10	30	36	22

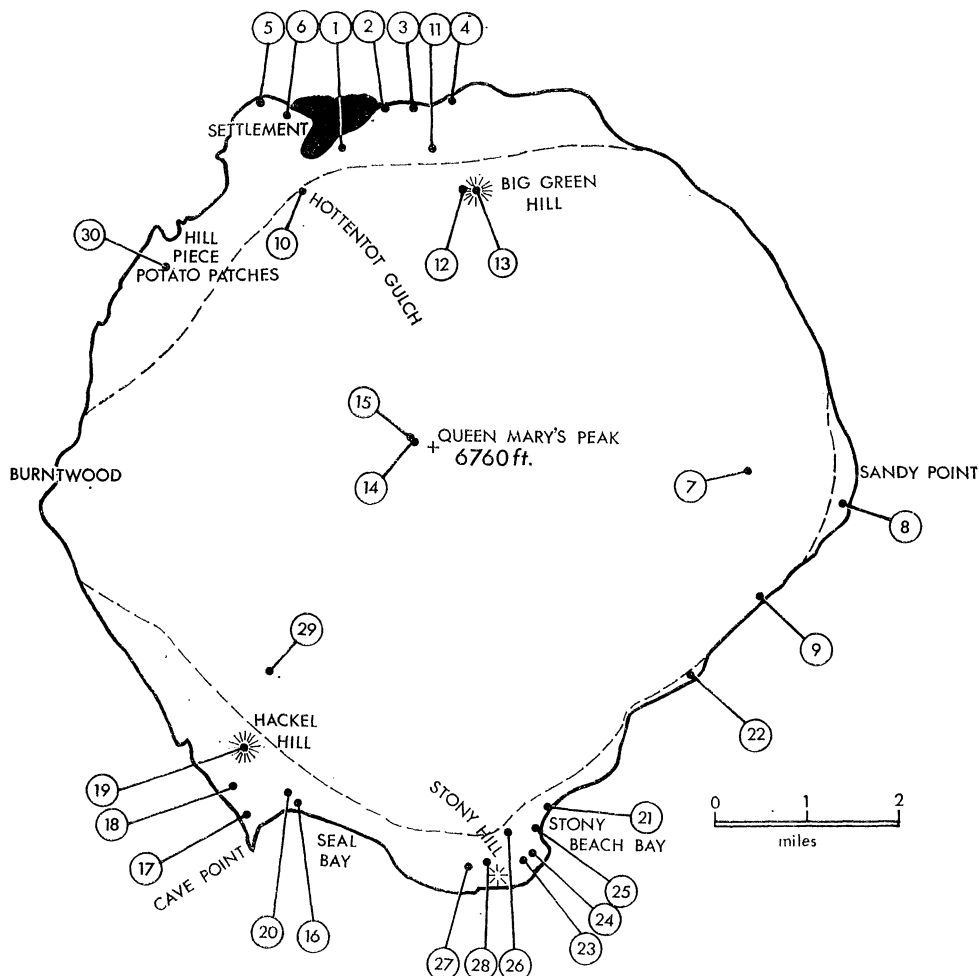


FIGURE 49. Zoological collecting stations on Tristan da Cunha, February and March 1962. The broken line shows the scarp of the Main Cliffs. The 1961 eruptive centre is indicated in solid black.

## 2. THE DIRECT EFFECTS OF THE ERUPTION

2.1. *General considerations*

In assessing the total effects of the volcano on the fauna of the island, it must be remembered that the Settlement Plain is the area most altered by man. In the last 150 years the natural habitats here have been radically altered by the removal of much of the native vegetation and its replacement by introduced species: over most of the region these form a sward closely grazed by imported livestock. A large number of alien invertebrates has been introduced, and while many of these are widespread over the island it is here that they are most concentrated. Bird life is almost non-existent in the area and has been substantially reduced over the whole island by the activities of man and imported predators such as the black rat and the domestic cat. In the last 150 years the Tristan races of the gallinule *Porphyriornis nesiotis* and bunting, *Nesospiza acunhae*, have become extinct, while the two formerly abundant species of seal have been reduced to a minute remnant. Because of its proximity to the Settlement, the new volcano exerted its effect, therefore, on a highly modified biota.

As Dickson (Part IV) has emphasized, the Tristan eruption was somewhat unusual in the small proportion of ash and pyroclastic materials it emitted: most of the damage to the vegetation was by fumes. Because the fauna seems to have been little affected by toxic gases, the direct effects of ash, lava and pyroclasts appear to have had a proportionately greater influence on the fauna than on the vegetation, but this is only the case because the total damage was far smaller.

2.2. *Coverage by lava and ash: severely affected area*

The new lava has covered about twenty acres of heavily overgrazed grassland and the adjacent littoral strip. The resulting destruction of the associated invertebrate fauna may possibly have caused the loss of the single representative of the Orthoptera known from Tristan, the endemic tridactylid *Tridactylus subantarcticus* Willemse. This species was collected by Hagen in 1937 only along the cliff edges between Big Beach and Little Beach, and in spite of a prolonged search in the small part of this strip which now remains uncovered by lava, it could not be found in 1962. Similar search in comparable habitats elsewhere on the island was also unproductive.

There is no evidence that the coverage of this small area by lava has affected the vertebrate fauna of the island in any way whatsoever, since the region was virtually devoid of birds or seals.

Immediately to the east of the volcano, damage to the vegetation was heavy and there was a fairly general coverage with ash. The invertebrate fauna was severely affected (column 1, table 34). The first living, non-flying, invertebrate was taken at station 1, about 200 m from the centre of the crater. It was the chilopod *Lithobius melanops*, and was found under a stone totally buried by 2 cm of ash. The station only yielded, apart from this, a number of dead curculionid beetles, and dead specimens of *Porcellio scaber*. Oligochaete tunnels were found in the soil, which was quite moist, and even to within a few metres of the edge of the lava, but the first live worms were not taken until a distance of 250 m, in moist soil overlaid with 15 cm of ash. Diptera, in contrast, were numerous



throughout the area of maximum damage. *Lucilia sericata* was the commonest species, and flies were seen resting on the warm stones of the lava itself, apparently unaffected by the fumes. Arachnids, in contrast, were not seen anywhere in this faunistically poor 'desert' zone between station 1 and the eastern limit of the lava field. The overall impoverishment of this zone is emphasized in table 1, column 1. Of the ten species collected, six were Diptera and the others infrequent myriopods, oligochaetes, and a single beetle and linyphiid spider, the latter from the periphery of the most affected area. Station 3, just east of the edge of the ash-covered region was in an area of poor vegetation and would not have been expected to carry a large fauna, but isopods, which might have been expected, were lacking and there were no Collembola.

### 2.3. *Damage by fumes: area east of the new volcano*

Stations 12 and 13, on the edge of the Base above the new volcano, were in areas with fairly severely damaged vegetation: 12 lay only 2 km from the main crater. The two dominant plants, *Phyllica arborea* and *Blechnum palmiforme*, were especially affected but a complete fauna was found at ground level and on their trunks. Collembola and aphids (*Aulacorthum solani*) were abundant, yet these are insects which might on subjective grounds be expected to be sensitive to toxic gases. The indirect effect of fume damage on the fauna is likely to have been mitigated for two reasons: first, as Dickson (1965) (Part IV, this Report) has shown, *Phyllica* and *Blechnum* are among the most sensitive native plants and secondly, as Holdgate (1965) (Part III, this Report) emphasizes, these are species which support few phytophagous invertebrates. It is, of course, difficult to assess the extent to which the fauna of such fume-damaged regions had been reconstituted by colonization after the eruption, but there is no reason to suppose this had occurred to any great extent. In the field, it seemed reasonable to conclude that the concentration of toxic fumes sufficient to induce necrosis in the dominant plants was not enough to destroy most invertebrate animals. Consequently, it can be said that even downwind from the volcano, the damage to the invertebrate fauna was inconsiderable beyond a mile radius.

The vertebrate fauna also seems to have been unaffected by the fumes even in close proximity. Particular attention was paid to the two albatrosses which are widespread and conspicuous breeding species over the island, and to the endemic thrush or 'starchy', *Nesocichla eremita*. The yellow-nosed albatross, *Diomedea chlororhynchos*, is the commoner and nests in more accessible places, and it appeared totally unaffected by the eruption. At 2000 ft. on the edge of the Base immediately overlooking the volcano a fledgeling was found in good condition. The surrounding vegetation had been severely damaged and during the time of maximum production of toxic fumes by the volcano the adult must have been incubating on its nest. Adults, both of this species and of the sooty albatross, *Phoebastria fusca*, were seen on several occasions to pass through the cloud of gases issuing from the volcano without altering course to avoid it, although these gases were unpleasant in the extreme to human nostrils by virtue of their high sulphur dioxide content. Downwind from the volcano, where the more sensitive plants were still severely damaged, sooty albatrosses were present on the cliffs in their accustomed numbers, although their breeding success was hard to determine in view of the greater inaccessibility of their nest-sites.

The endemic thrush, *Nesocichla eremita*, which has increased from a precarious population level since the early 1920's and is now widespread and numerous over the higher and better vegetated parts of the island, was also found breeding successfully in some areas where the more susceptible plants had been seriously damaged by fumes. The species was observed to be almost entirely a ground feeder, taking diplopods, chilopods, oligochaetes, and probably other invertebrates and since these food organisms were unaffected beyond a very short radius from the volcano the eruption is likely to have had a negligible effect on this bird also.

#### 2.4. *Slight fume and pyroclast damage: area near the Settlement*

To the west of the volcano there was practically no damage by ash covering the coastal plain. At 100 m from the base of the cone the soil and litter fauna (macroscopic) appeared normal, including Collembola and aphids. Station 5, which was only 1.2 km from the centre of the main crater, was worked intensively and at intervals throughout the expedition's stay on the island. It lay about 9 m above sea level, in a small dry gulch opening through the seaward cliffs of the Settlement Plain: its vegetation showed no obvious volcanic influence and its fauna was considerable. Two alien species of weevil, *Pantomorus cervinus* and *Phlyctinus callosus* were abundant: the latter is an expanding cosmopolitan pest now recorded from Tristan for the first time. These two species, together with the two Collembola taken on the Expedition, the aphid *Aulacorthum solani* and the ubiquitous larvae of *Agrostis segetum* were feeding densely on *Rumex obtusifolius*. On the rock walls of the gulch, araneids were plentiful and very large numbers of *Porcellio scaber* and *Orchestia platensis* inhabited the ground surface under a thick growth of grasses and under stones. The scarcity of staphylinid beetles, common elsewhere on the island, was noticeable but this could hardly be an effect of fumes since these beetles were found in the nearby Hottentot Gulch. Although no station exactly comparable with this one was worked in the unaffected area around Stony Beach, there appeared to be no significant difference in the fauna there except that staphylinids (particularly *Oxytelus* sp.) were common. Table 34 shows that thirty species were obtained in the mildly affected area around the Settlement, as opposed to thirty-six species in the unaffected region near Stony Beach and twenty-two species in undisturbed upland habitats, and this is a sufficient indication that the effects of the eruption on the invertebrate fauna of the Settlement Plain west of the volcano were not detectable.

#### 2.5. *Processes of recovery*

The rapid recovery of the vegetation at the periphery of the area of fume damage will undoubtedly be accompanied by the re-establishment of a completely normal associated fauna. Even in the areas of maximum damage, close to the east side of the new cone, small ferns, grass, *Empetrum*, and other plants are actively recolonizing. Mr H. G. Stableford, who observed this recovery in September 1962, noted also that there was an appreciable population of earthworms, spiders, and other invertebrates even in the ash-covered ground near to the new volcano.

Mr Stableford, on the other hand, observed no soil invertebrates or spiders on the new lava itself. It seems likely, by analogy with the Stony Hill area which was the site of the previous eruption 200 to 300 years ago, that recolonization here will be much slower. At

Stony Hill even the parts of the lava field and cinder cone that are protected by their rugged topography from grazing by cattle still lack a full fauna and a complete vegetation covering.

### 3. INDIRECT EFFECTS OF THE ERUPTION ON THE FAUNA

The evacuation of the island was followed by the decontrol of three kinds of grazing mammal (cattle, sheep, and donkeys), two kinds of poultry (geese and fowls), and two predators (dogs and cats). Semi-wild cattle had previously ranged over the Stony Beach area of the island and there were semi-wild sheep on the Peak and Base and feral cats, rats and mice over the whole island, but this abandonment of substantial numbers of other alien mammals produced a state of considerable instability. The status of the alien land fauna at the time of the Expedition's visit is summarized in the following sections.

#### 3.1. *Cattle*

In January to March 1962 some 200 head of cattle were counted on the Settlement Plain, and this represented no significant change from the estimated number left behind by the islanders. Only three adult carcasses were discovered. With two possible exceptions, however, it was found that no calves born since the eruption had survived. Examination of the carcasses found indicated destruction at the time of birth, and this was attributed to the dogs. The ears of other animals had been wholly or partially removed, fairly obviously due to the same cause. The cattle were in otherwise excellent condition, grazing close to the base of the volcano itself and apparently undisturbed by occasional falls of talus down its flanks. At Sandy Point, seventeen non-breeding animals were found in good condition and unmolested. No damage was found, either, among the semi-wild cattle at Stony Beach which, unlike the more domesticated animals at the Settlement have developed well-formed herds and might well be capable of driving off attacks by dogs. Three herds were counted, numbering 124, 49, and 17 animals, respectively, with numerous calves at foot. These animals have caused severe damage to the sward by overgrazing, and erosion is proceeding rapidly: reports by a series of Agricultural Officers suggests that there has been a slow population increase and that attention has repeatedly been drawn to the dangers of further overgrazing.

#### 3.2. *Sheep*

At the time of the evacuation there were about 740 sheep on the island (D. Simpson, Agricultural Officer, personal communication). In January 1962 only thirteen were seen at Burntwood at the western limit of the Settlement Plain, six on equally well protected ledges on the Hillpiece, fourteen at Sandy Point, and one ram on the Base above Hottentot Gulch, making a total of thirty-four. This startling reduction in numbers was clearly attributable to the dogs. Carcasses were found in groups at the foot of small cliffs, especially along the seaward edge of the Settlement Plain, and it seems likely that the animals had been driven over by the dogs. Few of the carcasses showed signs of having been eaten, and from their condition all appeared to have been killed in the same period, probably soon after the evacuation.

#### 3.3. *Donkeys*

The animals remained docile in January 1962 and showed no alteration in numbers from the original total of around seventy. No young animals which could have been born after



the eruption were seen, although no carcasses were found. They may possibly have been destroyed at birth by the dogs. The donkeys appeared to have been responsible for the destruction of the potato crop planted by the islanders before the evacuation, but were doing little to control the luxuriant growth of weeds which had sprung up subsequently.

#### 3.4. *Geese and poultry*

The Expedition found no trace of the flock of over fifty geese abandoned in the evacuation. Domestic fowl were, however, numerous both in the Settlement and around the hen houses to the west of it.

#### 3.5. *Dogs*

A few days after the evacuation, in October 1961, men from H.M.S. *Leopard* destroyed as many as possible of the dogs left behind by the islanders. The residue had become unapproachable by man, and semi-wild, by the time the Expedition arrived in January 1962. The number of individuals present was estimated at sixteen, and they were running in groups of two or three rather than as a pack. They appeared to have subsisted on calves, taken at birth, geese, perhaps a few of the sheep the carcasses of which remained accessible, and young yellow-nosed albatross *Diomedea chlororhynchos*. The latter food source was confirmed by examination of dog faeces on the Base. Other possible food sources would include rats, cats, and perhaps rockhopper penguins *Eudyptes crestatus*. The dogs found easy access to the Base but apart from the young albatrosses could not be shown to have taken any food there.

#### 3.6. *Cats*

About fifteen cats were found alive, and a comparable number dead, in and around the houses of the Settlement. The cause of death was not apparent from the carcasses, and since the bodies were unmutilated it seemed unlikely that dogs had been responsible. Feral cats have been established on Tristan for many years and it is possible that the balance of the abandoned Settlement population has moved into natural habitats to swell the numbers there.

#### 3.7. *Rats*

Two subspecies of the black rat, *Rattus rattus alexandrinus* (Desmarest) and *R. r. frugivorus* (Rafinesque), are known from Tristan, the species having been introduced in 1882. Rats are widespread over the main island up to around 3000 ft. but have been little studied. They are reputedly serious predators of the smaller ground-nesting birds and have also been serious pests at the potato patches and in the Settlement. When the Expedition arrived, however, rats were scarce in the Settlement and in over 7 days trapping only a single specimen was obtained. The numbers had also declined at the potato patches. In the latter area their population had probably been affected by the destruction of the potato crop, supposedly by the donkeys, but in the Settlement supplies of stored food in the abandoned canteen, including sugar and flour, had been little damaged. No explanation of this reduction in numbers, which persisted in September 1962, is apparent. Much detailed ecological work would be required before any evaluation of the relationship of the rats, feral cats, and the few surviving ground-nesting petrels could be made.

3·8. *Mice*

*Mus musculus* L. is widespread on Tristan but no detailed or reliable data on its habits or numbers are available. There is no indication that the eruption had any direct effect, and one mouse was observed among the talus at the base of the new volcano, on its west side. However, numbers appeared low around the Settlement and at Sandy Point, in contrast to the Stony Beach area where the animals were numerous, and there appeared to be some degree of inverse correlation between the numbers of rats and of mice in a given area.

3·9. *Native mammals and birds*

There is no evidence of any major effect, direct or indirect, of the eruption on the two species of seal (*Arctocephalus t. tropicalis* and *Mirounga leonina*) or the eleven species of bird known to be breeding on Tristan. The apparent immunity of albatrosses and Tristan thrushes to the fumes has already been mentioned, and there is no reason to suppose a greater sensitivity on the part of any other species breeding in the vicinity of the volcano. The indirect effect of uncontrolled dogs killing young albatrosses and perhaps moulting penguins has been mentioned, but the total loss from this cause was probably less than the combined depredations of men and a much larger number of dogs in normal years. Rats and feral cats have co-existed with the avifauna for many years, and while they have undoubtedly greatly reduced the population of many species, this is a long standing situation on which the volcano has had no influence.

The most significant indirect effect to have been expected on these species would only have become manifest with the continued absence of man. Assuming the abandonment of the island with no further interference, leaving dog and cat populations unchecked, one might have expected a severe rise in predation of albatrosses and penguins with a great reduction, if not extermination, of their residual breeding stocks. Assuming the destruction of dogs, but no other human interference, it is likely that a steady increase in the populations of albatrosses and of the two seals would have occurred, while penguin rookeries might also have extended. Now that re-settlement of the island has occurred, these topics must remain a matter of speculation.

3·10. *Invertebrates*

Similarly, a few small and temporary indirect effects, caused by the evacuation, have affected certain invertebrate species. The blowfly, *Lucilia sericata*, seemed to be enjoying a temporary increase in January to March 1962, perhaps because of the relative abundance of refuse and carrion and the cessation of direct control measures. It had attained a very high density in the Settlement. Three other pests, *Agrostis segetum*, *Aulacorthum solani* and *Pantomorus cervinus*, formerly had control measures taken against them, mainly by the spraying of the potato crop. After the evacuation, the potato crop was destroyed and these insects were forced on to other food plants, including native species, on which they have also occurred for some years. The only insect-eating bird on Tristan, the endemic thrush, occurs rarely in the Settlement, so that these alien pests have no natural controlling influences other than limitations of food and the presence of parasitic or predatory invertebrates. It is interesting in this context to note that a coccinellid, *Adalia flavomaculata*,

has recently arrived and is now widespread on Tristan and may become a significant predator of aphids. In general, however, the return of the islanders and the re-establishment of the former pattern of husbandry will undoubtedly soon reverse any such minor indirect changes.

### 3.11. *Control measures taken by the Expedition*

As the future of the island was uncertain, and resettlement remained a possibility, the Expedition decided to attempt to exterminate the dogs so as to safeguard the remaining sheep, fowl, and the wild birds. All except two of these predators were successfully killed. At the same time, it was decided to control the numbers of the Settlement cattle by castration of all young male animals, and this was done. The senior bull, who was nearing the end of his useful life, was slaughtered. It was felt that enough calves would be *in utero* to render this merely a temporary check for the ensuing few years, preventing overgrazing while some decision was reached on the future of the island.

### 3.12. *Subsequent changes in livestock numbers*

Possibly as a result of the reduced grazing pressure caused by the destruction of the sheep and geese and the reduced numbers of calves and young donkeys, the 200 cattle overwintered well and were in good condition in September 1962 when Mr H. G. Stableford arrived at Tristan. At that time about forty donkeys remained and were in good condition. It was not customary to supply any special winter feed on Tristan other than a small amount of potato waste from the houses, since owing to the mildness of the climate vegetation growth is barely checked at this season. The sheep population had, however, fallen further over the 1962 winter, and none were seen anywhere on the Settlement Plain: only the fifteen at Sandy Point apparently survived. No domestic fowls remained, nor were any geese seen. Part of this further destruction of fowls and sheep may be ascribed to the surviving dogs, two of which were seen around the Settlement area. Cats may have participated in the destruction of the fowls, since although many dead cats were found in and around the houses, two were seen in good condition in the village.

## 4. DISCUSSION

The recent eruption on Tristan da Cunha was minor in character and has had a correspondingly small influence upon the fauna. Apart from the secondary effects induced by man's presence on the island and his rapid evacuation, the pattern of events in 1961–62 was probably not very different from those accompanying similar eruptions in the past. There is considerable evidence that localized volcanic activity has occurred intermittently on Tristan throughout about the last 40000 years, but this has produced only small secondary cones and their associated flows and is unlikely at any time to have sterilized the whole surface of the island. While these eruptions differed in type and extent in each case, as with the recent eruption once direct damage had ceased and activity was over, there was ample opportunity for recolonization of the affected areas from the adjacent unharmed parts of the island. This process has gone to completion at Big Green Hill, Hillpiece, Hackel Hill and many other centres: it is as yet incomplete at Stony Hill and may be presumed to be starting on the new lavas of the Settlement Plain.