BIRDS AND AIRCRAFT: A PROBLEM ON SOME NEW ZEALAND AIRFIELDS

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INTRODUCTION

Since technology enables man to assert at least some control over most features of his environment it is surprising that in the planning of engineering projects the only features considered seriously are physical ones. Biological complications are often ignored until they become a problem and in this the aviation industry is no exception.

Recent advances in aircraft design and corresponding increases in air-speed have, along with increases in the population of some birds, particularly gulls, emphasised a problem, always apparent but not previously considered important: that of the risk of collision between birds and aircraft.

Examples such as the Boston Bay tragedy in October 1960 when, as the result of a collision with a flock of starlings, a turbo-prop Electra crashed with loss of 62 lives (Aircraft Accident Report 1962), have helped to convince aviation authorities and airline pilots of the need for urgent research into the bird hazard on airfields.

New Zealand airlines have a record almost free of serious incidents involving birds, although approximately 0.03% of all commercial aircraft movements in 1965–66 recorded either strikes or near misses. As would be expected, those airfields with the greatest number of movements had the most incidents; but when computed on the basis of incidents per aircraft movement we find that some airfields had up to 1.0% of movements affected. Of the total, 48% occurred at take-off, 36% at landing and 16% at other phases of flight near the airfield (calculated from data supplied by the Department of Civil Aviation).

Although advanced aircraft design has increased the severity of the bird problem, the siting of airfields is also an important contributing factor. Because airfields occupy large areas, marginal land such as swamps and sand-dunes is often chosen as sites and frequently parts of estuaries are reclaimed. Within New Zealand many airfields have been built in such areas.

Because of increasing bird strikes and the resulting increased maintenance costs, scientific investigations into birds as a hazard to aircraft began overseas about 1957. Since that time, in New Zealand, an additional international airport has been built and several secondary airfields have been reconstructed.

ANALYSIS OF THE PROBLEM

The new international airport at Auckland (Fig. 1) was built on a site where apparently little thought was given to the presence of large populations of birds. Indeed, there are few areas in the country which support a larger summer population of wading birds than Manakau Harbour. Hawkes Bay airport, Napier (Fig. 2), was recently reconstructed on a site immediately adjacent a large breeding colony of black-backed gulls (*Larus dominicanus*), a rubbish dump, a wildlife refuge, a lagoon and the sea. Invercargill airport (Fig. 3) is built on a reclaimed swamp at the head of an extensive estuary. Its environs are poorly drained and these, with the estuary and nearby rubbish dump, serve as a rich feeding ground for waders, waterfowl and gulls. As far as birds are concerned, these airfields could hardly have been built in more attractive areas. As well as providing sites for airfields, marginal land near cities is used for activities which would be offensive within the urban precincts, e.g., rubbish dumps, sewage farms and outfalls, abattoirs and pig farms. All these attract birds. Of the twelve problem airfields in New Zealand, each had, at the start of this investigation in 1964, one or more of the above activities nearby.

Determination of factors influencing the presence of birds requires a separate ecological study of each airfield. Although each has its own particular problems, there are some possessed in common: (i) Extensive ungrazed grass areas offer an ideal habitat for a large and varied insect population. To insectivorous species such as starlings (*Sturnus vulgaris*), banded dotterels (*Charadrius bicinctus*) and in some areas, South Island pied oystercatchers (*Haematopus ostralegus finschi*) and magpies (*Gymnorhina* sp.), such rich feeding grounds are a great attraction. Other than during the breeding season some, or all, of the above species—and others — have been recorded feeding throughout the day in large numbers.

(ii) Grass has so far been regarded as virtually essential on airfields for it binds the surface and traps dust. Some airfields have grass runways as cross-wind alternatives to the main runway. The grasses typically encouraged are brown-top (*Agrostis tenuis*) and Chewings fescue (*Festuca rubra* var. *commutata*). Couch (*Agropyron repens*) and *Poa pratensis* are also common. Several other grasses are used depending on local conditions: for drier areas, Bermuda grass (*Cynodon dactylon*), dryland brown-top (*Agrostis* sp.) and *Notodanthonia semiannularis*; in damp areas *Poa trivialis* and creeping bent (*Agrostis stolonifera*). All these are free-seeding and thus attract seed-eating birds, important amongst which are sparrows (*Passer domesticus*), greenfinches (*Chloris chloris*) and goldfinches (*Carduelis carduelis britannica*).

Most birds which feed consistently on airfields are highly social and it is their flocking habits that present the greatest danger.

(iii) Nearby feeding areas also create a problem. Airports such as Auckland, Nelson and Tauranga are near or extend on to large shallow harbour systems and the mud-flats exposed at low tides provide feeding grounds for waders. The habits of these birds at low water do not pose a hazard but at high water their flight paths to and from roosts frequently intersect those of aircraft.

(iv) Waterfowl are another group found in association with swamp, lake or lagoon; but as the flights of waterfowl are mainly confined to dawn and dusk, their activities, like those of waders, are to some extent predictable.

General aspects of the problem posed by birds on airfields in New Zealand can best be illustrated by reference, in some detail, to the situations at Auckland, Napier and Invercargill.

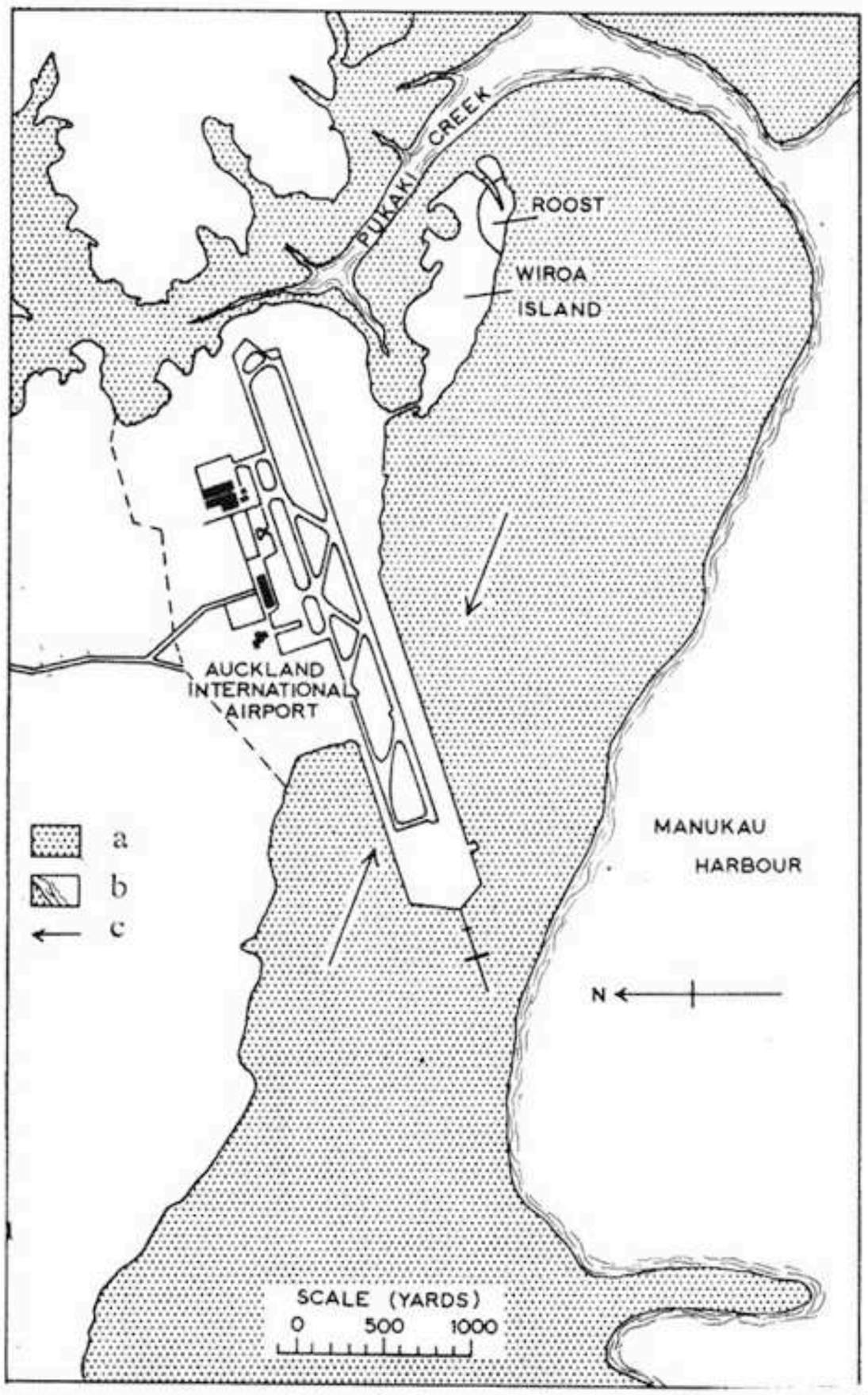

FIGURE 1. *Auckland International Airport and environs. (a) Tidal mud flats. (b) Permanent water. (c) Wader movement.*

Auckland

Auckland International Airport, Mangere (Fig. 1), has a finger-like reclamation projecting on to the mudflats of Manakau Harbour. It is flanked to the south and west by these and to the east by the large tidal Pukaki Creek. The mudflats support one of the largest concentrations of waders found in New Zealand. The activity of the waders is largely governed by the tides and at high water feeding areas are inundated and the birds forced to seek a roosting site. For this, in the absence of any deterrent action, the airfield reclamation apparently proves ideal (Saul 1967).

Nearby lies Wiroa Island — already used as a roost by waders during small to medium high tides. In an effort to remove the birds from the airfield, roosting facilities at Wiroa Island were improved. This improvement consisted of building a reclamation some five acres in extent above the height of the highest tides. Fresh water pools, a salt-water lagoon and windrows were formed. As grass grew to cover favoured bare areas on the airfield, the birds chose to use the Wiroa roost instead. However, because the major feeding grounds near the airport lie to the north, and Wiroa roost is to the south, bird flight across the airport reclamation remains as a lesser hazard. This flight is predictable within broad limits according to the times and heights of high water: the bigger the tide, the greater the number of birds which fly to Wiroa as

progressively more of the roosts close to the feeding grounds are swamped. Wader flight becomes an acute problem when numbers build up in late summer prior to migration.

Movements of communally-roosting species to and from their roosts at dusk and dawn offer another hazard: red-billed gull (*Larus novaehollandiae scopulinus*) and black-backed gull flight paths along Pukaki Creek take them directly across those of aircraft.

Feeding on this airfield is not the problem it is at some others. This is mainly because the birds are constantly harassed and the grass maintained at a height of four to six inches. (Overseas reports suggest that long vegetation inhibits the activities of the more social species such as starlings and this seems to be so at Mangere). However, what may discourage one species may indirectly encourage another. Longer grass is apparently good habitat for mice (*Mus musculus*) and, although these rodents are not a direct danger to aircraft, harrier hawks (*Circus approximans gouldi*) and white faced herons (*Notophoyx novaehollandiae*) that may hunt them over the airfield probably are.

Napier

Hawkes Bay Airport, Napier (Fig. 2), has a problem different from Mangere in that the concern here is mainly with the flight pattern of breeding black-backed gulls and the evening flights of starlings and waterfowl, mainly mallard ducks (*Anas p. platyrhynchos*) and black swans (*Cygnus atratus*).

The airfield is constructed on the Ahuriri Plain which, prior to a six-foot uplift by the 1931 Napier earthquake, was a shallow tidal lagoon about four miles long and two miles wide. A narrow lagoon now flanks the Ahuriri Plain to the south and west, and to the east lies Hawke Bay. An extensive system of open drains dissects the entire area and a small lagoon which forms part of the Westshore Wildlife Refuge adjoins the south-eastern boundary of the airfield.

Commonly found in the open water is a multitude of waders and waterfowl. Swans and ducks are particularly numerous during the game season in May and persist in the area until pairing takes place in July. It is their characteristic evening flights from the refuge to other feeding areas near the airfield that causes concern.

Starlings are present throughout the year but their numbers are noticeably greater outside the airfield. This is because the airfield pasture is poor and hence supports only a moderate insect fauna; whereas the surrounding farmland with its rich turf offers a uniformly rich fauna for food.

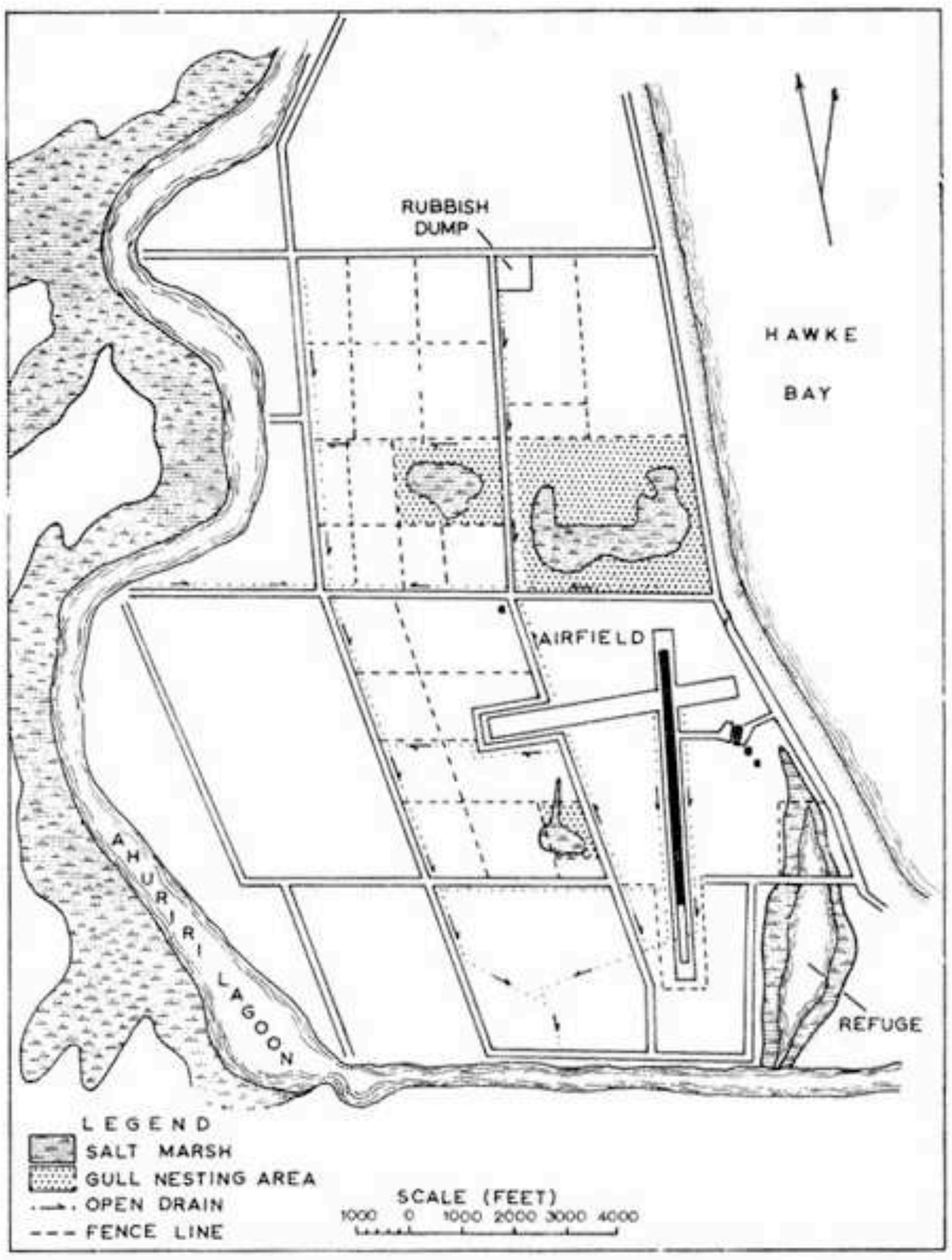

FIGURE 2. *Napier Airport and environs.*

Four hundred yards north was a large breeding colony of approximately 2,500 black-backed gulls. All aircraft, regardless of wind direction, had to pass low over the area occupied by the colony and although strikes occurred occasionally, with as many as 11 birds killed at one time, no serious damage to aircraft was sustained. Beyond the breeding season — which usually extends from July (when preliminary nesting behaviour begins) until late February (when the last chicks are fledged) — a large number of these gulls remained in the area feeding on the Napier City Council rubbish dump a little further north; this attraction has now been removed.

As at Mangere, flights to and from roosting sites cause concern and here starlings and black-backed gulls are involved — the former roosting in trees directly south and the latter on the edge of the lagoon to the south-west.

This airfield was modified in 1963–64 to allow use by jet-prop aircraft and it could well be that had full consideration been given at that time to the bird problem, an alternative site might have been sought.

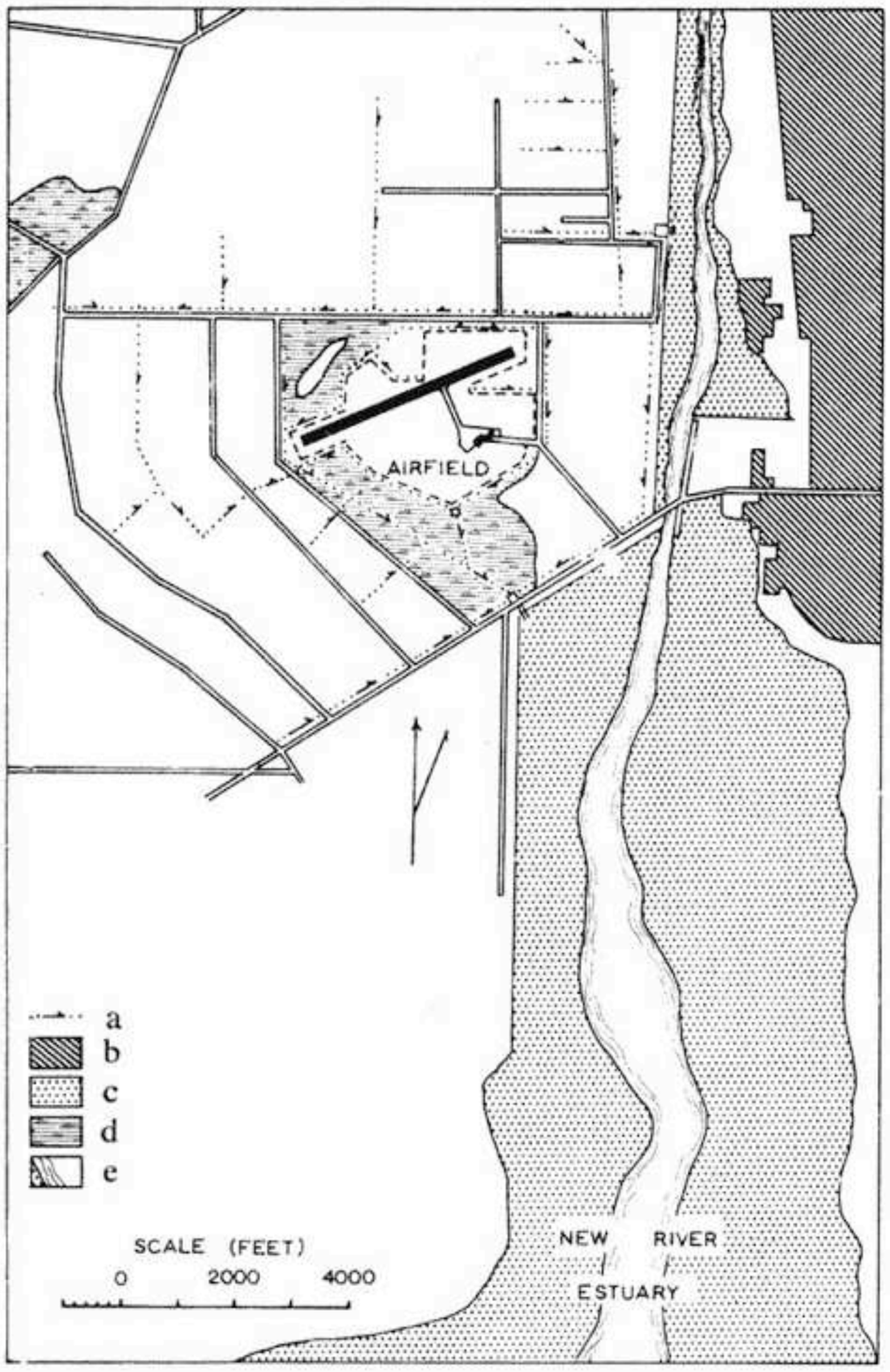

FIGURE 3. *Invercargill Airport and environs. (a) Open drain. (b) Residential and industrial area. (c) Tidal mudflat. (d) Open water.*

Invercargill

Invercargill Airport (Fig. 3) is situated on part of a reclaimed lake and swamp at the head of the New River estuary. Here, in contrast to Mangere and Napier, the problem is primarily one of birds feeding on the airfield. Drainage is so poor that grass overlies a layer of moss three inches thick and the surroundings include many pockets of open water and large drains.

Throughout the entire area and on adjacent farmland is a very high population of *Wiseana* (Porina) and it is the larval form of this moth that forms the major food item of the insectivorous birds which abound. Farming and the grazing of stock appear to discourage birds from feeding on the farmland; but the airfield is comparatively undisturbed and therefore constantly supports large numbers of feeding South Island pied oystercatchers, red-billed and black-billed gulls (*Larus bulleri*) and starlings.

Tidal influence on bird numbers is noticeable, abundance is greatest at high tide. At spring tides numbers reach a peak which indicates that the airfield and adjacent paddocks are used also for roosting at these times. An increase in waders and gulls is particularly noticeable in stormy southerly weather, to which most other roosing sites in the estuary are exposed.

The problem with waterfowl at Invercargill is similar to that at Napier with many birds living in the nearby open water.

Black-backed, red-billed and black-billed gulls constantly "trade" between the Invercargill city rubbish dump, barely three-quarters of a mile south-east of the airfield and two freezing works, four and a half and eight miles north respectively. This constant movement intersects aircraft flight paths.

Twilight flights of the three species of gull to their roosts also cause concern.

REMEDIES

The solutions which an ecologist offers to the bird hazard problem must be — (a) short-term to correct the immediate situation and (b) long-term to prevent repetition and to offer some form of prediction.

Besides this he must try to make his recommendations economically acceptable. He must also try to infringe as little as possible on present patterns of airport management, for, naturally, airport authorities are reluctant to alter existing practices. Nevertheless, this will sometimes be necessary. In this respect the problem is partly a human one, as man, the most adaptable of all creatures, often expects birds alone to change their ways.

Among short-term solutions used in this country, quite the most dramatic was the poisoning of the gull colony in Napier in November 1965 (Caithness, in press) — a measure that will be continued in forthcoming seasons to remove succeeding age classes as they return to their ancestral breeding ground. We must stress, however, that in most instances killing of birds on a scale great enough to solve the problem will not be possible. The Napier poisoning was practical only because of the well-defined breeding colony and it is almost

certain that once the colony is completely destroyed, the bird problems there will be solved as far as black-backed gulls are concerned.

Black-backed gulls roosting on grass adjacent to runways have proved troublesome and to discourage them favourable results have been achieved by placing "crucified" carcases (those with wings outstretched) on these areas. As a refinement, polystyrene models have proved equally effective and have the advantage of being more durable. Pyrotechnics such as carbide bird scarers, Very cartridges and shot-gun blanks all have a use but are best used in conjunction with some other stimulus, such as distress calls. By themselves, these particular remedies have little long-term effect as habituation to them soon occurs. Furthermore, response appears dependent upon the intensity of the bird's drive to remain in the area, i.e., with gulls the drive to breed and often to feed in a particular area is strong whereas there is a lesser drive to loaf or roost in any one place (Seubert 1965). On the other hand, with species such as starlings, roosting is more specific to an area than the other drives.

Long-term solutions are invariably costly for they basically involve some form of major modification of the environment. For example, to eliminate waterfowl their habitat must be removed. This in most instances calls for extensive drainage or filling or both.

The problem of discouraging social feeders on airfields is a difficult one but long grass approximately nine inches high is a fairly efficient deterrent. There are, however, several drawbacks to establishing such a sward — the present grass mixture used on airfields in New Zealand is made up of free-seeding species difficult to maintain at a suitable height all year round. Furthermore, during summer the dry leaves might present a fire hazard, particularly where pure jets are operating. A long sward might also have an adverse effect on drainage and thus reduce the bearing characteristics of off-runway areas (Cooke-Smith 1963) and might also reduce the braking efficiency of aircraft; but the main criticism by aviation authorities is that runway lighting would be obscured. By raising lights an extra few inches, by providing better drainage in the first place and by exchanging the present grass mixture for a non-seeding species, these difficulties could be resolved.

To remove the insectivorous birds effectively their source of food must be removed. Control of soil insects is not enough — complete elimination should be the goal. This requires the application of insecticides at rates of up to ten times those used in agriculture, thus creating a problem of toxic residues in run-off water, especially in inadequately drained areas close to cities or concentrations of wildlife. Detailed study of drainage patterns is necessary before the use of insecticides can be permitted; and insecticides should be sought that are not readily leached from the soil. Investigations along these lines are at present under way at Wellington Airport where the dye fluorescein is being used to get some idea of the level of contamination to be expected from drainage into the sea.

The provision of artificial roosts such as constructed at Mangere is another possibility in those localities where the airport is at present serving as a roost. Careful siting will be important, for birds should not be drawn across aircraft flight paths.

The natural environment often resists man's efforts to expand his habitat and the air is no exception. Though the ecologist can offer solutions to some aspects of the problem, the unfortunate siting of several New Zealand airfields in relation to large and varied bird populations will make it most difficult to obtain a satisfactory level of control. In the planning of airfields considerations of bird ecology must, in future, play an important part.

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