Arthur Rylah Institute for Environmental Research

TECHNICAL REPORT SERIES No. 98

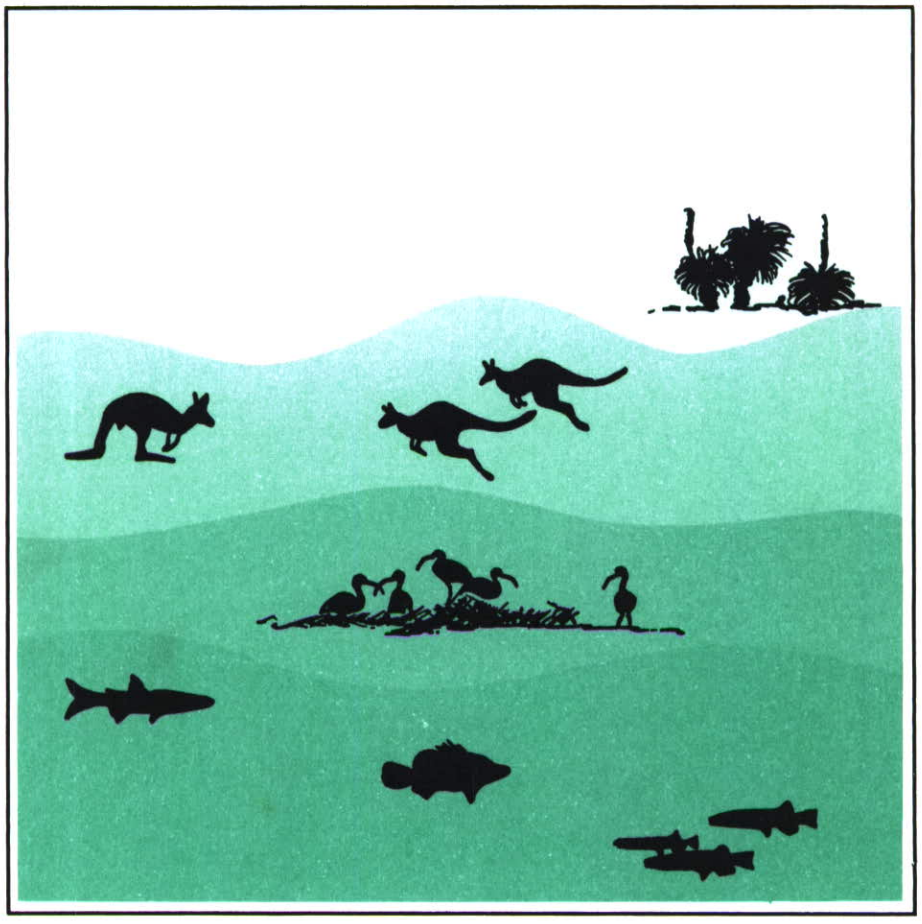
A Management Plan for the Altona Skipper Butterfly

Hesperilla flavescens flavescens Waterhouse

(Lepidoptera : Hesperiidae)

D.F. Crosby

May 1990



National Parks and Wildlife Division

Department of Conservation, Forests & Lands - Victoria

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Note the Department of Conservation, Forests and Lands became part of the new Department of Conservation and Environment in April 1990

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This document does not necessarily express the official view of the Department of Conservation and Environment, Victoria.

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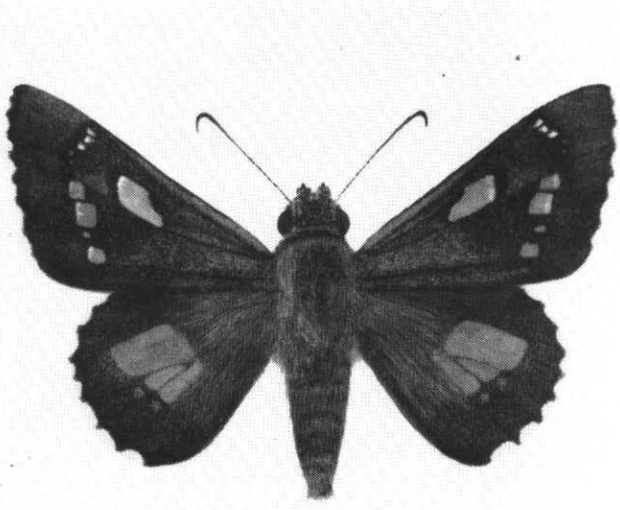
Altona Skipper on foodplant flowerhead



Upperside of male Altona Skipper
Actual width 33 mm

The above photographs were taken by George Self (MMBW) from original watercolour paintings by Nigel Quick.

CONTENTS

ABSTRACT

SUMMARY OF MANAGEMENT RECOMMENDATIONS

1. The habitats at Cherry Lake and Truganina Swamp in Altona, a western suburb of Melbourne, were crucial in the evolution of the Altona skipper butterfly, *Hesperilla flavescens flavescens* and require sympathetic management to ensure survival of the colonies . Some experimental procedures designed to improve the habitats are suggested, and the results of these procedures need to be monitored carefully. Supervision of the habitats by a ranger is recommended.

2. The colonies at Cherry Lake and Truganina Swamp, Altona, should be regarded as reference populations and should be treated as such.

3. The colonies at Skeleton Creek, Point Cook and Point Wilson, all of which are south-west of Altona, are important as back-up populations to those at Altona, because they, together with those at Altona, represent the true phenotype of the taxon. The three colonies have the advantage of being on Reserves, but will require a small amount of management to ensure their viability. Supervision and monitoring of the colonies will be necessary.

4. Habitats at other sites between Melbourne and the South Australian border, namely, Breamlea, Kooraweera Lakes, Lakes east of Lake Bolac, Rossbridge, White Lake, Lake south of Mitre, Mitre Lake, Olivers Lake, Ararat and Nelson should be regarded as sites of special biological interest and treated accordingly. Liaison with neighbouring property owners or operators will be necessary to ensure appropriate care and monitoring with minimal management.

5. Other colonies of *H.f. flavescens* should be safeguarded by co-operation of the landholders or the landholders of adjoining properties. No active management, but occasional monitoring and liaison would be desirable.

6. All sites should be safeguarded against the two principal threats of fire and changed hydrology. Weed infestation should be monitored.

1. INTRODUCTION

1.1 General

This report has been prepared for the Director, National Parks and Wildlife Division, Department of Conservation and Environment, Victoria, (DCE) to indicate the current conservation status of the Altona skipper butterfly, *Hesperilla flavescens flavescens*, and to make recommendations for its management. This work has required a review of the taxonomy, life history, ecology and present and past distibution of the insect. Extensive field surveys of the species were undertaken during 1983-89 to determine its distribution and identify threats to its populations and habitats. Major collections have been inspected.

1.2 Background to the Project

During the last decade, I have seen a gradual decline in the populations of *H.f. flavescens* at the type locality, Altona, a western suburb of Melbourne. In 1983, I obtained permission from the Melbourne and Metropolitan Board of Works (MMBW) to search for new colonies in the then recently declared Murtcaim Wildlife Reserve at Point Wilson. The reserve was adjacent to the MMBW sewage farm and was temporarily administered by the Board. A colony was discovered in the reserve in October 1984.

In September 1984, horses had been eating the butterfly's foodplants at Cherry Lake, Altona, and I informed the MMBW (the landowner) of the significance of the butterfly colony and requested reinstatement of the western perimeter fence of the lake reserve to keep the horses out, but the fence was not repaired. In the same period a search for the butterfly in its other known Altona colony, Truganina Swamp, was initiated.

An article in the "Victorian Entomologist" (Crosby 1986) resulted in the Entomological Society of Victoria, in March 1986, placing the butterfly on its list of insects voluntarily protected by members, pending clarification of its conservation status.

In May 1987, I wrote to the Director, National Parks and Wildlife Division, to indicate my concern that the survival of the butterfly appeared to be threatened. As a result, the Minister for Conservation, Forests and Lands wrote to the Minister responsible for the MMBW pointing out the problem and suggesting that a management stategy be developed for the Altona sites.

The need to study the conservation requirements of *H.f. flavescens* had been mentioned by New (1984; 1987) and reinforced by Hill and Michaelis (1988) and Vaughan (1988).

After starting work on the current report, I supplied the MMBW with a separate report on the colonies at the Altona sites in February 1989. Some data were also provided for the management strategies to be used in the Point Cook Park. The information applicable to the butterfly in both these reports is contained herein.

Concurrently with my field work, the Government was developing a conservation strategy for Victoria which resulted in the publication of a booklet titled "Protecting the Environment" in June 1987. One of the objectives of the strategy is to conserve threatened species, including invertebrates, principally through habitat protection. The Flora and Fauna Guarantee Act (1988) became

operative in October 1988. This Act has several new features of relevance to the present study, for example recognition of ecological communities and legislative breadth that includes all taxa of flora and fauna. The act promotes the protection of biologically significant sites.

2. THE SPECIES

2.1 History

The Altona skipper butterfly was first recorded by F.P. Spry, who caught specimens at "Altona Bay" on 3 April,1904. He exhibited these at a meeting of the Field Naturalists' Club of Victoria on 24 April 1904 under the name of *Hesperilla donnysa* Hewitson (Spry 1904).

It is not possible to determine precisely where these specimens were caught because the Altona area then contained more extensive swamps incorporating the butterfly's foodplant than currently. However, examination of old photographs, plans, and other records indicates that the most likely source was from the vicinity of what is now Cherry Lake.

During the years up to the Second World War, butterfly collectors usually continued to visit, year after year, the same localities which had proved productive and there were few attempts to find new colonies. Altona thus became the traditional locality for what was then regarded as an attractive yellow form of an otherwise widely distributed species.

After 1945, collectors had greater mobility and started to explore further afield. Colonies of this butterfly were found around Lake Connewarre near Barwon Heads, and at Corio. Later they were found at Breamlea, Point Lonsdale, and Ocean Grove. All are near or on the western side of Port Phillip Bay (Figure 1).

However, in 1947 F.E. Wilson discovered a small colony of what he believed to be the Altona skipper butterfly, breeding on thatch saw-sedge *Gahnia radula* (R.Br.) at about 18 km ESE of Ararat (Fig. 1). In 1951, J.C. LeSouef obtained further specimens from this locality, as did I and others on subsequent occasions. As the habitat, foodplant, and flight times of the butterflies from ESE of Ararat were different from those of the Altona colony, the record was of particular interest.

Burns (1951) studied the specimens from Altona, Barwon Heads, and Ararat to determine their taxonomic position and separated them from *Hesperilla donnysa* as a distinct species, *H. flavescens*.

Atkins and Quick (Atkins 1977) discovered a small colony of *H.f. flavescens* near Jacka Lake, 14 km WSW of Natimuk in the Wimmera in October, 1976. This colony's habitat was similar to that at Altona, namely, chaffey saw-sedge *Gahnia filum* (Labill.) growing around the edge of a salt lake. The specimens from Jacka Lake closely resembled those from Barwon Heads and Breamlea, and were a little darker than those from Altona. Their flight times of October/November and February/March were the same as those at Altona. This record indicated that the distribution of *H.f. flavescens* might be much wider than that described previously and helped to link the occurrence of *H. flavescens flavia* near Adelaide (in a typical coastal habitat).

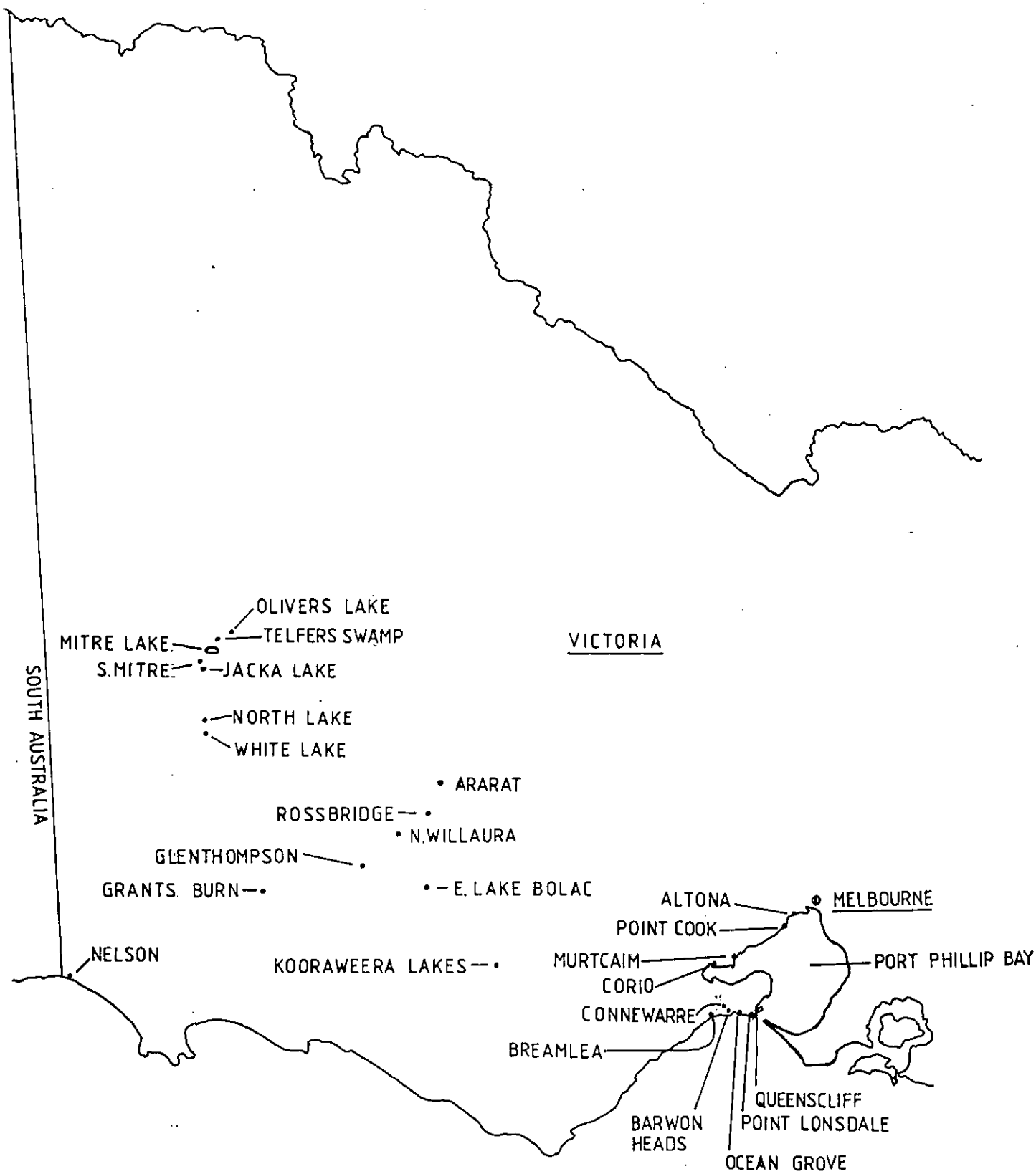


Figure 1. Distribution of *Hesperilla flavescens flavescens* in Victoria.

Since the late 1970s interest in *H.f. flavescens* has increased because of its unusually close affinity with the widespread donnysa skipper butterfly *Hesperilla donnysa* Hewitson and the apparent threats to the colonies at the type locality, Altona, because of substantial reduction in habitat as a result of gradual urban and industrial expansion in the area.

2.2 Taxonomy

Hesperilla flavescens flavescens belongs to the group called "skippers" (Lepidoptera: Hesperiidae), in the subfamily Trapezitinae, "which is confined to Australia except for a minor infiltration into New Guinea" (Evans 1949). The genus *Hesperilla* is solely Australian and consists of 14 species, found mostly in the eastern, south-eastern and south-western areas (Bassian Province). The genus is of particular interest due to its size and endemic nature. Several species, such as *H. donnysa*, are widely distributed in various habitats and show typical clinal variation.

Spry (1904) assigned the original specimens to *H. donnysa*, a species to which they are very closely related. G.A. Waterhouse and Lyell (1914) did likewise but mentioned that "examples from the volcanic plains near Altona Bay, Victoria, are all suffused pale yellow above, and the spots of the forewing are slightly more than average size". Waterhouse (1927) reviewed *H. donnysa* and separated three new subspecies, including *flavescens* for the specimens from Altona Bay, caught by Spry in March, April and November. Waterhouse (1932) again indicated that specimens were found "only near Altona Bay on the western side of Port Phillip" and that "this is a very distinct race, confined to a very restricted area".

Later, Waterhouse (1941) reviewed *H. donnysa* further and separated five additional subspecies, including *patmos* to cover all Victorian specimens other than those from Altona Bay (*flavescens*), and *flavia* for the yellowish specimens, similar to *flavescens*, from near Adelaide.

Waterhouse's classification was followed by Evans (1949) but Burns (1951) examined the two yellowish subspecies (*flavescens* and *flavia*), and decided that they could be separated from *H. donnysa* on the grounds of differences in coloration and markings and in the male genitalia of the adults, by the larvae and pupae, and by the food plants. He raised *flavescens* to a species and made *flavia* a subspecies of it.

This classification has been followed by subsequent authors including McCubbin (1971), Common and D. Waterhouse (1972; 1981), and Fisher (1978). Fisher pointed to the unusal, very close similarity between *H. flavescens* and *H. donnysa* and questioned whether the separation of *flavia* from *flavescens* was warranted.

Common and D. Waterhouse (1972) regarded the examples of *H. donnysa* from the Grampians, western Victoria, as *H. donnysa delos*, a race described by G. Waterhouse (1941) as a dark, often larger, form from the Mount Lofty Ranges, South Australia. The same authors later (1981) extended the Victorian range of *delos* to "south-western Victoria, from Ararat and the Grampians south to the coast between Port Campbell and Nelson". They also considered specimens collected about 1 km NW of Ararat to be *delos* but not those taken 18 km ESE, which they regarded as *flavescens*. Fisher (pers. comm.) has also bred *H. donnysa delos* from larvae and pupae taken from *G. filum* and *G. trifida* in south-eastern South Australia.

I have studied a large number of specimens taken from the various colonies up to mid-1988 and found that those from Altona, Point Cook and Murtcaim are particularly yellowish on both upperside and underside in both sexes and could be regarded as the same. Specimens from the other nearby localities show differences on the underside of the wings; those from Corio are slightly darker and less yellow; those from Barwon Heads, Point Lonsdale and Breamlea, greyer. Specimens from Jacka Lake and Ararat are similar to those from Breamlea. All have the characteristic yellowish flush of *flavescens* on the upperside.

A possible explanation of this type of variation could be that the yellowish form evolved at Altona spontaneously through some genetic or environmental influence and then it gradually spread south and west, mixing with *H. donnysa patmos* and became darkened by that influence.

If this was the case, Altona would represent the focus of the development of the yellow (and most extreme) form derived from an ancestor common to both *H. donnysa* and *H. flavescens* and has developed just far enough to be recognisable as a distinct species (Burns 1951). Thus the Altona populations are of particular scientific interest and are not duplicated elsewhere, except at Point Cook and Murtcaim, where the colonies are very small and may not be viable in the long term. The future of the colonies at Altona should therefore be safeguarded whilst they appear to be viable, to allow further study of this evolutionary process, and to find a solution to the factors which produced the intriguing, close relationship between the two species.

The use of both male and female genitalia as an aid in separating species of butterflies has now become prevalent. Burns (1951) used such evidence in his separation of *flavescens* from *donnysa*, and Atkins, who has dissected a limited number of specimens, believes (pers. comm.) that the differences are sufficient to warrant the separation. Conversely, Fisher (pers. comm.) disagrees. Undoubtedly, the two species are very closely related and if they are in the process of evolutionary differentiation, differences in the genitalia would be expected to be only marginal. Recent work by Sands (1986) in revising the Genus *Hypochrysops* (Lepidoptera: Lycaenidae) indicates that in some species parts of the genitalic structures do not become scleritized until about three days after emergence. Thus, evidence based on structures examined from bred material, as is frequently the case with Hesperiidae, may be misleading.

The taxonomic status of the *donnysa/flavescens* complex of *Hesperilla* requires complete investigation as there appear to be many anomalies in the current status. Evidence for these anomalies may be seen in the large number of specimens now available from a wide range of localities. A cladistical analysis may solve the problem, but this is not possible in this report. Specimens from Altona, Point Cook and Murtcaim, together with examples from some of the recently discovered colonies in western Victoria, appear to be readily separable from *donnysa*. Other colonies do not appear to have evolved sufficiently far to allow their specimens to be positively separated as *flavescens*.

Figure 2 shows the distribution of *H. donnysa* and *H. flavescens* in Australia.

The common or vernacular (English) name given to *H. flavescens* has been variable. Waterhouse (1932) used yellow donnysa skipper. McCubbin (1971) used flavescens skipper; Common and Waterhouse (1972; 1981) used yellowish skipper, an appropriate name. However, as a result of public and political interest the name "Altona skipper" has recently become widely used in Victoria and I have chosen to use this in my report.

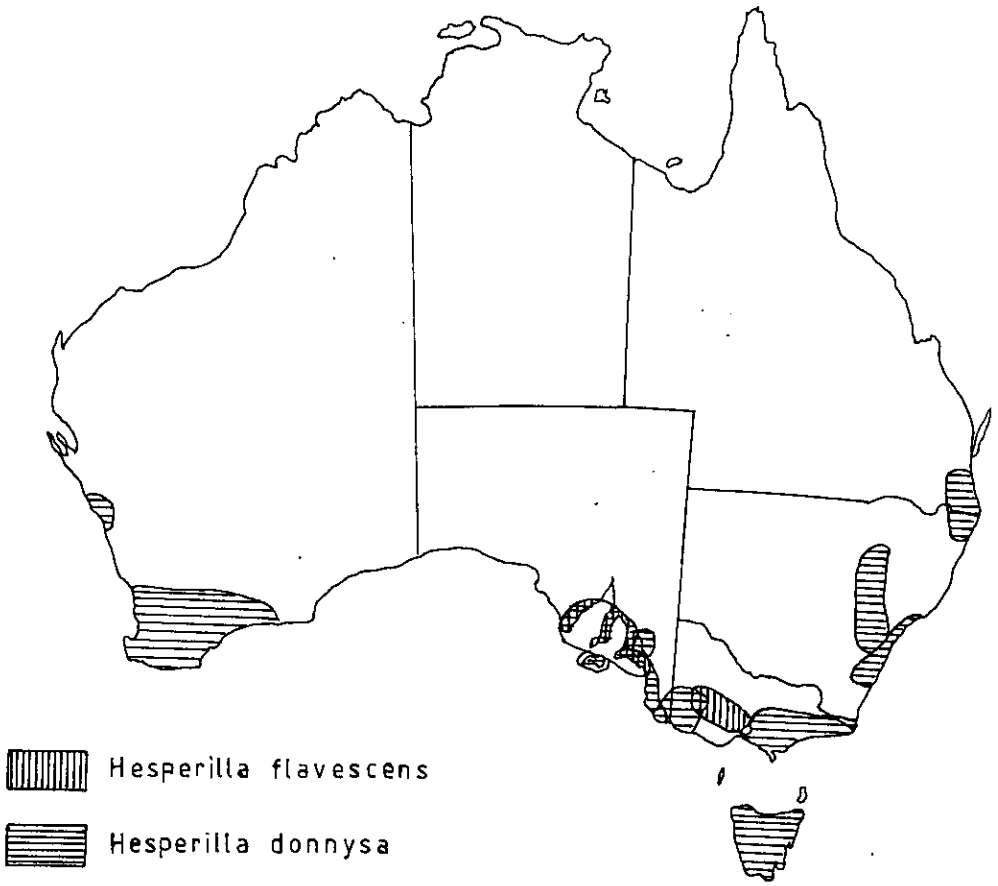


Figure 2. Distribution of *Hesperilla flavescens* and *Hesperilla donnysa* in Australia.

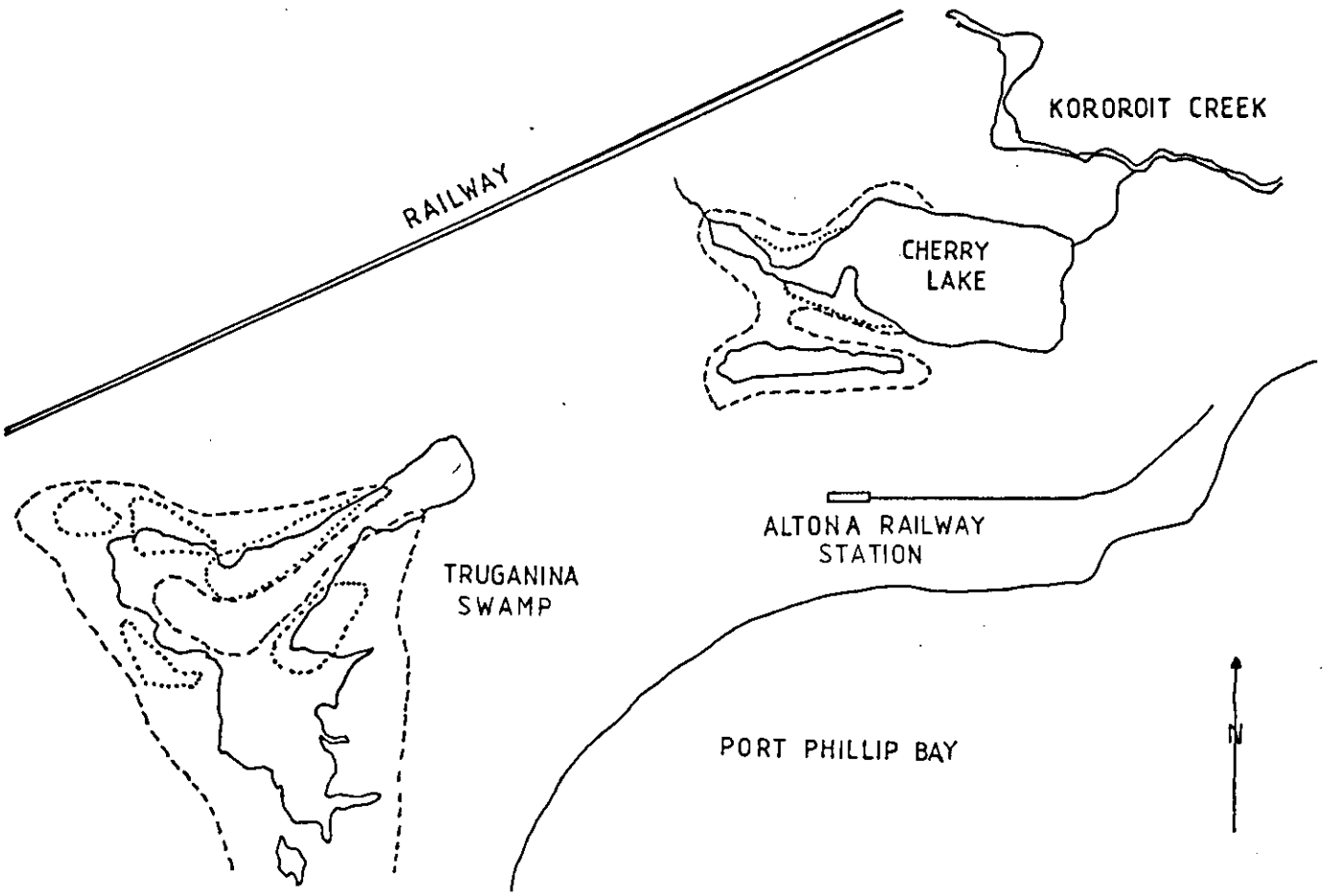


Figure 3. Altona Sites: base map about 1880, showing approximate extent of foodplant areas in 1945 ------- and 1988 ·····

2.3 Biology

Butterflies are very sensitive to changes in their habitat and environment, whether these be changes to vegetation, foodplant availability, soil type, physical nature, temperature or moisture.

The insect undergoes a complete metamorphosis during a life cycle consisting of egg, larva, pupa and adult, with each stage having critical requirements for existence. *H. flavescens*, in common with many other Australian butterflies which inhabit warm areas, produces adults in the spring and autumn. Few general studies have been done to determine whether the autumn emergence results from spring-laid eggs, with two separate broods per year, or from a single brood in which some larvae develop slowly; Atkins (1976) believes the latter to be the case. No work has been done yet specifically on *H. flavescens* to determine its breeding characteristics. Such work would be worthwhile especially as the species would be relatively easier to study than others because its habitat is so circumscribed.

In an attempt to shed some light on this problem, I marked 57 larval shelters at Point Cook by 6 February 1989 and checked them on two subsequent visits. The results were:

	NUMBER OF SHELTERS			
	MARKED			UNMARKED
	28/2/89	17/3/89	Total	17/3/89
Small larvae	5	1	6	16
Medium larvae	5	4	9	16
Large larvae	2	-	2	2
Pupae	5	6	11	12
Emerged pupae	-	15	15	20
Parasites	-	1	1	6
Empty shelters	-	12	12	-
Dead larvae/pupae	-	-	-	2
TOTAL	17	39	56*	74

* One not accounted for; label detached.

On 17 March 1989, I counted not only 56 marked, but also a further 74 stages (larvae, pupae, parasites) shown above in the column "UNMARKED". This result shows that the spring count was an underestimate; the colony size is nearer 250 specimens. These data also indicate that there is not a clearly defined second emergence, but rather a continuing flight through the summer into autumn. The larvae counted on 17 March would almost certainly produce adults the following spring.

2.3.1 Life History

The adults generally fly near the foodplants, the males often perching on the higher leaves to stake out small territories, from which they attempt to drive off other males. The females appear to mate very early, often following their first flight. During oviposition, the females fly slowly, down low amongst the foodplants to seek out a suitable bush. They alight on the base of a leaf and move backwards down it to lay a single egg not far above the ground (Atkins and Dunn 1986).

The larva on emergence, about three weeks later, climbs the plant and makes a small cylindrical shelter out of one or more leaves held together with silk and closed at one end. The larva feeds on adjacent leaves at night. The larva grows through five instars (four skin-moults), making several shelters as it increases in size, and ultimately pupates in the final shelter with head towards the open end. The first few larval shelters are frequently near the top of the food plant but the final shelter is often low down and short in length and well camouflaged amongst the leaves. The pupal duration is about three weeks. See Illustrations 5-7, 14-19.

The adults sometimes alight on small flowers, possibly to take nectar. Such behaviour does not appear to be essential for survival, as is the case for many butterflies, because some colonies have no flowering plants available, particularly at the time of the autumn flight. At sites without nectar sources the adults may well have shorter lives; this has not been studied.

The extensive surveys I conducted for this report indicated two conditions not previously recorded. First, the pupae collected in February and March were often appreciably smaller on average than those collected in spring, and produced proportionally smaller adults. Second, all pupae noted or collected from January onwards were much paler than those of the spring emergence. Whereas the size reduction did not apply at all colonies, the colour difference did. I noticed as had Fisher (1978), that the specimens of the autumn flight at some of the colonies were often less yellowish than in the spring flight.

The dark brown pupae of the spring emergence were almost identical in shade to those of *H. donnysa*. See Illustration 17.

I detected no consistent differences between the larval heads or between the pupal caps of the two species. Other species of *Hesperilla* have such differences, particularly in the pupal caps.

On the other hand, the flight times of the two species differ; *flavescens* was on the wing mostly from late September to early November and during April, whereas in Victoria, *donnysa* emerges in early November and is present till the end of December, or rarely early January. Common and Waterhouse (1981) state that *patmos* has a second generation in February and March, but I found no evidence of a second generation.

2.3.2 Factors influencing the life of a colony

Foodplants

Foodplants are a prime requirement and are particularly important where, as for *H.f. flavescens*, the range of plants acceptable to the larvae is very limited. The foodplant is chaffy saw-sedge, *Gahnia filum* (Labill.), which itself is restricted in distribution as it requires a specific habitat consisting of damp, mildly saline, unshaded conditions, usually shallowly inundated for part of the year, ie. swampy areas. See Illustrations 1-4.

Willis (1962) states that chaffy saw-sedge is "widespread and locally abundant on wet sandy ground of southern and western Victoria from Portland district to Mallacoota, usually near-coastal and often bordering salt-marshes". The plant is distinctive and is the only large species of *Gahnia* with smooth leaves.

Altona skipper butterflies from Ararat fed on *G. radula*; consequently there is the question of whether they are really *H. flavescens*. Coast saw-sedge *G. trifida* Labill., a closely related sedge, could be an alternative foodplant. *G. trifida* is found in open forest, heathland, and damp to swampy conditions which are very

similar to those where *G. filum* is found but which are not necessarily saline; its leaves are scabrid (cutting). The two species are occasionally, but rarely, found together (eg. Anglesea, Portland). Illustrations 20, 21.

The data available appear to indicate that *H. flavescens* feeds only on *G. filum*, whereas a sub-species of *H. donnysa* feeds on *G. trifida* and *G. radula*. Several stands of *G. filum* in south-western Victoria in habitats typical for *flavescens* do not appear to have been colonized. (e.g. Lake Yambuk, Curdies Inlet, Port Fairy.) See Appendix 3.

Predators

Little research has been done on predators of butterflies generally and none specifically on this species. Birds, small mammals, and spiders would constitute the main dangers, principally attacking the juvenile stages. Because of the butterfly's small size and flight speed, birds are unlikely to catch butterflies. An unidentified bird or mammal (possibly a mouse) frequently tears open the larval or pupal nests of the related species, the chrysotricha skipper *Hesperilla chrysotricha cyclospila* (Meyrick and Lower), which is often found with *H. flavescens* on *G. filum*. But I have noted such predation only once for *H. flavescens*. Large spiders are often seen on the foodplants, particularly those badly infested around the base with grass (usually sea couch, *Distichlis disticophylla* (Labill.) Fassett. These spiders may take larvae feeding openly at night. See Illustrations 11-13.

Occasionally, earwigs are found in empty larval shelters and may have eaten the larvae.

Parasites

Certain wasps (Hymenoptera) and flies (Diptera) are frequent parasites of the larvae of *H.f. flavescens*. The spring brood of the colony of this butterfly at Truganina Swamp was noted to be heavily infested by a wasp in 1988. From larval counts at that time, I estimate that at least one larva in five died because of parasites. Parasitism therefore is a significant cause of death.

The parasitic wasp generally kills the host larva before pupation, but the wasp larva leaves the host to spin a small cocoon in which it pupates, close to the host. Inspection of the larval shelter reveals the fate of the butterfly larva. In contrast, the larvae of the parasitic flies normally make a puparium and pupate within the already pupated host; therefore the presence of a parasite cannot be confirmed until the adult parasite emerges instead of a butterfly.

In some colonies parasitism was less in the autumn pupae than in the spring pupae.

Table 1 shows the parasites recorded to date as affecting *H. flavescens* and where they have been recorded.

Diseases

A small percentage of larvae die from bacterial, viral and fungal infections. Death from such infections can be noted during survey counts, because the normally green larva turns black and the body liquefies or becomes covered with fungal hyphae or sporangia, which give the larva a furry appearance. The usual source of infection is leaves infected with bacteria, virus or fungal spores. The problems of disease arise principally during warm humid weather conditions, sometimes prevalent during the spring brood. The problem is aggravated by the

Table 1. Parasites bred from *H. flavescens* in the colonies shown.

PARASITE	LOCATION OF COLONIES
HYMENOPTERA	
ICHNEUMONIDAE:	
Echthromorpha intricatoria	Cherry Lake, Altona North Lake Aireys Inlet
Casinaria sp.	Breamlea Point Wilson Cherry Lake, Altona Truganina Swamp, Altona Lake 3 km S of Mitre Telfers Swamp White Lake Point Cook
CHALCIDAE:	
Brachymeria sp.	Lake S of Jacka Lake Telfers Swamp N of Willaura Rossbridge
DIPTERA	
TACHINIDAE:	
Tritaxys sp.	Jacka Lake (private) Grange Burn near Hamilton Cherry Lake, Altona Rossbridge

damp environment associated with most colonies. However, more than one or two infected larvae per foodplant is unusual because larval density is small. More than five larvae on one plant is unusual. Dispersal of the infecting organism is not widespread because the infected larva usually dies in its shelter, the leaves of which normally die within one season, isolating the diseased larva or pupa.

Other butterflies

As already mentioned, *Hesperilla chrysotricha cyclospila* is often found in association with *H. flavescens*, but is more common and can form relatively large colonies in favourable seasons. However, the flight season of *H.c. cyclospila* is later than that of *flavescens* and generally there is little overlap because *cyclospila* has only one emergence, November and December. Even where *cyclospila* is much more abundant than *flavescens* at a joint site, *cyclospila* does not seem to interfere with *flavescens*. However, large numbers of *cyclospila* larvae attract predators and parasites. The resulting larger population of parasites may result in a higher than normal level of parasitism in the *flavescens* colony; such appeared to be the case at Truganina Swamp and Altona in spring 1988. Neither of the Altona colonies contained any *H.c. cyclospila* until the late 1960s, when a few pupae were noted at Truganina Swamp. At present *cyclospila* is quite common there. Although *cyclospila* is now present at Cherry Lake, it has arrived only recently and is only in small numbers. Its growth there together with its effect on *flavescens* will be interesting to monitor. The joint colony at Barwon Heads has, at least since the late 1940s, generally contained a higher proportion of *cyclospila* than *flavescens*. *H.c. cyclospila* is the more mobile species, not restricting its flight solely to the environs of the foodplant. *H.c. cyclospila* also has a wider distribution as its larvae will feed on red fruit saw-sedge *G. sieberiana* Kunth. and *G. trifida* as well as *G. filum*.

Colonies of *H. flavescens* that cohabit with colonies of *H. chrysotricha* are shown in Appendix 2.

Weather

Weather plays a vital role in the well-being of insect communities. Butterflies can fly only when they can absorb radiant heat from the sun (on sunny days) and the ambient temperature exceeds about 16° C. Unless these conditions prevail, butterflies are inactive and will not mate. If poor weather persists for the whole of the flight season, many adults do not emerge and do not mate if they do. Extreme heat will desiccate pupae and kill the adults. Drought can kill the foodplants or at least prevent the essential new leaf growth or seedling production.

Prolonged adverse conditions can eliminate a colony or, at least, substantially reduce the number of adults and so ultimately lead to the colony's collapse. At best, the colony may take several favourable seasons to recover, during which time the colony is under threat.

Isolation

Adult *H.f. flavescens* do not appear to fly far from the foodplants. Thus, if an isolated colony dies out, recolonization of the habitat is unlikely. But how were these populations established? Wind-blown fertilized females probably contributed, but there seems little doubt that the foodplant was much more widely distributed before swamps were drained or filled for use as water

storages. Thus sites would have become isolated. Alternatively, the foodplant may have been able to exist in the more shaded areas before the tree cover was substantially removed, or the butterfly's diet may have changed.

2.4 Habitat Requirements

Because of the very specific requirements of the foodplant, *G. filum*, the butterfly's habitat is well defined. However, the foodplant's associated flora varies from locality to locality, but does not appear to influence the presence or absence of butterflies. The larger butterfly colonies are generally associated with foodplants in areas which are not inundated during the summer and autumn. The butterflies often alight on the bare ground or may take nectar from the flowers of creeping brookweed *Samolus repens* (Forst. & Forst.) Pers., southern sea-heath *Frankenia pauciflora* DC., and rounded moon-flower *Disphyma crassifolium clavellatum* (Haw.) Chinnock, where these are present. See Illustrations 5,6. Vaughan (1988) stated that the butterflies feed on nectar from beaded glasswort *Sarcocornia quinqueflora* (Bunge ex Ung.-Sternb.) A.J. Scott. I have not observed this.

The butterflies prefer small plants of *G. filum* which have soft new growth essential for young larvae. The new plants also have very few dead leaves which can harbour predators. See Illustrations 1,4.

Because the butterfly lays its eggs low down on the foodplant, it is preferable that there be little or no grass infestation at the base of the foodplant. Sea couch *Distichlis distichophylla* commonly invades the base of the older plants and grows up to 30 cm or more. Sometimes sea barley grass *Critesion marinum* (Hudson) A. Love is also present. Both plants can harbour predators and can deter oviposition. Foodplants in weed-infested habitats generally have no butterfly larvae. See Illustrations 5,7,10,11,12,13.

The species' preference for new growth was confirmed during larval counts, which were significantly higher on new growth appearing after recent fires, and on seedling plants.

Relatively small changes in the vegetation composition or structure of the habitat can affect an insect's ability to utilize or colonize a particular habitat (New 1984). For instance, the loss of nectar sources may have an adverse effect. Small changes, not immediately apparent without careful examination, may quickly change the viability of a colony. However, the observed absence of the butterfly in what appear to be suitable habitats is so far unexplained, as small variations in the flora and physical aspects between sites do not seem to be critical for *H. flavescens*. Perhaps the weather or the distance of a colony from other colonies (to allow establishment or re-establishment) are the critical factors.

2.5 Potential Threats

The long-term viability of the butterfly colonies depends principally on the maintenance of the habitat, enabling the foodplant to survive and multiply. The threats to the habitat can be listed as:

(i) Pollution: atmospheric (herbicides) or surface (mainly water borne).
(ii) Human interference: trampling, rubbish dumping and the creation of dust.
(iii) Animal interference: horses or stock eating or tramping the plants.
(iv) Fire.
(v) Changed hydrology: excessive flooding or lack of water.
(vi) Weeds and overgrowth.

Secondary threats come from factors affecting the butterflies themselves, such as:

(vii) Predation.
(viii) Parasitism.
(ix) Disease.
(x) Over-collecting.
(xi) Pesticides.

Many authors (including Key 1978; New 1984; New 1987; Vaughan 1988; Hill and Michaelis 1988) have emphasized the importance of habitat protection in insect conservation. The intimate relationship between the butterflies and their larval foodplant is fundamental. Insects depend upon the maintenance of the physical and biological characteristics of the habitat for survival (Key 1978).

2.6 Causes of Population Decline

The principal reason for the population decline at Altona and Corio is habitat loss caused by drainage of swamp-land and its alienation for domestic or industrial use. Populations can expand and contract over time as a result of any combinations of the factors mentioned above as influencing the life of a colony, but habitat loss is normally irreversible.

Reduction in the area of the habitat often results in a disproportionate reduction in colony size due to changes in the flora composition or the physical environment (eg. less shading, more wind, etc.), removal of nectar sources and favoured flight areas, and other consequences. The population can thereby fall below a sustainable level.

2.7 Distribution, Past and Present

Data to mid-1988

Until 1943, all records of the Altona skipper butterfly came from "Altona Bay", where the species appeared secure. Specimens from Lake Connewarre (Barwon Heads) were first taken in November 1944. Landy (pers. comm.) collected the species at Corio in October 1946. Subsequently, colonies have been found at Ararat, Breamlea, Queenscliff, Ocean Grove, Point Lonsdale, Point Cook, Jacka Lake (near Natimuk), Natimuk, Murtcaim Wildlife Reserve (Point Wilson).

Investigation of early plans, maps, and aerial photographs indicates a substantial reduction in suitable habitat around Altona. Figure 3 shows the approximate extent of the swamps containing foodplants in 1945 and at present. During the last 40 years the area of habitat has been more than halved.

The only colony which appears to have been lost is that at Corio, where the very restricted colony was wiped out by industrial expansion in the 1960s.

New Data

During the field surveys in spring 1988 and autumn 1989, the following *Hesperilla* colonies were discovered:

Butterfies associated with:	*G. filum*	19
	G. trifida	6
	G. radula	5
	G.sieberiana	1
		31

Appendix 1 sets out in detail how the surveys were planned.

All the specimens obtained as part of this study, mainly by breeding from pupae, were examined and compared with a typical series of *flavescens* from Altona and with a typical series of *H. donnysa patmos* from various areas near Melbourne, including a few bred from slender saw-sedge *G. microstacha* Benth. from Lerderderg Gorge, north of Bacchus Marsh. The results indicated that the new specimens associated with *G. filum* were *flavescens* and those associated with *G. radula*, *G. trifida* and *G. sieberiana* were *H. donnysa*.

Appendix 2 shows the results for 304 specimens. In addition several hundred specimens in the Museum of Victoria and the Australian National Insect Collection (ANIC), CSIRO, Canberra, were inspected.

Butterflies which appear to be *H. flavescens* are present at 27 locations:

Previously known	New
Cherry Lake, Altona	Municipal tip, Altona
Truganina Swamp, Altona	Skeleton Creek, Laverton
Point Cook	Connewarre
Point Wilson	Kooraweera Lakes, N of Camperdown
Corio	E of Lake Bolac
Point Lonsdale	Rossbridge
Barwon Heads	N of Willaura
Breamlea	Glenthompson
Jacka Lake, WSW of Natimuk	Grange Burn, ENE of Hamilton
ESE of Ararat	White Lake, S of Douglas
	North Lake, N of Douglas
	S of Jacka Lake, WSW of Natimuk
	N of Jacka Lake, WSW of Natimuk
	S of Mitre
	Mitre Lake, NW of Mitre
	Telfers Swamp, NW of Natimuk
	Olivers Lake, N of Natimuk
	Nelson

These colonies are briefly described in Section 3 and discussed in more detail in Appendix 5, and are shown on the distribution map, Figure 1, and in the ENTRECS map, Figure 4.

Taxonomic Status of Populations

The butterflies examined vary from nearly typical *donnysa* through to nearly typical *flavescens*. However, when specimens from each population were placed together, and the populations were arranged in a geographic sequence, all the *filum* feeders exhibited the faint golden flush on the uppersides of typical *flavescens*, whereas those feeding on the other foodplants did not; an exception was those from Ararat. The undersides were very variable and did not approach the typical ash-grey to yellow-grey of *flavescens*.

This report is not a taxonomic treatise, but it was necessary for present conservation purposes to attempt to classify the various populations. For the classification, the Altona specimens were used as the reference and regarded as typical *flavescens* and the other populations were compared by means of several significant characters. Genitalia were not dissected and compared, although such a comparison would have helped the classification.

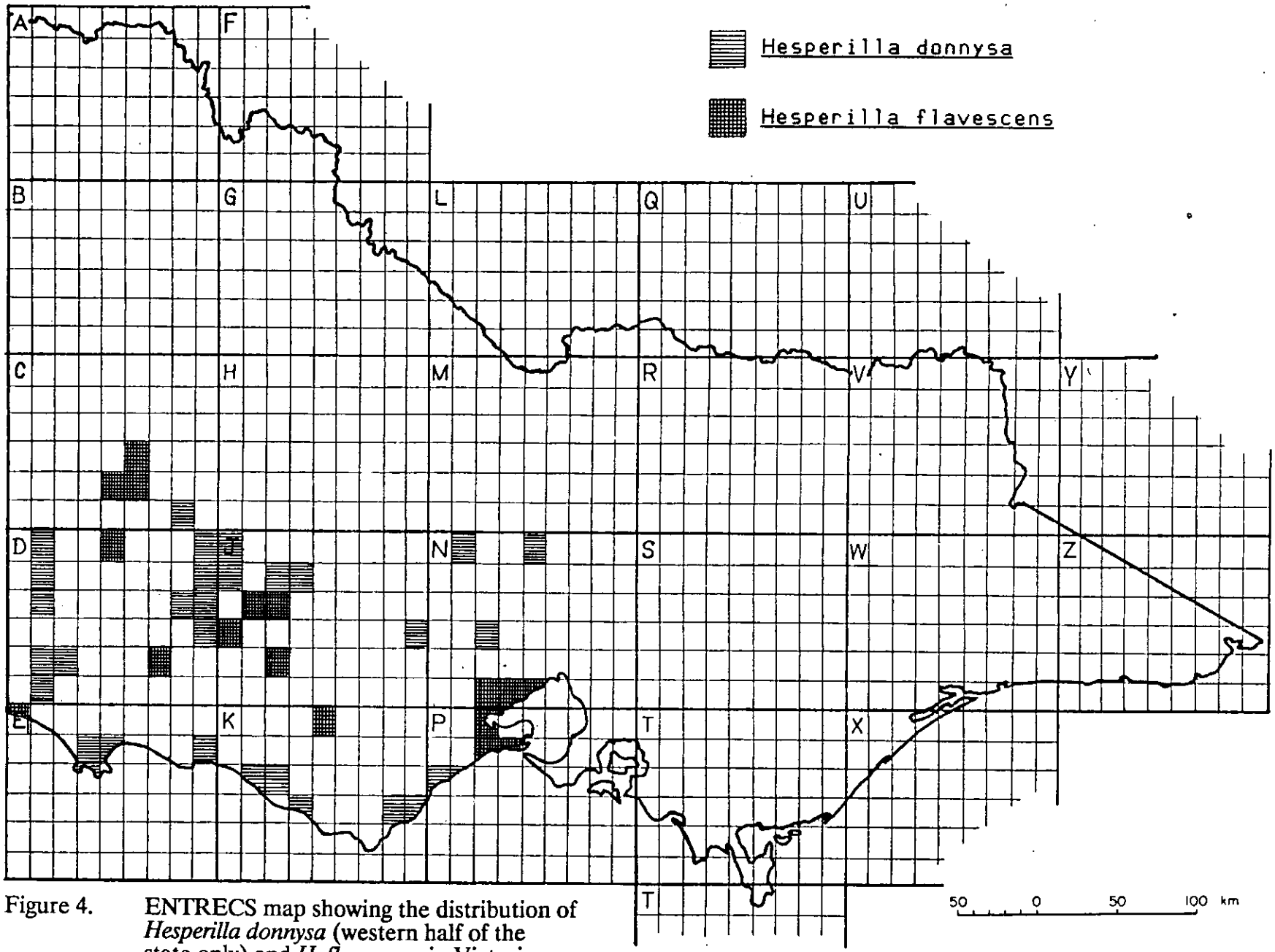


Figure 4. ENTRECS map showing the distribution of *Hesperilla donnysa* (western half of the state only) and *H. flavescens* in Victoria.

This evaluation confirmed that the specimens from Corio were the closest to typical, as would be expected. All the other populations, although internally variable, were similar to the reference specimens on the uppersides, probably rating a rather subjective correlation of 60% - 80%, but on the undersides there was a greater tendency in most colonies towards the grey of *donnysa*; the correlation was 30% - 50%. I believe the majority of phenotypes appear to be closer to *flavescens*, although there were some specimens which were difficult to classify when a combination of both uppersides and undersides was considered. However, examination of the genitalia of examples from each of the colonies and a greater number of specimens from some colonies would enable a more positive classification to be made.

2.8 Conservation Status

Any assessment of the conservation status of an animal or plant is, to a degree, subjective. At a particular time the status will depend upon many factors, such as the perceived threats and the importance of their effects, the taxonomy, distribution and general population dynamics, ecology and type of habitat. However, the greater the amount of data available on these and other factors the less the degree of subjectivity. Unfortunately data on many of the influencing factors are not available for most species of insect.

Collins and Morris (1985), in the IUCN Red Data Book on the swallowtail butterflies of the world, listed the principal threats as habitat destruction, pollution, introduction of exotic species and commercial exploitation. For *H.f. flavescens* habitat destruction is the only relevant threat. New (1987) summarizes the principal factors in the decline of butterfly numbers in Australia and discounts the effects of collecting on species with little or no commercial value. He confirms the importance of habitat change.

Habitat change or destruction has its greatest effect on sedentary populations in specialized habitats or with restricted distributions. New (1984; 1987) points to the importance of retaining such discrete, geographically isolated populations, which are thereby biologically isolated, and have no natural opportunity to interchange individuals. - "They are thus incipiently on the path to diversification and taxonomic distinctiveness".

As previously mentioned, the colonies of *H. flavescens* at Altona represent a core population which has distinct characteristics and which has been much reduced in size. On present knowledge, *H. flavescens* particularly fits New's category and additionally shows a very interesting, and so far unexplained, range of variation. The species needs to be conserved because of its uniqueness and its link in the evolutionary chain involving other species in the genus. The discrete but disjunct distribution is another interesting facet, but one which represents an inherent danger to species' survival. This danger is aggravated by the small size of most of the colonies, in which the populations appear to fluctuate in numbers from year to year. Current land practices constitute a constant threat to survival of the taxon, although public awareness is now higher due to the current wetlands conservation program.

The IUCN recognises several categories for describing the conservation status of a given species (Collins and Morris 1985):

EXTINCT:	definitely not located in the wild in the last 50 years.
ENDANGERED:	in danger of extinction and whose survival is unlikely if the causal factors continue operating.

VULNERABLE: believed to be likely to move into the endangered category in the near future if the causal factors continue operating.

RARE: small populations, not at present endangered or vulnerable but at risk.

INDETERMINATE: known to be endangered, vulnerable or rare but where there is not enough information to say which of the three categories is appropriate.

These categories have now been widely accepted and on this basis the populations of *H.f. flavescens* at Altona are VULNERABLE. Unless the destruction and degradation of its habitat at Altona ceases, these populations, representing the originally described type, will become endangered. This is because the only other substantially similar populations, at Skeleton Creek, Point Cook and Murtcaim, are very small and may not be viable in the long term.

Accordingly, every possible action should be taken now to protect the Altona colonies, as a first priority.

The variability of the adults from the other colonies, mostly in widely scattered localities, is worthy of further study and all the colonies should be retained. Such study may be able to assess the degree to which the colonies may be partial hybrids with *donnysa*. The genetics involved would be interesting.

3. SITES WHERE *Hesperilla f. flavescens* OCCURS IN VICTORIA

Appendix 2 provides a complete list of the sites where the butterfly is now known to occur in Victoria. That Appendix also gives map co-ordinates and grid references applicable to the Entrecs recording scheme. The significant factor to note is the wide separation of the colonies and the resultant difficulty of recolonization.

The following brief comments describe salient features of each site. Comprehensive details of each site are provided in Appendix 5.

3.1 Cherry Lake, Altona

Probably the first recorded site, now managed by the MMBW. I estimate colony size is 250, with another colony of about 100 on adjoining private land which the MMBW may purchase. Sensitive management and careful monitoring are needed.

3.2 Truganina Swamp, Altona

This is another important site, about 3 km south-west of Cherry Lake. There are several separate colonies at this site and all appear to need cleaning up. The hydrology should be investigated. I estimate the size of the combined colonies to be 600 *H.f. flavescens*. This is the largest and most valuable site near Melbourne and requires prompt rejuvenation.

3.3 Municipal Tip Area, Altona

This is a neglected area with a colony of probably 200-300 in two sections. The section outside the tip is in good condition and with careful management should be retained as a valuable colony.

3.4 Skeleton Creek

This colony, in poor condition, is in the reserved section of the old Cheetham Salt Works evaporation ponds. I estimate its size at 100. It could be rejuvenated.

3.5 Point Cook Metropolitan Park (MMBW)

This is a medium sized colony of about 250 butterflies. It has excellent potential for gradual upgrading.

3.6 Murtcaim Wildlife Reserve, Point Wilson

This is a medium-sized but important colony of about 200-300 butterflies. It appears to have a secure future and only requires monitoring.

3.7 Corio

The original colony which existed here in the 1940s and 1950s has been destroyed but there may be some butterflies remaining in the Limeburners Lagoon reserve.

3.8 Point Lonsdale

A widespread, thinly distributed colony, the size of which I was unable to estimate.

3.9 Barwon Heads

A colony apparently in a poor state, probably in decline. I did not survey it.

3.10 Connewarre

This is a definite colony of unknown size probably spread over a large area on the southern and western sides of Lake Connewarre.

3.11 Breamlea

This is a thriving colony in a large area of *G. filum* within a reserve about 18 km S of Geelong. I did not attempt to survey the full extent of the colony but I estimate it would be at least 400, possibly very much larger. No immediate action is required here. This is the southern-most colony near Melbourne.

3.12 Kooraweera Lakes

This is a significant colony about 21 km NE of Camperdown. It appears to be in good condition but it is used by a sheep farmer. I estimate the size of the colony to be about 500. It is a valuable colony.

3.13 Lakes East of Lake Bolac

A medium sized colony of at least 200 in a rather poor quality swamp. The colony may be more extensive than currently surveyed.

3.14 Rossbridge

This is a very strong colony of at least 500 in an ideal swamp habitat which is a reserve. It should be easy to maintain despite being used by a farmer for sheep grazing under a lease. It is an important colony and should be monitored.

3.15 North of Willaura

This colony probably extends over a substantial area as there are several adjoining large salt lakes, all with sound stands of the foodplant. The colony investigated, adjoining the road to Ararat, probably numbered 200 butterflies. No action is recommended.

3.16 Glenthompson

This is a very small colony of less than 100 on private land. Additional colonies may exist in swamps to the west.

3.17 Grange Burn, ENE of Hamilton

This is a small colony of less than 100 butterflies in a roadside depression, which may extend into private land on both sides of the road in scattered swamps. No action suggested.

3.18 White Lake

This is a strong colony in a reserve. I estimate the size to be at least 500, possibly very much more as the area of foodplants is extensive and they are in good condition. I recommend action to ensure the colony is preserved.

3.19 North Lake

This is a small colony of less than 100 located around a salt lake in a reserve about 5 km N of White Lake. It should be preserved if possible but is not as important as White Lake.

3.20 Jacka Lake

This colony of about 100 butterflies is around a salt lake on private land. It should be preserved with co-operation of the landowner.

3.21 Lake South of Jacka Lake

This lake is on private property less than 1 km south of the previous colony. Although small, estimated at about 100, the colony probably extends several kilometres south to include other lakes and thus may be very much larger.

3.22 Lakes North of Jacka Lake

There is a chain of lakes of varying size, most with *G. filum*, in a depression which leads north from Jacka Lake. Two of these were inspected and found to have small (<50) colonies. The other lakes may also support colonies. Most are on reserved land.

3.23 Lake South of Mitre

This is a large salt lake with foodplants around its southern end supporting a medium sized colony of at least 150 butterflies. It is a reserve and worth preserving. It is grazed by sheep and will require monitoring.

3.24 Mitre Lake

This a very large salt lake. There is a strong colony which I estimate to be at least 300-400 *H.f. flavescens* around the northern end. This area is also used for sheep grazing although it is in a reserve. The colony should be monitored and preserved.

A small, probably unviable, colony of less than 50 exists at the southern end of Mitre Lake. There are several other lakes and swamps on private land nearby which probably maintain colonies. These were not surveyed.

3.25 Telfers Swamp

A medium sized colony of about 200-300 butterflies exists around the NW end of a lake which is partly in a reserve. The colony should be preserved.

3.26 Olivers Lake

This is a large lake with many mature foodplants supporting a colony of 200-300. As it may represent the most northern site, it should be preserved. Appropriate management is recommended.

3.27 Ararat

The colonies 18 km ESE and 1 km NW are most unusual, being in areas which are completely unlike the usual *flavescens* colony, much more typical of *H. donnysa* colonies. However, I regard the specimens caught to date as probably *flavescens* but I feel they require further examination.

3.28 Nelson

The status of the single specimen bred from this site is not clear. Further investigation is required.

4. CONSERVATION CONSIDERATIONS

4.1 General

Current overseas practice favours management of habitat rather than management of individual species of insect (Hill & Michaelis, 1988) because habitat management allows implementation of a wider protection. These management practices are evident particularly in USA and UK. Management of habitat would protect *Hesperilla flavescens* and any other invertebrates in the community. Declaration of "Sites of special scientific importance" (SSSI) by the Nature Conservancy Council (NCC) in UK is an application of this approach which could be used in Victoria under the Flora and Fauna Guarantee Act. Some of the sites could be declared "reference sites" because of their particular value. An "invertebrate site register", similar to that compiled and maintained by the NCC would be of value in leading up to the declaration of an SSSI. The matter of reference sites has been suggested by New (1987).

4.2 Populations of *H.f. flavescens*

Because the genus *Hesperilla* is going through a stage of genetic development, it would be desirable but impracticable to conserve all the colonies. Therefore the various populations have been rated on a scale of desirability to retain (Table 2). Where funds and/or manpower are unavailable, certain sites can be safely left unmanaged, but there is a need to ensure that, as with all sites, neighbouring property owners/operators are made aware of the value of the sites and their help enlisted to ensure retention. This approach is assisted in this case by the relatively small areas required to maintain a colony, even with reasonable buffering, and the poor quality of the habitat for agricultural use. Also, because of the specificity of the foodplant requirements, the habitats are fairly easily found.

5. MANAGEMENT RECOMMENDATIONS

5.1 Scope and Objectives of Management

The primary objective of these recommendations is to ensure the long-term future of colonies of *H.f. flavescens* in all sites and to improve habitat conditions to encourage an increase in abundance with a minimum of expenditure. The colonies may then be better able to withstand the impact of any unexpected adverse factors in the future.

The second objective is to ensure that if a highly rated colony becomes extinct, others will survive and allow re-stocking of the habitat when foodplants are available.

5.2 State Management Strategy

When the apparent distribution of *H.f. flavescens* and the relative value of each colony has been determined, resources should be directed to managing the most valuable sites to ensure their permanent survival.

Most effort should be expended at three locations: Altona (three sites), Point Cook, and Point Wilson; all should be regarded as "reference sites". The other sites selected as requiring particular attention should be regarded as "sites of special scientific importance". These sites are marked SSSI in the recommendations listed in the next section. The remaining sites should be managed to encourage preservation if funds are available.

Priority will be given to those colonies already on public land, but where this is not appropriate, private landholders with colonies on their land should be encouraged to help those colonies survive.

Colonies, except reference sites, are generally surrounded by farmland. The owners/operators of that land should be informed of the importance of the colonies and asked to ensure that their operations, such as pesticide/herbicide spraying, straying of animals, fire control, alteration to hydrology, and clearing, be done in a manner which will not adversely affect the colonies.

The management program could be integrated into the DCE Wetlands Stategy.

Monitoring the current status of the colonies and the results of particular management practices should be an on-going process.

Table 2. Approximate rating of existing colonies for conservation purposes.

Site	Area	Colony size	Habitat	Threats	Ref %	Site status	Site rating
Cherry Lake	25	350	fair	people	100	reserve	1
Trugannina	150	600	fair	overgrowth	100	reserve	1
Tip, Altona	20	2-300	fair	rubbish	100	Crown land?	2
Skeleton Creek	5	100	poor	overgrowth	100	reserve	3
Point Cook	15	250	good	nil	100	reserve	1
Point Wilson	10	2-300	good	overgrowth?	100	reserve	1
Point Lonsdale	-	?	fair	clearing/fire	80	private	4
Barwon Heads	10	?	poor	fire	85	private	4
Connewarre	>100	?	fair	fire	80	reserve	2
Breamlea	80	large?	good	nil	80	reserve	2
Kooraweera	20	500	good	stock/weeds	80	reserve	2
Lake Bolac	50	200?	fair	overgrowth?	80	reserve	2
Rossbridge	60	>500	good	nil	85	reserve	2
N of Willaura	50	200?	fair	overgrowth	80	road/private	4
Glenthompson	1	<100	poor	stock	85	private	4
Grange Burn	2	<100	poor	overgrowth	80	road/private	4
White Lake	50	>500	good	nil	75	reserve	2
North Lake	5	<100	poor	overgrowth	70	reserve	2
S of Jacka Lake	5	>100	good	fire?	70	private	3
Jacka Lake	3	<100	good	fire?	75	private	3
N of Jacka Lake	-	?	fair	fire?	70	private	4
Lake S of Mitre	10	>150	good	fire?	70	reserve	2
Mitre Lake	50	3-400	good	nil	70	reserve	2
Telfers Swamp	20	2-300	good	nil	75	reserve/priv.	3
Olivers Lake	80	2-300	fair	mature	70	reserve	2
Ararat	10	200	poor	fire?	70/90	road	2
Nelson	50	?	poor	overgrowth	75	national park	2

Area — approximate area in hectares

Habitat — general suitability of site taking into account: condition of plants, degree of seedling growth, weeds, hydrology and stock damage

Ref% — phenotype rating compared with Altona (100%)
ie. >50=*flavescens*, <50=*donnysa*

Site ratings:
1 essential to preserve, includes Reference Sites
2 very desirable to preserve, includes SSSI's
3 desirable to keep for further study
4 desirable to keep, no management

5.3 Management of Known *H.f. flavescens* Populations and their Habitats

5.3.1 Cherry Lake, Altona (Reference Site - Figure 5)

(i) Owing to its proximity to the public council-operated reserve and its current use for walking by the public, this site should remain accessible to the public. All vehicular access should be prevented by low wooden log barriers. The existing chain wire fence should be removed. The butterfly colony should be fenced off by similar low wooden log barriers to stop trampling.

(ii) Weeds and rubbish should be carefully removed and controlled in future.

(iii) If the adjoining private land is not purchased, a stock-proof fence should be installed along the northern and western boundaries of the reserve. If the private land adjoining Cherrys Creek is purchased, the fence should be diverted to enclose this land as part of the reserve. Action should be taken to ensure that there is no possibility of horses gaining entry to the reserve.

(iv) A regeneration trial should be run on the foodplants in area C in Figure 5. A sample of, say, 20% of the area should be slashed low to the ground in late winter and the rate of regrowth monitored. If the regrowth is satisfactory, the rate of colonization by the butterflies should be monitored.

(v) If the regeneration trial above is not successful, a similar trial by burning should be carried out and fully monitored. Great care will be needed to ensure that no valuable plants are destoyed.

(vi) Additional areas should be selected each year for treatment by whichever of the above procedures proves best, so that the whole area will be upgraded over a period of five years.

(vii) Some mowing between the boundary fence and the foodplants may be desirable to provide a firebreak and to keep the grass low.

(viii) If the private land is purchased, some effort should be made to remove or limit the further expansion of the *Phragmites* growing along Cherrys Creek. The area should be generally cleaned up by the removal of other weeds and rubbish. The horses must be removed.

(ix) Restricted butterfly collecting under permit should be allowed to bona fide (non-commercial) entomologists; for example, those who hold permits from DCE to collect in National Parks.

(x) A ranger should be appointed to supervise the on-going maintenance and should have ready access to entomological advice.

(xi) Comprehensive conservation measures require an adequate buffer between the protected area and sources of external threats. The proposal to purchase some of the privately owned land next to Cherrys Creek, as shown in Figure 5, would provide a small buffer and would be an excellent solution. This buffer would also add a reasonable area of foodplant and butterflies to the colony already in the MMBW reserve.

The planning scheme amendment (RL99) for the Altona petrochemical complex includes a far larger buffer: south from the railway and Kororoit Creek Road. If the plan is implemented, a really effective buffer will have been created. The effectiveness of this buffer could be reduced if any development, such as filling, takes place on this land.

5.3.2 Truganina Swamp, Altona (Reference Site - Figure 6)

The object of the procedures here is to isolate a site that supports the principal colony of the butterfly at Altona. Isolation is desirable because:

- the site has not been traditionally open to the public;
- the site has several discrete habitat areas which can be individually safeguarded;
- the site is less likely to be affected by pollution than Cherry Lake;
- the site is larger and lends itself better to habitat experiments;
- the site has a butterfly colony larger than that at Cherry Lake.

(i) The whole of Truganina Swamp should be kept free of public access, whether on foot or in any sort of vehicle, particularly trailbikes, to prevent rubbish dumping (introducing weeds), trampling and fires. The gate at the point where Laverton Creek meets Queen Street bears a "no entry" sign and yet it is always left open. Low barriers should be installed promptly to prevent vehicles entering from Victoria Street, possibly near where Kayes Drain meets Laverton Creek. The perimeter chain-wire fence adjacent to the houses and golf links on the eastern side has been damaged in several places and requires repair to prevent general access. Many of the domestic properties on that side have rear access gates onto the area, so presumably the occupants have been given access rights which cannot now be controlled. It is hoped that these rights do not include trailbikes. The legal position on access for trailbikes should be clarified, as it is important not to alienate public goodwill.

(ii) Weeds and rubbish should be removed and controlled in future. Advice should be sought as to how the weeds in sector 4 could be eradicated without damaging the foodplants, other important plants, and the existing butterflies. The artichoke thistles in sector 6 need to be eradicated quickly before they spread any further, and the *Phragmites* should be controlled as far as possible because the plant could become a major threat. *Phragmites* seems to be present over a large portion of the site. The botanical survey will undoubtedly reveal other undesirable exotics and discuss their removal and control.

(iii) Some form of fire buffer to separate the three main colony areas, in sectors 3-8 should be considered. A mown grassy strip would probably suffice, provided it was kept mowed.

(iv) Regrowth experiments could be carried out here if this was more appropriate than Cherry Lake. When the best method has been determined it should be used on this site to achieve optimum foodplant growth on a similar five year rotation. These experiments should be done in close liaison with a botanist.

(v) Early consideration should be given to removing the very thick masses of *G. filum* in the soaks in sectors 2 and 3, with the object of making them attractive to colonization by butterflies. A trial slashing of a small area in the soaks before they become too wet seems appropriate.

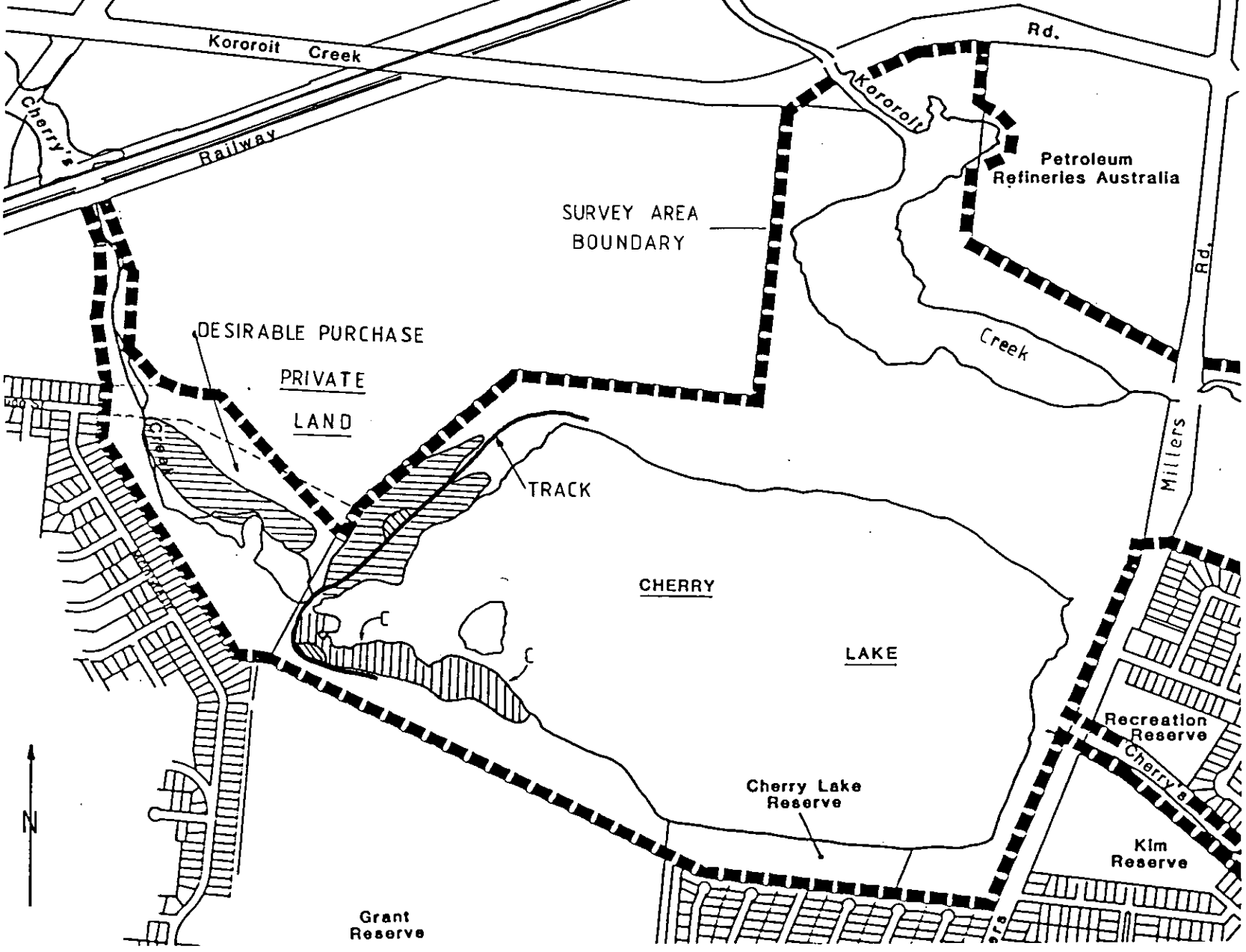


Figure 5. Cherry Lake site showing locations of *G. filum* plants.

(vi) The ranger appointed for Cherry Lake should also be responsible for Truganina Swamp.

(vii) Because of the site's location, an effective buffer zone around the site generally is not possible. However, the proposal to acquire private land between the railway and the present northern boundary, as part of amendment RL99, is an excellent one and should be endorsed. If this proposal eventuates, consideration should be given to isolating the land from the railway easement, which can be subject to fire and/or spraying for weed control.

The whole site consists of three colonies, in sector 4, sector 5, and sectors 6, 7 and 8. Some internal buffering to prevent fire wiping all colonies out at once should be considered.

The foodplants on sector 1 are on private land and are not essential for conservation. Sector 2 would be obtained if the private land is purchased and action to rehabilitate it as a butterfly colony should be considered. The dense growth in sector 3 should also be thinned out.

SUMMARY OF PROPOSALS FOR CHERRY LAKE AND TRUGANINA SWAMP

As the two Altona sites, at Cherry Lake and Truganina Swamp, are on MMBW land and close to each other, a joint approach to the sites appears appropriate. The following table summarises the various proposals given above on a time priority basis.

CONSERVATION ACTIONS PROPOSED

CHERRY LAKE	TRUGANINA
1. Appoint ranger	1. Appoint ranger
2. Stop vehicle access	2. Stop vehicle access
3. Regeneration trial in area C	3. Remove weeds and rubbish
4. Remove weeds and rubbish	4. Test slash in swamp
5. Remove horses	5. Remove *Phragmites*
6. Remove *Phragmites*	6. Take steps to stop public entry
7. Instal boundary fence	7. Start regeneration work
8. Start regeneration work	8. Cut firebreaks
9. Cut firebreak	
10. Instal internal barriers if needed	

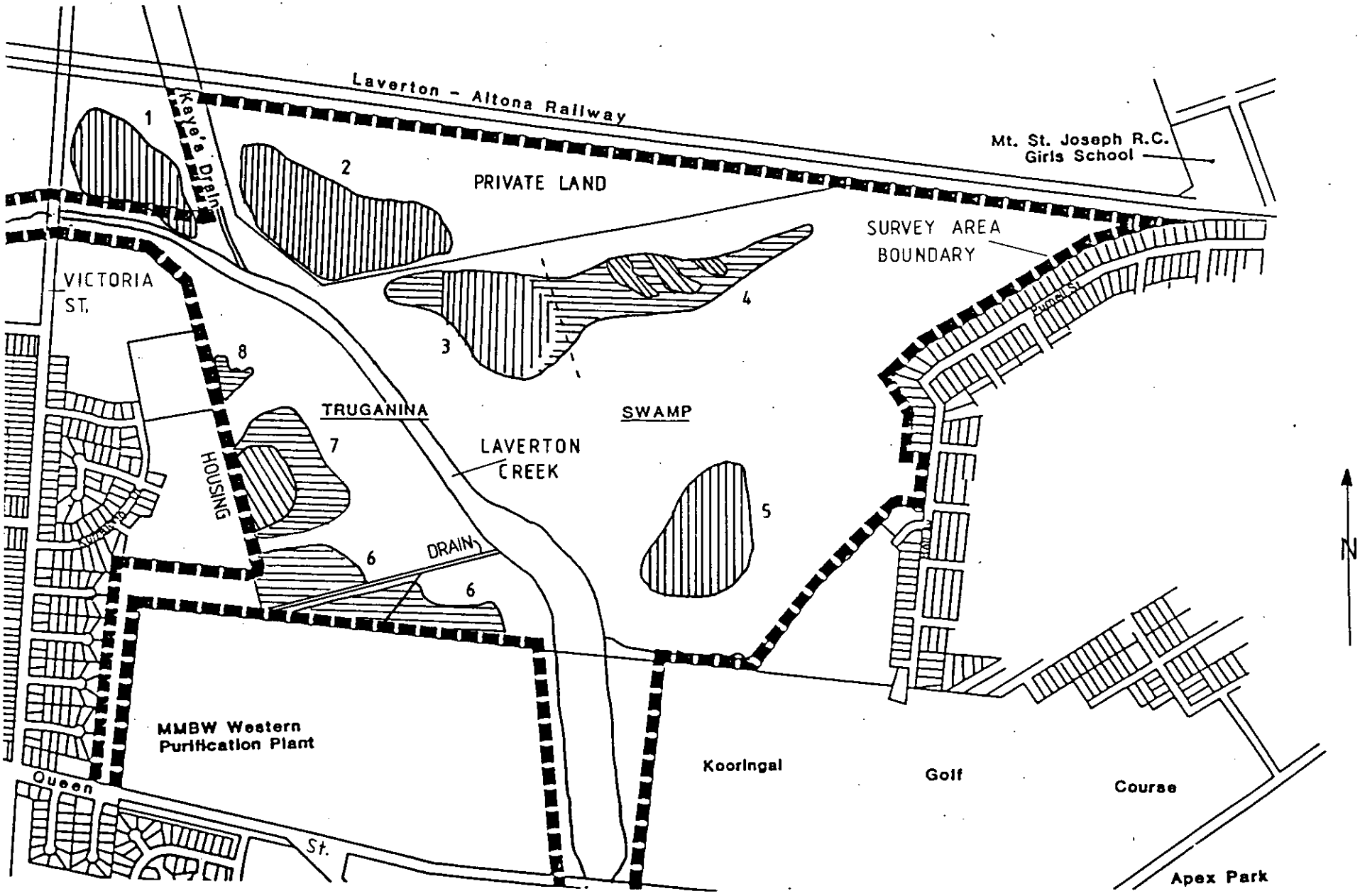


Figure 6. Truganina Swamp site showing locations of *G. filum* plants and Sectors (by number).

BURNT UNBURNT MATURE

Some of these proposals may conflict with the conservation priorities for the plants and the other fauna, and some proposals may have to be modified when the complete management plan is drawn up for the sites. Consultation with the botanists and zoologists on this matter is desirable.

The sites at Cherry Lake and Truganina Swamp are extremely important habitats for the Altona skipper butterfly. The survival of this insect probably hinges on ensuring its long- term viability at these sites and all reasonable steps should be taken to protect it. By using suitable management procedures with careful monitoring, this objective is achievable.

5.3.3 Altona Tip Area

This is an important site. The part of the colony within the tip reserve should be retained if possible. The part of the colony outside the tip appears to be on Crown land and as it is mainly in good condition should be fenced and reserved. This section should be managed to prevent public access and any rubbish dumping and trampling. Some grass should be removed. All vehicles should be excluded and the site monitored.

5.3.4 Skeleton Creek Reserve

Being only a small colony, it is unnecessary to do much work on it. If facilities were available, slashing of some of the invading plants next to the foodplants would be helpful.

5.3.5 Point Cook Metropolitan Park (Reference Site - Figure 7)

The following comments are made with the objective of maintaining and improving the colony of the butterfly in the Park. The proposals may need to be modified in line with considerations for conservation of plants. The actions suggested are:

(i) Ensure that the RAAF lake is not drained or the general hydrology changed in any way.

(ii) Ensure that the RAAF lake does not become polluted.

(iii) Allow controlled grazing, by sheep only, around the foodplants, and that this be carefully monitored to ensure that the sheep do not eat the foodplants.

(iv) Eradicate any artichoke thistles, particularly near the foodplants.

(v) Take steps to remove as many as possible of the plants overgrowing the foodplants at the western end of the RAAF lake. As an initial test this could be tried with a carefully controlled rotary slasher. If this did not work, "Roundup" may be applied by wand to the low regrowth.

(vi) Experiment with badly overgrown foodplants in the lignum lakes area in an attempt to have them generate new growth. The first step would be to rotary slash the foodplants low to the ground, including a reasonable area around them to control competing growth. If the foodplants sprouted, the surrounding area should be kept free of competing plants. If this procedure was not successful, a small area including the foodplants could be burnt in late winter, as the sedge is known to survive fires. The problem with fire is that it encourages weed growth.

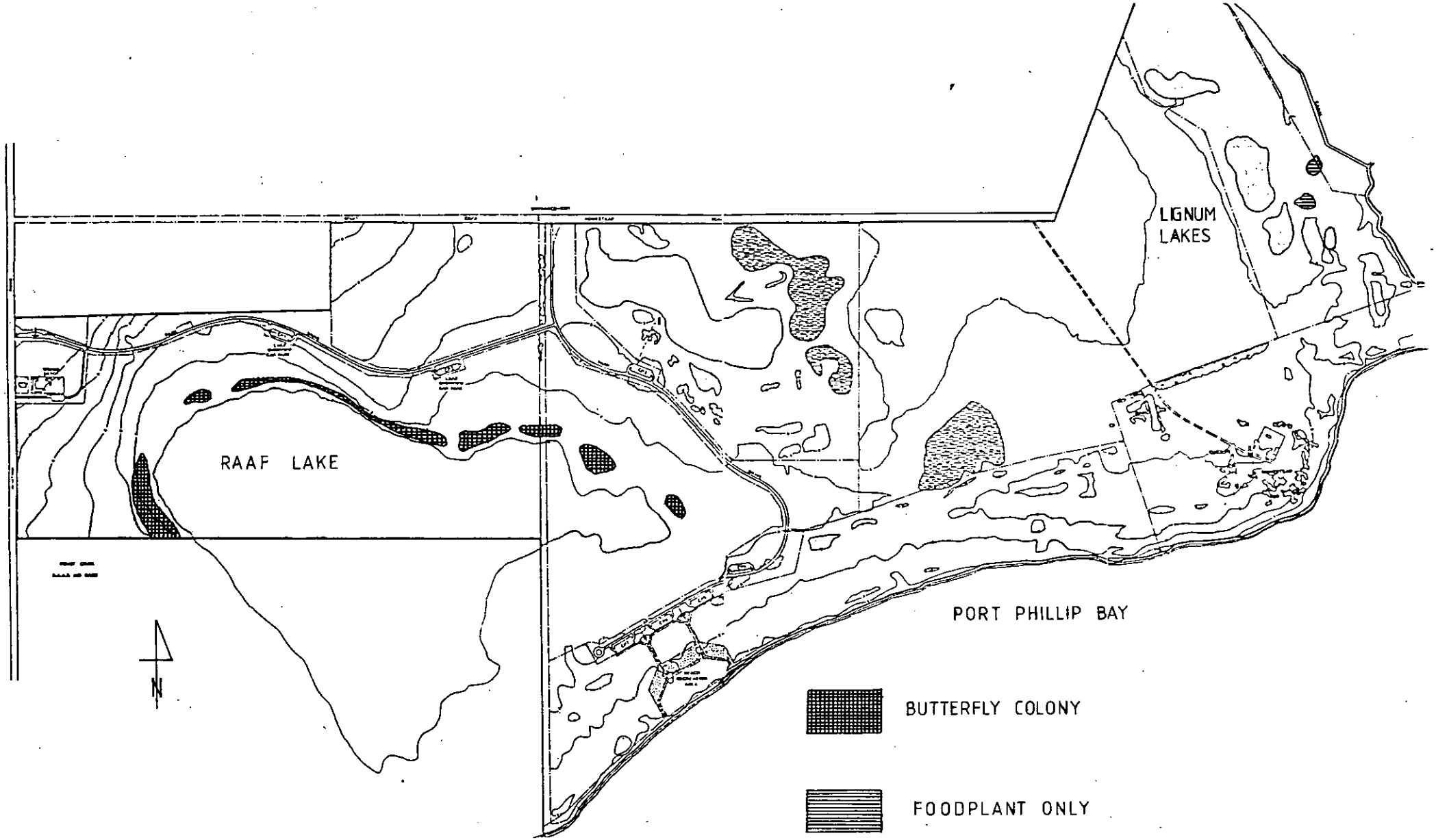


Figure 7. Point Cook Metropolitan Park (MMBW) showing colony of *Hesperilla flavescens flavescens.*

(vii) Ensure that, when any insecticide sprays are used, there is NO possibility that ANY spray can drift onto the foodplants.

(viii) Ensure that fire does not destroy the foodplants.

(ix) Plant additional sedges in a selected area with the object of establishing at least one "block" of foodplants towards the western end of the RAAF lake. The plants for this could be selectively culled from the existing stands. There are several areas, mainly opposite the Lake Overview carpark, which are starting to produce this formation with new seedling growth. It is important to ensure that sheep do not eat these plants.

NOTE: Items (i) and (ii) may require liaison with the RAAF.

5.3.6 Point Wilson (Reference Site - Figure 8)

The butterfly's habitat is in a reserve and the foodplants are in reasonable condition, with a number of seedlings. Some reduction in the grass growth around some of the plants would be beneficial but is not essential. Because the yellow bellied parrot feeds in this area at certain times in the year it may be advisable to defer any action until it is essential. No other management would appear to be needed apart from monitoring.

5.3.7 Lonsdale Lakes Reserve

Because sedges are known to be growing in this reserve, the ranger should be alerted to their possible importance in supporting a colony of *H.f. flavescens*, so that the plants are protected. In due course, a survey of the reserve should be undertaken.

5.3.8 Lake Connewarre

The colonies at "Barwon Heads" and Connewarre are on private land and are not important if there is a colony in the lake reserve on the opposite side of the road because the reserve is managed by DCE. A search in this area would be worthwhile. The ranger should be told of the possible existance of a colony so that all areas of *G. filum* are protected.

5.3.9 Breamlea (SSSI)

The colony at Breamlea is already in a reserve and the ranger should likewise be informed of the presence of the butterfly colony and its importance. The colony here is in good condition and, provided it is not interfered with, should continue with minimal management. The principal threats would come from fire, vehicular disturbance and uncontrolled dumping of rubbish.

5.3.10 Kooraweera Lakes (SSSI)

This colony is also on a reserve and the comments in 5.3.9 also apply here. Because this colony is surrounded by private unfenced rural land used by the farmer for grazing sheep, every effort should be made to obtain the farmer's co-operation in conserving the habitat, particularly from fire and cattle.

5.3.11 Lakes East of Lake Bolac (SSSI)

Comments as for 5.3.10.

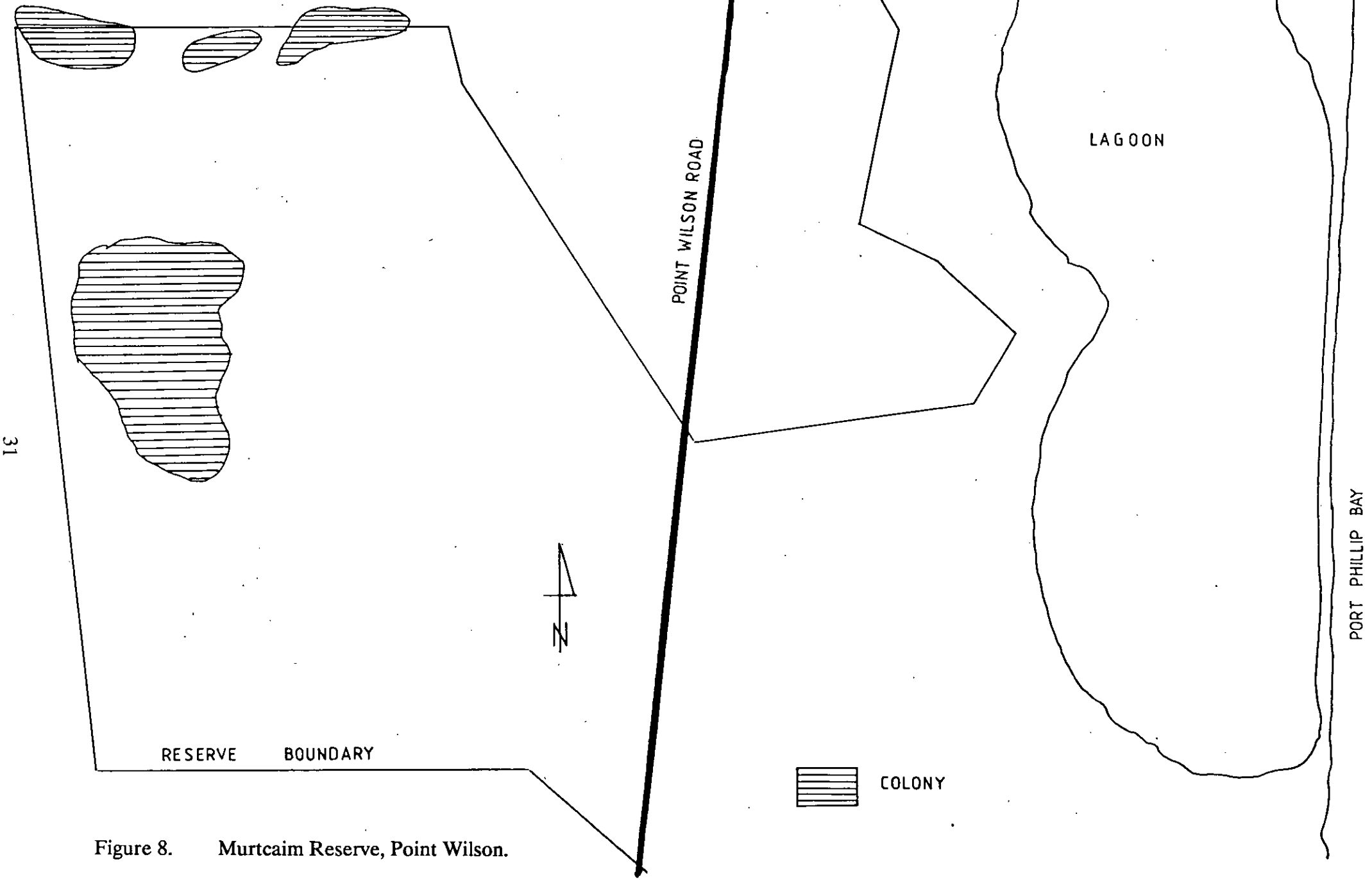


Figure 8. Murtcaim Reserve, Point Wilson.

5.3.12 Rossbridge (SSSI)

The same comments apply as for 5.3.10 but this is a particularly strong colony which has a DCE developmental threat hanging over it. It is most important to preserve this colony because it is in such good condition, and the specimens from it closely resemble those from Altona.

5.3.13 North of Willaura

This colony is interesting but of lower rating than Rossbridge, which is in the same general area. The authority responsible for the road reserve should be requested to try to protect the plants as far as possible. The owner of the adjoining private land could be requested to co-operate also.

5.3.14 Glenthompson

This colony is in an area separated from the others and it is desirable to retain it if possible. The landowner should be contacted and requested to co-operate by keeping stock out, at least in the short term, until the nearby areas could be searched for other colonies. Alternatively, the landowner may be willing to allow the relatively small area of foodplants to be fenced off.

5.3.15 Grange Burn, ENE of Hamilton

This colony is also in a separate area and should be maintained. Initially the authority responsible for the road reserve should be asked to co-operate by not damaging the plants. A search of nearby potential colony sites should be undertaken to determine the extent of the butterfly in the vicinity and a conservation decision made thereafter.

5.3.16 White Lake, Douglas (SSSI)

This is an excellent colony which should be carefully maintained. The ranger responsible for the reserve should be alerted to the situation and instructed as to suitable management practices. Unnecessary vehicular access should be prevented and suitable picnic areas constructed to ensure that fires are lit only in prescribed places. Fire appears to be the principal threat apart from excessive human use.

5.3.17 North Lake, Douglas

Although this is a reserve, it is very poorly maintained, with weed invasion particularly, probably because it is adjacent to a main road. It would be desirable to preserve this colony if possible, although White Lake is relatively close. Contact with the responsible authority would be warranted.

5.3.18 Jack Lake Area, SW of Natimuk

This consists of the colony around the lake on private land (opposite Jacka Lake Reserve), the small lake on private land south of the reserve, and several small lakes within two kilometres north of Jacka Lake (some reserves), and all surrounded by private land. The colonies are all small and do not warrant any action, apart from requesting the owner of the land north of the reserve to co-operate in conserving the colony.

5.3.19 Lake South of Mitre (SSSI)

This is a strong colony and as it is in a reserve, it should be preserved. Contact should be made with the managing body to ensure that it is aware of the situation, requesting that the adjacent landholder co-operates by keeping stock out of the area and regulating the number of sheep admitted. Fire should also be guarded against.

5.3.20 Mitre Lake (SSSI)

The north end of the reserve should be managed to preserve the colony here. The comments in 5.3.19 apply.

5.3.21 Telfers Swamp, NW of Natimuk

This is a medium-sized colony which should be preserved if possible. It is in a reserve so the manager should be advised and requested to assist. Apart from fire control, no specific management appears warranted. The landowner responsible for the private part of the lake should be asked to co-operate.

5.3.22 Olivers Lake (SSSI)

As the whole of this large lake is in a reserve, the manager should be advised and requested to monitor the colony. As the foodplants are mostly mature, a small area should be selected and slashed as a test to promote new growth. Adjacent landowners should be advised of the significance of the colony and should be asked to co-operate to prevent dumping of rubbish and fires. All stock must be kept out.

5.3.23 Ararat (SSSI)

The initially-discovered colony is in a road reserve and the relevant authority should be requested to refrain from damaging the area. However, on the northern side of the railway opposite the colony there is the Langi Ghiran State Park, and it is likely that the colony extends into this. This likelihood requires further investigation. Fire is probably the principal threat apart from clearing.

The colony to the NW of Ararat is not as significant as the ESE site, and requires no specific protection.

5.3.24 Nelson (SSSI)

This colony, being in the Discovery Bay Coastal Park, should be secure. It would be advantageous to have a small secluded area of the foodplants slashed to encourage new growth and the results monitored. As the area is not subject to public use, the only threat is from fire. A small explanatory display could be provided at the ranger station in the Lower Glenelg National Park, to the north of the town, if it is subsequently confirmed that a colony of *H. flavescens* does exist there.

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8. APPENDICES

APPENDIX 1. DETAILS OF FIELD SURVEYS

1. PRINCIPLES

1.1 AREA

All current evidence suggests that *H. flavescens flavescens* exists only west of Melbourne. Butterflies bred from larvae and pupae taken from *G. filum* from localities east of Melbourne, such as Tooradin, Toora Beach, Dromana, appear to be *H. donnysa*. Therefore, the search was confined to the western half of the State.

1.2 FOODPLANT

There was no evidence that *H.f. flavescens* was associated with plants other than *G. filum*, but as *G. trifida* sometimes grows in situations similar to those used by *G. filum*, localities where *G. trifida* grows were also searched.

1.3 LOCALITIES

Locality records for *G. filum* and *G. trifida* were obtained from the Melbourne Herbarium and details of all their occurrences were obtained from the survey records of A.C. Beauglehole. In addition, the maps from all Beauglehole's surveys in the western half of the State were scanned for other possible localities on private land.

1.4 ACTION & TIMING

As the adult insects have proved very difficult to locate in the field because the weather conditions have to be ideal for them to fly, the foodplant colonies were searched for during the spring and autumn when pupae would be available. The periods were mid September to end October and late February to end March. About six pupae were taken from each colony (unless this was deemed unwise) and all were bred out indoors in Melbourne.

2. RESULTS

Appendix 2 lists the localities where butterflies were recorded. Many of the foodplant colonies could not be found, as they were either too far from reasonable access or time did not permit lengthy searches over large tracts of ground where there was no obvious lake, soak or damp depression indicated on the maps to use as a starting point. Many of the public land reserves where the plants had been recorded were isolated pockets surrounded by large tracts of farming land which would have required time to find the owner to seek permission to traverse. In some cases, where the prospects looked good, permission was not obtained before entry. Only a few sites on private land were considered worth inspecting.

In passing through an area, I inspected plants if a prospective locality for *H. donnysa* associated with another species of *Gahnia* was noticed. However, such inspections were not regarded as an objective of the field searches.

Appendix 2 shows the localities where butterflies were found.

Appendix 3 lists the sites where foodplants but no butterflies were found.

Appendix 4 lists sites where *G. filum* and *G. trifida* are reputed to occur but where none were found.

Appendix 5 provides detailed descriptions of each site.

APPENDIX 2: LOCALITIES WHERE BUTTERFLIES WERE FOUND

Lat. °S	Long. °E	Grid No.			Name	Plant	Butterfly
38 24	144 12	P20		+	Anglesea	*G. filum*	?
						G. trifida	*H. donnysa*
38 28	144 07	P19		+	Airey's Inlet	*G. filum*	? (*H. donnysa*)
37 04	141 45	D5			White Lake, S of Douglas	*G. filum*	*H. flavescens*
38 14	142 04	E18		+	St. Helens Flora Res.	*G. trifida*	*H. donnysa*
						G. radula	*H. donnysa*
37 15	141 16	D11			Dergholm, reserve	*G. trifida*	*H. donnysa*
37 23	141 11	D20			Dergholm, forest	*G. radula*	*H. donnysa*
37 31	142 46	J20		+	N of Willaura	*G. filum*	*H. flavescens*
36 48	141 48	C41	*		Jacka Lake (priv.)	*G. filum*	*H. flavescens*
36 44	141 46	C41			S of Mitre	*G. filum*	*H. flavescens*
36 48	141 47	C41			N of Jacka Lake, WSW of Natimuk	*G. filum*	*H. flavescens*
38 12	141 36	E13		+	S of Heywood (priv.)	*G. trifida*	*H. donnysa*
37 02	141 45	D 5			North Lake, N of Douglas	*G. filum*	*H. flavescens*
37 05	141 16	D 2			S of Edenhope, (priv.)	*G. radula*	*H. donnysa*
38 04	141 01	E 1		+	Nelson (national park)	*G. filum*	? (*H. flavescens*)
37 38	142 33	J28			Glenthompson	*G. filum*	*H. flavescens*
37 42	141 24	D39			S of Casterton	*G. sieberiana*	*H. donnysa*
37 43	142 06	D43			Grange Burn, E of Hamilton	*G. filum*	*H. flavescens*
37 43	141 14	D38			Wilkin, SW of Casterton	*G. radula*	*H. donnysa*
36 48	141 48	C41			S of Jacka Lake (priv.)	*G. filum*	*H. flavescens*
36 37	141 56	C33			Olivers Lake, Natimuk	*G. filum*	*H. flavescens*
36 41	141 50	C42			Telfers Swamp, Natimuk	*G. filum*	*H. flavescens*
36 43	141 50	C42			Mitre Lake	*G. filum*	*H. flavescens*
38 06	143 17	K 5		+	Kooraweera L., N of Camperdown	*G. filum*	*H. flavescens*
38 31	143 02	K31		+	N of Port Campbell	*G. trifida*	*H. donnysa*
38 38	143 05	K31			Port Campbell Nat. Park	*G. trifida*	*H. donnysa*
38 34	142 48	K29			W of Peterborough (priv.)	*G. radula*	*H. donnysa*
37 29	142 52	J21		+	Rossbridge	*G. filum*	*H. flavescens*
37 43	142 43	J39		+	E of Lake Bolac	*G. filum*	*H. flavescens*
37 20	143 05	J13	*		ESE of Ararat	*G. radula*	*H. flavescens*
WESTERN PORT PHILLIP AREA							
37 53	144 47	N50	*	+	Cherry Lake, Altona	*G. filum*	*H. flavescens*
37 53	144 47	N50	*	+	Truganina Swamp, Altona	*G. filum*	*H. flavescens*
37 53	144 48	N50			Tip, Altona	*G. filum*	*H. flavescens*
37 54	144 47	N50			Skeleton Creek, Laverton	*G. filum*	*H. flavescens*
37 56	144 46	N50	*	+	Point Cook	*G. filum*	*H. flavescens*
38 04	144 31	P 4	*	+	Point Wilson (Murtcaim)	*G. filum*	*H. flavescens*
38 05	144 24	P 3	*		Corio	*G. filum*	*H. flavescens*
38 17	144 36	P13	*	+	Point Lonsdale (priv.)	*G. filum*	*H. flavescens*
38 16	144 26	P12		+	Connewarre	*G. filum*	*H. flavescens*
38 16	144 28	P12	*	+	Barwon Heads	*G. filum*	*H. flavescens*
38 17	144 24	P12	*	+	Breamlea	*G. filum*	*H. flavescens*

* Previously known sites
\+ Sites where *H. chrysotricha cyclospila* also present
? Identification not confirmed

APPENDIX 3: SITES WITH *G. filum* and *G. trifida* WHERE NO BUTTERFLIES WERE FOUND

Lat. °S	Long. °E	Grid Ref.	Name	Plant Present
36 48	141 48	C41	N of Jacka Lake (priv.)	*G. filum*
37 28	142 47	J20	Lake Buninjon (no access)	*G. filum*
38 17	141 33	E22	Cape Nelson	*G. trifida*
38 16	141 25	E12	Mount Richmond	*G. trifida*
38 15	141 47	E14	Tyrendarra Flora Res.	*G. trifida*
38 16	141 52	E15	Tyrendarra Coastal Res.	*G. trifida*
38 12	141 33	E13	Cobboboonee Forest	*G. trifida*
38 12	141 20	E12	NE of Swan Lake	*G. trifida*
37 44	141 23	D39	Weecurra Res.	*G. trifida*
38 07	141 45	E 5	Homerton Forest	*G. trifida*
37 43	141 24	D39	Merino Water Catchment	*G. trifida*
37 39	141 16	D29	Near Casterton	*G. trifida*
37 28	141 03	D19	Lake Mundi Res.	*G. trifida*
37 33	141 14	D29	Near Casterton	*G. trifida*
37 33	141 08	D28	Near Casterton	*G. trifida*
38 14	141 23	E12	Near Mt Richmond	*G. trifida*
38 20	142 03	E16	Lake Yambuk	*G. filum*
37 06	141 18	D 2	Near Edenhope	*G. trifida*
38 16	141 43	E14	Surrey River mouth	*G. trifida*
37 02	141 44	D 5	Small lake near Centre Lake	*G. filum*
37 03	141 45	D 5	Centre Lake, Douglas	*G. filum*
36 43	141 47	C41	Mitre Res. (no access)	*G. filum*
36 25	141 57	C24	Loch Iel	*G. filum*
38 08	142 18	E 8	Hawkesdale (priv.)	*G. trifida*
38 07	143 18	K 5	Lake Terangpom	*G. filum*
38 37	142 53	K30	Curdies Inlet	*G. filum*
38 23	142 14	E26	Port Fairy (priv.)	*G. filum*
38 23	142 10	E25	Near Goose Lagoon (priv.)	*G. trifida*
37 44	142 44	J29	Cockajemmy Lake (no access)	*G. filum*
38 22	141 36	E22	Fawthrop Lagoon (no access)	*G. filum* & *G. trifida*
37 34	142 15	D35	Bryan Swamp (no access)	*G. filum*
37 09	141 53	D 6	Kanagulk Res.	*G. filum*
37 15	142 12	D17	Glenisla (priv., no access)	*G. filum*

APPENDIX 4: SITES WHERE *G. filum* or *G. trifida* ARE REPUTED TO OCCUR BUT WERE NOT FOUND

Lat. °S	Long °E	Grid Ref.	Name	Plant
38 07	141 05	E1	Discovery Bay Coastal Park	*G. filum & G. trifida*
38 03	141 06	E1	Lower Glenelg Nat. Park	*G. filum & G. trifida*
37 00	141 43	C50	Jilpanger Res.	*G. filum & G. trifida*
36 58	141 47	C50	Jilpanger Res.	*G. filum*
37 15	142 12	D17	Grampians Forest	*G. filum*
37 13	141 13	D 2	Meereek Forest	*G. filum*
36 46	141 45	C41	Near Mitre	*G. filum*
37 37	142 32	J28	Green Swamp Res.	*G. filum*
37 28	142 16	D26	Grampians Nat. Park (Victoria Ra.)	*G. filum*
38 18	141 24	E12	Grampians Nat. Park (Bridgewater)	*G. filum*
38 21	141 28	E21	Bats Ridge Res.	*G. trifida*
38 19	141 27	E12	Tarragal Educ. Res.	*G. trifida*
38 24	141 33	E22	Cape Nelson State Park	*G. trifida*
38 23	141 34	E22	Trewella Res.	*G. trifida*
37 53	141 02	D46	Dartmoor Forest	*G. trifida*
37 57	141 16	D47	Near Dartmoor	*G. trifida*
38 04	141 13	E 2	Lower Glenelg Nat. Park	*G. trifida*
37 58	141 31	D49	Near Hotspur	*G. trifida*
37 54	141 09	D46	Near Dartmoor	*G. trifida*
37 44	141 22	D39	Near Casterton	*G. trifida*
36 57	141 35	C49	Near Douglas	*G. trifida*
37 04	141 17	D 2	Lake Kemi Kemi	*G. filum*
36 56	141 48	C50	Bow Lake	*G. filum*
36 40	141 54	C33	Lake Wyn Wyn Res.	*G. filum*
36 33	142 02	C34	Little Desert Nat. Park	*G. filum*
36 35	142 30	C30	Little Desert Nat. Park	*G. filum*
36 42	141 48	C41	Lake Res.	*G. filum*
38 29	143 01	K22	Timboon Res.	*G. trifida*
38 35	142 49	K29	Bay of Islands area (national park)	*G. trifida*
38 41	143 09	K40	Serpentine Creek Res.	*G. trifida*

APPENDIX 5: DESCRIPTIONS OF SITES WHERE *Hesperilla flavescens flavescens* OCCURS IN VICTORIA

1. CHERRY LAKE, ALTONA

1.1 Habitat

The area occupied by this now permanent lake was previously a swamp. The swamp was converted into a permanent retarding basin in the late 1960s with the retarding wall on the west side of Millers Road. Previously, water-levels in the swamp fluctuated widely and the lake could be either wet or dry for long periods in the year. However, 60 ha of the original 101 ha are permanently inundated. Aerial photographs taken before and after this alteration indicate that there was little loss of foodplant as a result. The principal habitat losses have occurred in the areas surrounding the lake, mainly between it and the sea. The remaining *G. filum* is now concentrated at the south-western end of the lake, near where Cherrys Creek discharges into it. There is a section of foodplant upstream beside Cherrys Creek for a distance of about 400 m, all of which is on private land. The areas of foodplant are shown in Figure 5.

A section of the foodplant is too mature and partially invaded by weeds to be of use to the butterflies. A small portion has been burnt in the last 1 - 3 years and the regrowth is favoured by the butterflies, with a higher density of larvae and pupae. The remaining areas consist of plants that are older than the burnt ones, but not yet mature; they produce the annual new growth required by the butterfly larvae.

In the colonized areas the larval density varies considerably due mostly to the condition of the foodplants; the higher density being associated with smaller, fresher, open bushes.

Through the centre of the strongest part of the colony passes a rough vehicular track which is used by walkers, joggers, cyclists, trail-bike riders and some vehicles. Rubbish has been dumped beside the track. There is no evidence that horses have damaged any of the plants, compared with the extensive damage evident 3-4 years ago. There is some natural regrowth of the foodplant, particularly on the north-western edge of the colony, and in the area of the plain adjacent to the creek. The creek is becoming overgrown with *Phragmites* and this threatens to overgrow some of the foodplants bordering the creek.

Industrial development appears to be taking place on the private land next to the foodplant area. This development seems to be in advance of land-filling operations already started 200-250 m to the north-west.

There is some invasion by weeds, particularly of artichoke thistle and prickly pear cactus. Most of the foodplants are free of sea couch growth and attendant spider webs.

1.2 Size of Colony

Several larval/pupal counts were made at the end of September and early October 1988, before the emergence of adults, to obtain an estimate of the size of the colony. The results of these counts are shown in Table 3, where the numbers from the private land and the MMBW land are shown separately. Taking into account the nature of the site (size and density of the plants), the

difficulty of counting every actual larva or pupa, and based on short trial recounts, I estimate that the actual population would be 50% to 100% higher than the counts.

Table 3. Results of counts of *H.f. flavescens* juvenile stages at the Altona sites in spring 1988. With *H.c. cyclospila* for comparison.

ITEM	CHERRY LAKE		TRUGANINA
Land Owner	MMBW	Private	MMBW
Dates	27,30/9/88	11/10/88	11,13,27/10/88
Small Larvae	8	3	2
Medium Larvae	17	8	26
Large Larvae	26	8	12
Pupae	50	16	31
Emerged Pupae	7	3	17
Diseased Larvae/Pupae	9	3	4
Parasitized Larvae	14	2	25
TOTAL	131	43	1167
H.c. cyclospila Larvae/Pupae	6	2	53
COUNT FACTOR	x2	x2	x4

The colony on the MMBW land is about 250; about 100 on the private land. When the rate of finding the larvae/pupae in 1988 is compared with that in the 1950s, I consider the present population to be about one third of that in the 1950s.

1.3 Predators, Parasites and Disease

The incidence of disease was about the usual level of 1-2% and wasp parasites were a little lower than the normal 10%. No spiders were seen, but there were several earwigs.

1.4 Threats

Atmospheric pollution is unlikely to be a threat but considering the proximity of petrochemical and industrial complexes, the possibility does exist. No provision for occurrence can be made. The proximity to dwellings would ensure a rapid response.

Severe pollution of surface-water or ground-water by accidental or deliberate release of chemicals from the industrial areas to the north and west is possible and constitutes a continuing threat. Very careful monitoring is essential. If such pollution is detected by effects on the habitat or wildlife, it is usually too late to remedy. The most likely source of entry to the area would be via Cherrys Creek, but a major threat could ensue from industrial runoff during high rainfall followed by surface flooding. However, the creek appears to be very polluted already and the plants may have adapted to an existing level of pollution. If this is the case, it will be interesting to monitor the effects this may have on the

butterflies breeding on the affected plants. The levee bank beside Kororoit Creek should protect the site from discharges originating in its much greater drainage area. This point should be checked.

Several threats stem from human interference. Dust is very deleterious to all insect populations, particularly when larvae are active. All vehicular use of the track through the colony and any within at least 100 m should be prevented at all times. A ban on vehicles would also discourage rubbish dumping. Land-filling and construction activities close by would thus be most inappropriate. I do not consider it necessary to ban walkers and joggers, provided they keep to the track. Previous efforts to prevent entry seem to have been thwarted, and no real attempt has been made to maintain the barriers.

Animal interference arises principally from horses eating the tender new shoots on the foodplants in summer when other green herbage is not available. Simple fencing prevents this. This problem occurred a few years ago when the fence dividing the reserve from the private land was knocked down and not replaced. The colony appears to be still recovering from the effects of this. Many of the properties backing on to Cherrys Creek appear to have horse paddocks, so it is essential to monitor this threat.

Fire is another threat but the proximity of houses encourages the monitoring and control of this. However, the fire brigade should be alerted to the need to prevent fire entering the foodplant zone. Perhaps a firebreak could be considered.

The correct moisture regime is essential if the foodplants are to survive and multiply. Therefore changes to the regime should be prevented as far as possible. When industrial expansion takes place to the north and west, surface drainage will be a critical consideration as the ability of the natural surface to absorb water will be removed; elevation of the surface above flood-level will exacerbate the problem. All drainage should be directed to the Kororoit Creek system; the diversion will alleviate the pollution threat too. However, the possibility that this will reduce the natural flows into Cherrys Creek will require investigation, so that the creek will not dry up or become stagnant.

Weeds also present a problem. *Phragmites* in Cherrys Creek requires control and garden escapees from nearby residences are always possible. The keeping of horses further encourages the introduction of weeds with feed and faeces, and should not be allowed.

2. TRUGANINA SWAMP

2.1 Habitat

Truganina Swamp was basically a swamp fed by Laverton Creek and Kayes Creek until a channel to the sea was constructed in about 1965. The channel drained water from some of the foodplant areas, which are now becoming affected by lack of new growth and seedling production.

For ease of description the area has been divided into eight sectors, as shown on Figure 6, and are as follows:

Sector 1.
This is on private land. It is very densely packed with mature foodplants; impenetrable for investigation. A low ranking area.

Sector 2.
As for Sector 1.

Sector 3.
As for Sector 1, except on MMBW land.

Sector 4.
This is an area with a flourishing colony but is now becoming badly overgrown with weeds and subject to dumping. Three tongues of burnt land, from fires during the last 12-18 months, run into this area. In the burnt areas there is much regrowth of the *G. filum* favoured by both *H. flavescens* and *H.c. cyclospila*. The fires have killed some of the foodplants and encouraged a great deal of weed regrowth, which has grown dramatically during the three months October - December, and will soon overgrow the foodplants. This section is a good example of how fire can rejuvenate some foodplants to the initial, short term advantage of the butterflies. The difference between larval/pupal counts in the burnt and unburnt areas was significant. See Illustrations 8-10.

Sector 5.
This sector consists mainly of mature *G. filum* plants, generally not very large, but lacking in any new regrowth or seedlings. The sector is slightly elevated and appears too dry now. There is some grass growth which could deter the butterflies. The area is exposed and would suffer from strong winds.

Sector 6.
This sector is a flat swampy area with run-off going into a drain. There are many good foodplants here, although invasion by artichoke thistle is bad and could threaten the foodplants soon. There are some mature bushes and some seedling growth. The sector is potentially a suitable breeding area for the butterflies but needs cleaning up, including some rubbish removal.

Sector 7.
This sector is virtually a continuation of Sector 6, but is below the filled land on which houses are now being built. There is much rubbish and weed infestation, particularly adjacent to the houses; an easy place to dump rubbish. A central area, commencing at the houses, was burnt 2-3 years ago and the foodplant regrowth is relatively recent. The central area is infested with some weeds in the form of large clumps of grass, which could spread, and regrowth of *Phragmites*, which could become a significant problem later. Nevertheless, the butterflies particularly favoured this area, possibly because it is partially protected from cold southerly winds. The butterfly's density here is probably double that elsewhere in Truganina Swamp. There is a border of rather older, but not mature, foodplants which are also used by the butterflies.

Sector 8.
This sector is small and wetter than sector 7. The ground flora grows to greater height but this is not detrimental. A severe infestation of *Phragmites* requires urgent control. The sector was not surveyed in detail, but it does contain the butterflies, and the foodplants are worth looking after.

2.2 Size of Colony

Sectors 1, 2 and 3 were not checked for numbers of butterflies because no access was possible, and because the potential was low.
Sector 4 was sampled and was estimated to have about the same number of larvae and pupae as sectors 6 and 7 combined. However, this will be controlled by the weed growth, which, if not checked, will halve the population.

Sector 5 was sampled and found to have very few larvae and pupae due to the lack of fresh foodplant growth.
Populations in Sectors 6 and 7 were counted during the middle of October 1988. The results are shown in Table 3. The method applied to the Cherry Lake site gave an estimated population of 250. The number of *H.c. cyclospila* larvae was much higher than at Cherry Lake. The total population of *H. flavescens* is about 600 and that of *H.c. cyclospila* is about 300.

2.3 Predators, Parasites and Disease

As at Cherry Lake, the main problem is parasitism, but here it is much higher at about one in five. Comments on this have been made in Section 2.3.2. There was only a low level of diseased larvae and pupae.

2.4 Threats

Atmospheric pollution does not appear to be a potential problem, unless there was a drift of toxic discharges from the industrial complex to the north.

Surface water pollution from Laverton Creek or Kayes Creek would need to be monitored, as both pass through or near industrial areas. Domestic pollution, largely due to runoff into sectors 6, 7 and 8, should be investigated. If it is a threat, a small channel could be dug along the boundary to terminate in the existing diagonal drain in sector 6.

Trampling and rubbish dumping appear to be the main human interference problems and their prevention will require action. Residents can easily dump trash over their fences into sectors 6 and 7. Indiscriminate dumping in the other areas is difficult to prevent due to uncontrolled public access from Victoria Street.

Animal interference does not appear to be relevant.

In sectors 6, 7 and 8, fire is always possible with the houses being so close but the presence of houses probably leads to protection. The other sectors and areas are more remote and prone to vandalism and fire. These risks could be reduced by preventing public access.

Altered hydrology appears to be a problem. Although the swamp has been effectively drained by channelling Laverton Creek, immediate consequences are difficult to determine. There may be long term effects. The poor condition of the foodplants in sector 5 appears to stem from dryness.

Runoff from the filled area now used for housing adjacent to sectors 6, 7 and 8 will have to be controlled, if this has not already been done adequately. It is not expected to be a problem. Drying out is more of a threat.

Flooding from excessive runoff into Laverton Creek and Kaye Creek must have been reduced by the treatment of Laverton Creek and the opening of an access to the sea. However, the possibility should be investigated. Flooding would be a danger only if the water inundated larvae for more than a few hours and particularly if it brought a sediment which was deposited over the foodplants. Most larvae will survive a brief immersion in water.

As at Cherry Lake, weeds need control, particularly the bad infestation of artichoke thistle, grasses and *Phragmites* in sectors 6, 7 and 8, together with the bad invasion of several apparent weeds in sector 4. This problem needs to be discussed with the botanists.

3. ALTONA TIP AREA

3.1 Habitat

This colony is divided into two parts. The principal and larger section is immediately south and south-west of the municipal tip enclosure south of Queen Street, Altona Meadows. To the east are the coastal swamps, to the south the northern edge of the old Cheetham Salt ponds, and to the west an area of cleared land about to be developed for domestic housing. The foodplants appear healthy and parts of this section have been burnt and contain healthy young foodplants, but with some grass infestation. Rabbits appear to have been eating the foodplants. The site is damp but probably swampy in winter. There are several tracks through it and some dumping of rubbish. I believe this site could be readily conserved and managed to maintain a valuable colony.

3.2 Size of Colony

Life-histories were not counted at this site, but I estimated that it could contain 200 - 300 specimens. The colony would be useful as a back-up colony.

3.3 Threats

The principal threats appear to come from rubbish dumping and consequent trampling, grass infestation and fire.

4. SKELETON CREEK

4.1 Habitat

This site contains a few dozen *G. filum* plants beside the road leading east in the Cheetham Salt Works Wildlife Reserve, Aviation Road, Laverton. It is about half way between the Altona Tip site and the Point Cook colony, and is about 0.5 km from the Aviation Road entrance. The plants are in poor condition, have very little new growth, and are scattered over an area of about half an hectare.

4.2 Size of Colony

I estimated this colony to contain about 100 *H.f. flavescens*.

4.3 Threats

The main threat to this colony is overgrowing by grass and other plants.

5. POINT COOK METROPOLITAN PARK (MMBW)

At present the colony here is small but may not be viable in the long term, because of its isolation. However, with careful management, it has the potential to be retained and even expanded, and will thus serve as a very valuable support for the colonies at Altona, particularly if some catastrophe affected the latter area. The foodplants are in relatively good condition and the site would be excellent for further, extensive studies on the the butterfly.

5.1 Habitat

This colony is restricted to the foodplant areas on the north and west sides of the RAAF lake (Figure 7). The plants extend in a more or less narrow band on a

contour around the lake, with some minor discontinuities. Compared with most other sites this structure is unusual, as the sites normally have areas where the plants compose a block. A block formation gives greater protection from cold winds often present in the otherwise unprotected sites. A block formation also provides small open areas between plants where flowers can grow and the butterflies fly, or sun themselves. In other sites these were frequently used by adults.

The foodplants here are healthy, and there is good growth of new seedlings, which are essential to survival of the colony. Even the larger plants have been putting on new growth. The small larvae need soft new growth to survive and to be able to draw together two or three leaves to make their shelters. Mature plants with little or no new growth are almost always avoided by the butterflies.

Sheep can adversely affect the availability of the new growth if they are allowed or forced to feed on the foodplants. However, if sheep are allowed in amongst the plants when there is plenty of other soft palatable grass to eat, they generally do not damage the sedges. Sheep should be admitted only when this grass is available and should be removed when it has been eaten. For such control to be possible, the number of animals must be low and conditions monitored. At other sites, controlled within these constraints, the sheep are beneficial as they tend to clean up the grasses which usually accumulate around the bases of the sedges. Accumulated grass provides hiding places for a range of larval predators and obscures the bases of the sedge leaves. The grasses causing this problem are sea barley grass *Critesion marinum* and sea couch *Distichlis distchophylla.*

The foodplants at the western end of the lake are becoming overgrown with sea rush, *Juncus kraussi*, and partly smothered by austral sea-blite, *Suaeda australis.* There are a few other similar threats along the northern side of the lake but these are minor.

Foodplants were also seen at two locations near the coast, along the track to the lignum lakes area. At both locations the plants were badly overgrown and appeared to be mature, with no new growth. No signs of *H.f. flavescens* could be found at either.

In common with most of the other colonies, the glasswort *Sarcocornia blackiana* is present, together with *Frankenia pauciflora*, *Samolus repens*, and *Disphyma crassifolium*, all of which have flowers frequented by the butterflies, presumably for nectar. A ground cover of *Selleria radicans* is frequent too.

5.2 Size of Colony

The size of the colony was estimated by inspecting every plant of *G. filum* and recording the various stages of the *H.f. flavescens* early in October 1988 before the major emergence of adults in the spring flight. The results were as follows:

Small larvae	4
Medium larvae	8
Large larvae	19
Dead/diseased larvae	1
Live pupae	31
Emerged pupae (this season)	4
Parasitized larvae/pupae	11
TOTAL	78

Check counts done during the surveys at Altona show that only about half the larvae and pupae are recorded. Therefore, the size of the colony appeared to be

about 200 specimens. The colony is small but obviously viable as it has been known to exist for over 20 years, probably very much longer.

As mentioned in section 2.3 on page 7, further counts made in February and March 1989 indicated the estimated size of the colony to be 250.

5.3 Predators, Parasites and Disease

As the invasive grasses seem to be kept in check by the sheep, predators should not present a problem. As usual, the colony is parasitized by a wasp, (Family: Ichneumonidae, *Casinaria* sp.) at about the usual level. Larval counts show that about one larva in ten dies from parasitism which is therefore a significant cause of death. Attack by the usual fly parasite (Family; Tachinidae, *Tritaxys* sp.) has not been recorded yet, but, as the fly has been noted at Altona, parasitism would be expected. No action can be taken to reduce the impact of parasites or diseases.

5.4 Threats

Aerial pollution from agricultural sprays used either in the park or neighbouring properties is possible.

Surface water pollution through contamination of the RAAF lake is also possible and should be watched for. Its occurrence would be obvious through the immediate effects on the plants fringing the lake and probably the bird life.

Human interference is unlikely as the park is being managed with environmental sympathy. The public is not allowed access to the lake area, which appears to be monitored.

The use of sheep has been mentioned above. Cattle can be much more damaging because they trample the plants and often eat them severely from the top, consuming larvae and pupae. Cattle and horses must be kept out at all times.

Fire is unlikely to pose a threat as the colony is in a park.

Changed hydrology would result from changes in the level of the RAAF lake, and should be monitored.

6. MURTCAIM WILDLIFE RESERVE, POINT WILSON

6.1 Habitat

The butterfly colony is located in *G. filum* along the northern and western sides of the section of the park to the west of the Point Wilson road. See Figure 8 and Illustration 1. The land is swampy and the foodplants are scattered over about 10 hectares; the plants have a reasonable amount of seedling growth. Many of the plants are mature but are infested with grass. There are areas of the usual ground-dwelling flowering plants between some of the stands of the foodplant. No butterflies were seen using the flowers. See Illustrations 5,6,11,12,13.

6.2 Size of Colony

H.f. flavescens were not counted, but I esimated of the size of the colony is 200-300 specimens. The colony appeared to have grown in size during the last few years.

6.3 Predators, Parasites and Disease

The incidence of parasitism appeared appreciably higher than normal, (35-45%). The degree of grass infestation around the bases of the foodplants indicated a potentially high level of predators, and the number of spiders was unusually high. The spiders would have accounted for the high level of empty larval shelters. Only a low level of disease was noted.

6.4 Threats

The colony is in a declared reserve; therefore no threats are serious, but the grass infestation would need to be monitored. Fortunately, no weeds were noted.

7. CORIO

This colony existed on the shore of Corio Bay below where the Shell refinery now stands and between Lowe Street/Wharf Road and the bay. A few scattered foodplants remain but they are insufficient to support a colony.

I have been advised by a botanist (C. Beardsell, pers. comm.) that there are some plants of *G. filum* in the Limeburners Lagoon Flora and Fauna Reserve, at the head of the Lagoon, at the northern end of Corio Bay. However, I was unable to find these plants during a short visit and this area should be further investigated.

8. POINT LONSDALE

The foodplant grows in the ponds formed during the shell-grit mining operations to the east of the Lonsdale Lakes Reserve, and in the reserve. It is also found to the west of Queenscliff, at the southern end of Swan Bay, mainly on private land. The colony is very scattered; pupae and larvae have been seen intermittently over the whole area. Access was not available to the lakes reserve, so an assessment of the colony size was not possible. However, it is probably small, and is being reduced by domestic dwelling development of the swamps on private land east of the lakes reserve. Further investigation is warranted.

Atkins has taken specimens from "Ocean Grove". These would probably have been collected in a swamp to the east of the town, behind the beach dunes, on private land. This swamp is an extension of the low lying land west from the Lonsdale Lakes Reserve. This area was not investigated.

9. BARWON HEADS

G. filum grows around Lake Connewarre (north and north-west of Barwon Heads), principally around the western edge; however, much of this area is swampy and inaccessible. The first records of *H.f. flavescens* came from an arm of the lake which is next to the Barwon Heads-Geelong Road, about 2 km WSW of the town. In recent years this area has become weed infested and has dried out, so the colony is struggling to exist. The colony was not surveyed.

10. CONNEWARRE

This colony exists on another arm of Lake Connewarre which also crosses the Barwon Heads-Geelong Road, but at about 5 km WSW of Barwon Heads. The foodplant here is very dense and harbours a small colony. The size of the colony

was not assessed because access through the greater part of the site was impossible. There is a large area of foodplant so the colony could be a large. The area is quite swampy and does not appear to be weed affected.

11. BREAMLEA

This colony exists in the Breamlea Flora and Fauna Reserve, immediately behind the sand dunes facing the beach. There are extensive areas of *G. filum* in good condition with adequate small seedling plants. There are also stretches of the usual low flowering plants, which the butterflies were using. There were 80 hectares of the foodplant, so the colony here would be large and widely spread. Some parasitized larvae were noted but no more than usual. There was very little weed infestation.

12. KOORAWEERA LAKES

These lakes are a wildlife reserve about 21 km north east of Camperdown and the lake investigated was situated near the centre of the group. See Illustrations 3,4. The lake was not fenced and the neighbouring farmer seems to use it as part of his land. There was evidence of sheep having used the swamp when it was dry in the summer months. There was evidence of domestic dumping (bottles, tins, etc.) but this was not serious. Open areas between the plants were suitable for *flavescens*, but had no flowers. There was practically no grass invasion, undoubtedly due to the sheep. The plants were in good condition, and there were many small plants suitable for larvae; this is probably a result of the swamp having been burnt about five years ago.

A small amount of *Phragmites* was developing, and may have been reduced by the fire. A large lily type of plant seemed to have become established in one section. Some of the pupal shelters appeared to have been opened by a bird or mouse.

The colony of about 500 butterflies occupied about 5-6 ha. Many butterflies were seen flying in late February 1989.

13. LAKES EAST OF LAKE BOLAC

These lakes comprise a wildlife reserve within 2-5 km of the eastern shore of Lake Bolac. The large central lake supported a small colony of butterflies at its northern end. The foodplants were sparse, rather infested with grass, and mostly mature. There were some seedling plants which were used by the butterflies. The lake is extensive and, when dry, is used by the neighbouring farmer for his sheep. These did not seem to be able to keep down the grass around the plants. Because of the lake's open nature, the plants were exposed with little in the way of protected flight areas for the butterflies.

The colony was estimated to be about 200 butterflies, but could be larger if it extends into the other areas which were not searched.

14. ROSSBRIDGE

This swamp, 1.5 km. east of Rossbridge, is a wildlife reserve of about 60 hectares and is leased to a local farmer who has been running a small flock of sheep on it for many years. The number of sheep does not damage the foodplants. There

appears to be little disease and the parasitism is low. The foodplants are generally in good condition with a reasonable level of new growth, but some areas appeared to be rather dry. Weed infestation was minimal, including grass at the bases of the sedges. The grass was probably kept in check by the sheep. There were remarkably few spiders present and very few flowers. There is a good range of microhabitats, from dense growth to sparse, with small clearings suitable for adult flight. The hydrology appears to be good. Of the total site, about half would be covered with foodplants.

Many butterflies were observed on the wing in late February 1989, indicating that there was a large colony (at least 500) present.

15. NORTH OF WILLAURA

This site on the west side of the Willaura-Ararat Road, 6 km NNE of Willaura, extends from the roadside reservation west into private land surrounding a large lake. It is 1 km SW of Lake Buninjon. The colony is on scattered foodplants in moist terrain. There is much weed and grass growth but also many small foodplants. The foodplants in the private land are in a narrow band around the lake, covering a substantial area. Generally their condition is reasonable. Parasitism is about normal and few diseased larvae were found. The size of the colony was not estimated but in the area between the road and the lake there could be 200. There were many adults on the wing in late February 1989.

16. GLENTHOMPSON

Here the colony is in a swampy area left when the main road from Glenthompson was shortened to cut out a bend. The area is 2.5 km north of the town on the east side of the road to Ararat. The area is fenced and has had stock in it. Stock has eaten and trampled many foodplants and little young growth remains. The colony is consequently small, probably less than 100. There may be other colonies on scattered foodplants in the paddocks to the west of the road and still further west there were two reserves which were not accessible. They may warrant inspection.

17. GRANGE BURN, ENE OF HAMILTON

This colony is also in the road reservation on either side of the Glenelg Highway 9 km ENE of Hamilton. The foodplants in scattered clumps stretch into swampy areas in the adjoining fields for over 500 m. These were not checked, but would probably be used by the butterflies.

The roadside colony is small (< 100) and the foodplants are scattered. They are in poor condition, although there are some small plants. Those in the paddocks appear better but are probably infested with grass. Part of the area has been bulldozed.

18. WHITE LAKE

White Lake, located 2 km south of Douglas, is a large saline lake with *G. filum* growing more or less completely around it. The plants at the northern end are mature, and very badly infested with grass. There are no butterflies there. However, down the eastern side, along the southern end and up the western side there are many patches of good plants, nearly all of which are colonized.

The lake and the surrounding land is a reserve, so the habitat is secure. Weed infestation in the colony areas is minimal, and the plants are generally widely scattered with many potential flight areas, but there are few flowers. Some parasites were noted. The colony must be at least 500, possibly very much more.

19. NORTH LAKE

This saline lake, also a reserve, is 3 km north of Douglas. The foodplants are concentrated along the eastern and south eastern sides in a narrow band and are badly overgrown with weeds and grass. They may only number around 100 and the colony is similarly restricted, probably to less than 100 individuals. It seems to suffer from a high level of parasitism.

20. JACKA LAKE

This saline lake on private land immediately north of the Jacka Lake Wildlife Reserve is 13 km WSW of Natimuk on the Wimmera Highway. (The reserve contains few foodplants and a colony was not found there). The colony is around the southern end of this lake, adjacent to the road. The plants are in good condition, with new growth. There is a small amount of grass infestation. The colony would be less than 100.

21. LAKE SOUTH OF JACKA LAKE

This colony is around a small lake immediately south of the Jacka Lake Reserve and on private land used for sheep grazing. A series of small lakes or depressions connect this lake with the much larger Heard Lake less than 1 km further south. The foodplants appear to extend between the lakes, and not all of them were inspected.

The lake has some melaleuca at its southern end and the foodplants invade this area, in addition to being around the lake. The plants are mainly young as much of the area has been burnt within the last three or four years. This has encouraged *H.f. flavescens*, although they are heavily parasitized by a chalcid wasp. There is no weed or grass infestation. This colony would be about 100, but is possibly much larger if it extends far to the south.

22. LAKES NORTH OF JACKA LAKE

There is a series of small lakes on both sides of the road which runs north from the Wimmera Highway at Jacka Lake to Mitre. Two of those to the east of the road were investigated and were found to have small colonies.

23. LAKE SOUTH OF MITRE

This lake is located further north along the same road as in 3.20, but is on the western side and 3 km south of Mitre. It is a large salt lake. The colony here is at the southern end near the road. It is partly amongst melaleuca trees, which give protection. A large part of it has been burnt recently and the new growth is favoured by *H.f. flavescens*. Sheep have been kept in the area and they have helped to keep down the grass around the plants. The area of foodplant extends west for some distance and the whole of it was not checked. The size of this colony is about 150.

24. MITRE LAKE

Mitre Lake is a very large salt lake about 4 km to the east of Mitre. At the southern end there are scattered foodplants with a very small colony of an estimated 50 specimens. This colony appears to be in decline.

At the north end of the lake there is a large area of foodplants in the lake reserve and nearby paddocks, mostly in excellent condition with no weed or grass infestation, due to the presence of sheep. Although there are not many seedling plants, the new growth on the larger plants makes up for this. The colony is large (300-400). Wind-blown specimens from this colony have probably created the small colony at the southern end of the lake. This northern colony is strong and should be preserved.

About 2 km to the west is an area known as Conran Swamp, (apparently on private land) and this appeared to contain stands of the foodplant, and may contain a colony. It was not investigated.

About 0.5 km further west and slightly to the south is another swampy area with sedges and this could also be colonized. This swampy area was also on private land and was not inspected.

25. TELFERS SWAMP

About 3 km north of Mitre Lake is another reserve called Telfers Swamp. There is a salt lake in this swamp with the western half in the reserve and the eastern half on private land. The lake has sedges growing around its western and northern shores. A strong colony of the butterflies exists here, particularly in an area of the private land recently ploughed where there was a large number of healthy small regrowth plants. The other foodplants are larger, some in dense thickets together with melaleucas. These foodplants are also used by the butterflies, but less intensely. The colony is probably about 200-300. There is evidence of grazing by sheep which have not completely kept the grass down. Weeds are not a problem. There is a moderately high degree of parasitism.

26. OLIVERS LAKE

This reserve is 11 km north of Natimuk, and includes a large salt lake almost surrounded by *G. filum* plants. Most of the plants are mature with little new growth and few seedling plants. Nevertheless a colony of *H.f. flavescens* was found on the western side of the lake adjacent to the road. There is no evidence of sheep being present and there is some grass infestation and some weeds. Owing to the size of the reserve, it was not searched fully, and a tentative estimate of the population was 200-300. This may be an understatement if the colony extends further around the north and east sides of the lake, where it was not searched for. Limited parasitism was noted.

27. ARARAT

In this area *H.f. flavescens* were first found at the side of the Western Highway, near the base of Mount Langi Ghiran, 18 km ESE of Ararat. (Habitat similar to Illustration 21.) The foodplant, *G. radula*, grows in lightly timbered heath country between the road and the railway to its north. One male and one female *flavescens* were bred by Wilson in November 1947 (Museum of Victoria) from pupae believed to have been taken here. These two specimens are nearly typical

flavescens, but nine specimens bred by LeSouef, also believed to be from the same site, in 1951 (ANIC) are darker but appear close to *flavescens*. Two females,that I bred in November 1975, are appreciably closer to *donnysa*. In November 1975 Quick and Atkins bred a series of 19 adults from pupae taken on *G. radula*, growing beside the Highway, about 1 km NW of Ararat. These appear to be indistinguishable from the LeSouef specimens and have been regarded as *flavescens*, although they come from a habitat even more typical of *donnysa*. The specimens from both localities near Ararat are therefore intriguing and require further study.

28. NELSON

There are extensive swamps in the headland south of the town where the headland projects into the estuary of the Glenelg River. Most of these swamps have fringes of *G. filum*, usually very grass-infested. After extensive searching in early November 1988 two pupae were found and only one female emerged. Further specimens from the area are required to confirm the identification. Fisher (pers. com.) has found *H. donnysa delos* on *G. filum* in the south-east of South Australia. So far this combination has not been recorded from Victoria. No adults could be found in March 1989; their absence could indicate *donnysa* because *flavescens* would have been on the wing. However, the small size of the colony may have contributed to their absence.

More work needs to be done in this area.

Illustration 1. A typical *G. filum* swamp, Point Wilson. Note seedling growth in addition to larger plants.

Illustration 2. *G. filum* plants behind coastal dunes at Nelson.

Illustration 3. A typical inland *G. filum* swamp, Kooraweera Lakes.

Illustration 4. A selection of small and medium sized *G. filum* plants at the edge of the swamp at Kooraweera Lakes.

Illustration 5. A typical, medium sized, *G. filum* plant, with little grass infestation. Note open flight area with flowers.

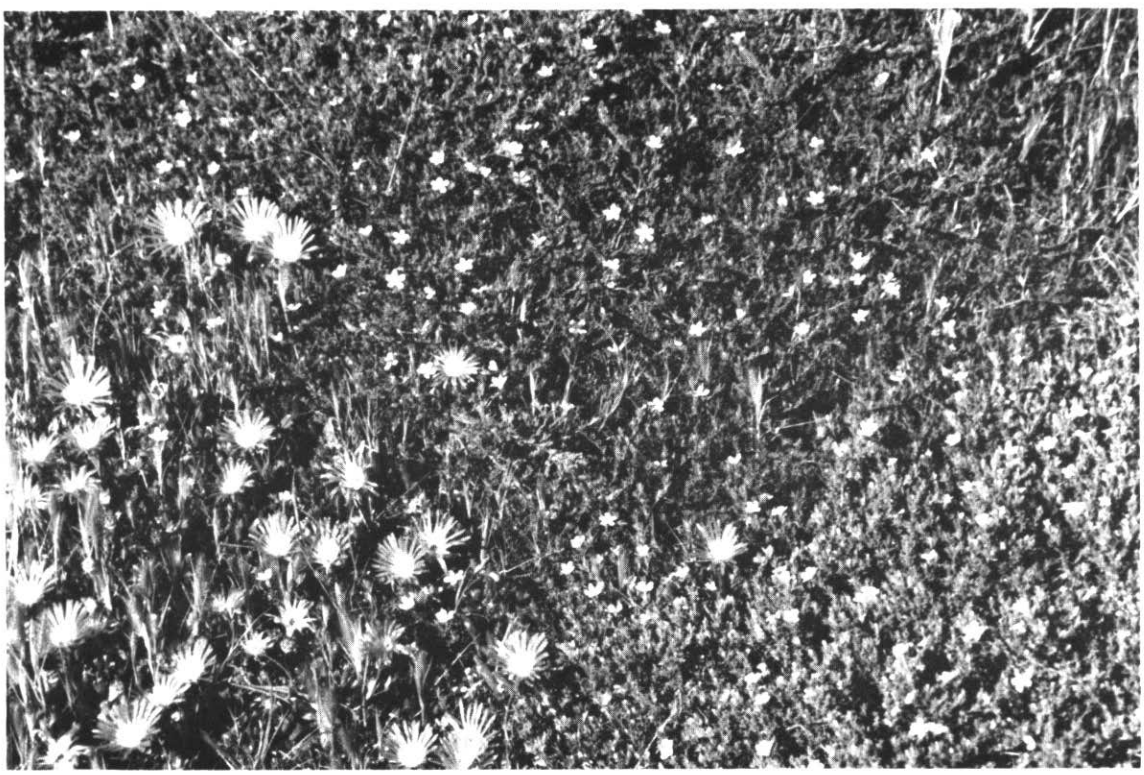

Illustration 6. Pink flowers of *Disphyma crassifolium* with white-flowered *Frankenia pauciflora*, both used by the butterflies. Point Wilson.

Illustration 7. Another typical *G. filum* plant. Note the larval shelter in the foreground and *Sarcocornia* around base. Point Wilson.

Illustration 8. Regeneration of *G. filum* plants after recent burning. Truganina Swamp, Altona.

Illustration 9. Regeneration of *G. filum* after burning. Note development of weed growth.

Illustration 10. New growth of *G. filum* after burn, with older unburnt plants at left and weeds appearing.

Illustration 11. Partly grass-infested *G. filum* plants at Point Wilson.

Illustration 12. Badly grass-infested *G. filum* plants at Point Wilson.

Illustration 13. Spiders' nest in a moderate grass-infested *G. filum* plant. Point Wilson.

Illustration 14. A typical shelter of a large *H. flavescens* larva.

Illustration 15. Shelter in previous illustration opened to show larva.

Illustration 16. Final instar larva, at about natural size.

Illustration 17. Shelter opened to show pupa. About natural size.

Illustration 18. An obvious larval shelter on a medium-sized foodplant.

Illustration 19. Another shelter, on a small plant.

Illustration 20. Typical habitat of *G. trifida* in lightly timbered area. Note light brown flower heads. St. Helens.

Illustration 21. Typical habitat of *G. radula*, in lightly timbered area. Note black flower heads on some of the plants, which consist of only twenty or thirty leaves. A typical plant may be seen about two metres to the right of the central tree. The stand consists of a large number of small plants, often very close together.