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# *HEMIPHLEBIA MIRABILIS* SELYS: RECOVERY FROM HABITAT DESTRUCTION AT WILSONS PROMONTORY, VICTORIA, AUSTRALIA, AND IMPLICATIONS FOR CONSERVATION MANAGEMENT (ZYGOPTERA: HEMIPHLEBIIDAE)

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An important colony site for *H. mirabilis* at Wilsons Promontory National Park, Victoria, was burnt accidentally in April 1987. Monitoring over the following 6 flight seasons has shown that the population there has now recovered. The implications of incorporating low intensity control burning for habitat maintenance into conservation management for *H. mirabilis* are discussed.

## INTRODUCTION

The taxonomically-isolated damselfly *Hemiphlebia mirabilis* Selys has attracted considerable attention as a species of concern for its conservation. It is listed currently as a threatened taxon on Schedule 2 of Victoria's Flora and Fauna Guarantee Act 1988. An 'Action Statement' on its conservation needs is mandatory for such listings. The species was feared to be extinct until a thriving colony was found in Wilsons Promontory National Park (DAVIES, 1985) and, until recently, it was categorised as 'Endangered' in conservation ranking (WELLS et al., 1983).

However, *Hemiphlebia* occurs also in parts of the Goulburn Valley, Victoria, and northeast Tasmania (TRUEMAN et al., 1992) and on Flinders Island in eastern Bass Strait (ENDERSBY, 1993). Its status is not as tenuous as supposed earlier, but *Hemiphlebia* may still be vulnerable. Loss of habitat has certainly resulted in extinction of colonies known formerly from some other parts of Victoria, although it has persisted at others, such as Alexandra (TRUEMAN et

al., 1992). Understanding *Hemiphlebia*'s biology and capacity to resist environmental disturbance is important in assessing management needs for this evolutionarily-important species.

During a study of *Hemiphlebia* at Wilsons Promontory (SANT & NEW, 1988; YEN et al., 1990), the site of the largest-known population there suffered extensive damage by burning. This note documents the fate of that site, and the trend in *Hemiphlebia* numbers there, over the following six seasons.

## THE EVENT

SANT & NEW (1988) and TRUEMAN et al. (1992) discuss the colony sites of *Hemiphlebia* at Wilsons Promontory. The seasonal swamps are on sandy heathland with patches of *Banksia serrata* and extensive *Leptospermum* thickets. Over much of the area, successional progression is countered in part by mosaic controlled burning to regenerate earlier seral stages. Fire is used also to reduce the amount of fuel on the ground, which could lead otherwise to higher intensity natural fires.

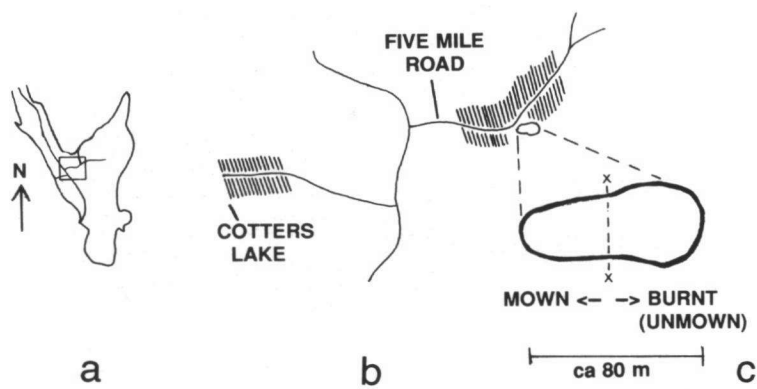
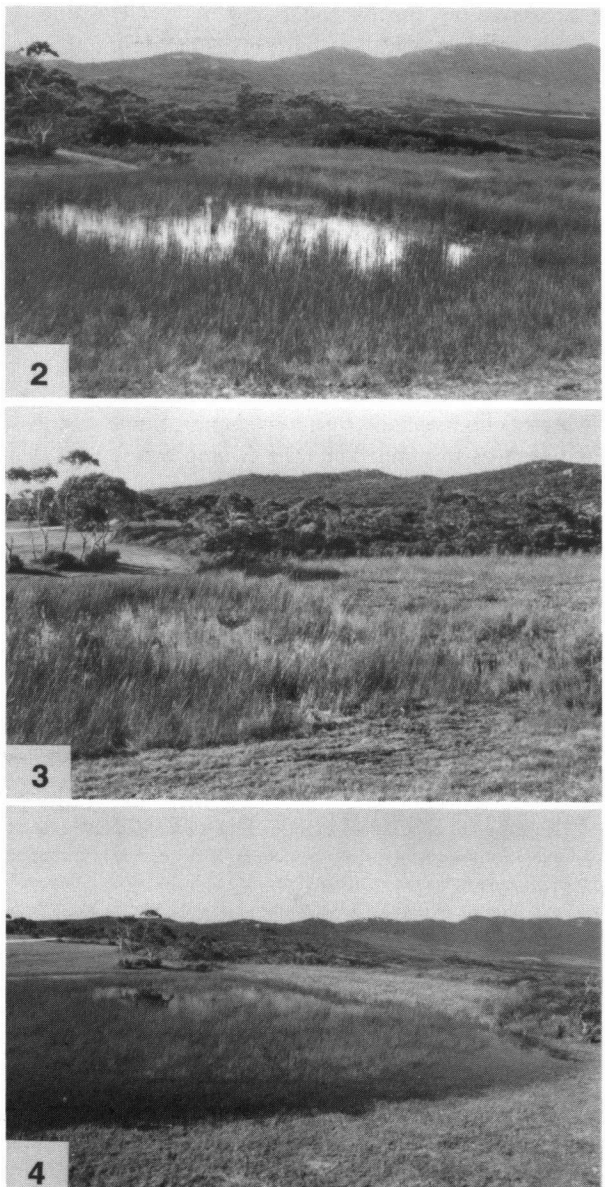



Fig. 1. Locality map: (a) Wilsons Promontory, southern Victoria; – (b) enlargement of area framed on a, with sampling areas of this study hatched; – (c) enlargement of main colony site, x---x boundary between mown (left) and unmown (right) areas.

On April 9 1987, one such control burn spread inadvertently to the site of the largest-known *H. mirabilis* colony along Five Mile Road (Figs 1, 5: site E), producing a visually dramatic destruction of aerial and emergent vegetation (Figs 2-4). This apparent catastrophe was feared to have severe adverse effect on *Hemiphlebia* because:

(1) removal of emergent vegetation (mainly the reed *Chorizandra cymbaria* R. Br.) increased exposure of the swamp, which was previously entirely covered;

(2) deposition of ash onto the water, together with larger pieces of charred




**Figs 2-4. Photographs of the swamp shown in Fig. 1c, the main site of *H. mirabilis* along Five Mile Road: (2) April 1987, before burn; – (3) May 1987, after burn; – (4) September 1987, initial recovery from burn (photographs: G.J. Sant).**

vegetation, with likelihood of change in water quality;
(3) increased access to the site by cattle seeking water, resulting in extensive trampling and dunging, as well as bush breakage during the ensuing months.

SANT & NEW (1988) feared that this despoliation could lead to extermination of the colony, but pointed out that part of the adjoining habitat was not damaged as severely. The mown roadside area (the region west of the line X---X on Fig. 1c), comprised about 40% of the total swamp area, remained green and relatively lush during summer and, although charred in places, appeared to be damaged little.

The perspective for management and the safety of *Hemiphlebia* was thereby changed from (i) the main (burnt) swamp area serving as a refuge for *Hemiphlebia* and buffering it against effects of habitat alteration by mowing to (ii) the mown area being a possible reservoir for *Hemiphlebia*, buffering it against the effects of burning the larger part of the site. Although the mown area was also affected by cattle, this situation could occur every year because it is more easily accessible to them. Mowing occurs annually, in late summer. Some months after the fire, the mowing regime was suspended and the swamp was fenced to exclude cattle.

The fence has remained in place, protecting the area during regeneration, and cattle leases in the National Park expired in 1992.

## METHODS

*Hemiphlebia* adults occur at Wilsons Promontory from late November to late February or early March, with their greatest abundance in mid to late January. Visits of one or two days were made in the second half of January each year from 1988-1993. On each occasion, adults were counted along transect lines and in quadrat sweeps at several sites along Five Mile Road (including separate assessment of the burnt and unburnt areas of the main site) and at Cotters Lake, using the same sample sites each year. All counts were made between 1000 and 1500 hours local summer time, in calm weather with intermittent or constant sunshine. Temperatures were always above 20°C, sometimes around 30°C. Access to the deeper parts of the swamp was not possible every year. The number of 'samples' was limited by the small size of the habitats and the risk of disturbance, and data are not strictly reliable for quantitative assessment, but the rationale was to attempt to estimate adult abundance at each site in ways sufficiently standardised that relative changes between years could be indicated. Numbers of each sex were scored separately.

(i) Transects ranged from 10-100 m x 2 m wide, along edges of vegetation and across swamps and open ground (Fig. 5); a pole held horizontally was used to define the width. Adults were counted but not captured or otherwise disturbed while I walked slowly along each line.

(ii) A 60 cm diameter white butterfly net was used to sweep low vegetation (including emergent weeds, mown and unmown grass, low shrubs) to give samples of 20 sq.m. ground area each. Five samples were taken at each of five sites. The wide-mesh net was used in preference to a coarse net bag to avoid damage to the damselflies, and all adults were released immediately at the sample site.

## RESULTS

Numbers of *Hemiphlebia* recorded or captured each year are given in Table I. In contrast to the relatively constant abundance implied for the Cotters Lake (Site A: Fig. 5) and undisturbed Five Mile Road sites (sites B, C) (collectively, 'control sites') over the six seasons of assessment, the burnt site (site E) yielded no individuals for the two seasons after the burn. A few were found in the third season (1990) and numbers increased thereafter.

In the mown (unburnt) area (site D), *Hemiphlebia* numbers were equivalent

Table I

Numbers of *H. mirabilis* in samples at Wilsons Promontory, 1988-1993. Sites lettered as shown in Fig. 5: Site A: Cotters Lake; – B-C: Five Mile Road, unburnt; – D: mown, unburnt part of swamp; – E: burnt part of same swamp

| Localities | Numbers (male : female) in year | | | | | |
|---|---|---|---|---|---|---|
| | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 |
| Transects | | | | | | |
| Site A | 7:1 | 4:0 | 6:2 | 4:1 | 11:2 | 7:3 |
| B | 13:1* | 23:0* | 5:3 | 18:5 | 5:0 | 12:2 |
| C | 13:2* | 36:7* | 11:4 | 26:4 | 32:14 | 16:9 |
| D | 0 | 1:0 | 4:1 | 14:3 | 9:3 | 12:1 |
| E | 0 | 0 | - | 5:2 | - | 8:0 |
| Sweeping | | | | | | |
| Site A | 6:3 | 12:9 | 3:3 | 5:1 | 10:6 | 11:4 |
| B | 14:6 | 18:4 | 4:6 | 22:6 | 19:3 | 31:7 |
| C | 11:6 | 11:8 | 16:6 | 34:9 | 6:0 | 10:6 |
| D | 0 | 2:0 | 3:5 | 19:5 | 11:7 | 16:4 |
| E | 0 | 0 | 7:2 | 8:1 | 8:5 | 15:7 |

* Extrapolated upward from results from shorter transects than later years: perhaps misleadingly high.

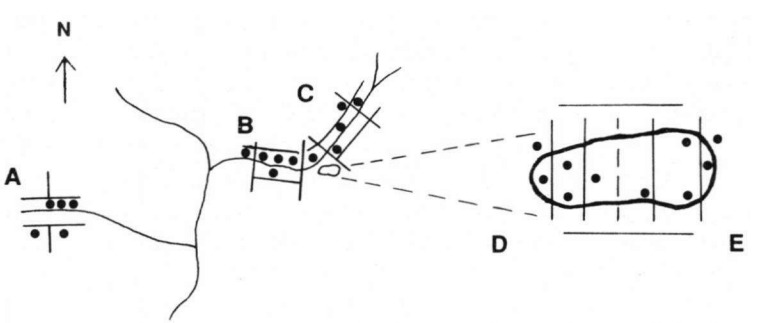



Fig. 5. Sample sites for *H. mirabilis* at Wilsons Promontory 1988-1993 (see Fig. 1 for location). – [A: Cotters Lake; – B-E: Five Mile Road; – B, C: unburnt, D-E: unburnt and burnt areas of same swamp. – [Lines are transect paths; spots are sites of sweep samples].

to those at other sites after four seasons, but were very low before then. The burnt site was slower to recover, but reasonable numbers of *Hemiphlebia* were recorded in 1992 and 1993. Few traces of burning were evident after only two seasons, but *Hemiphlebia* had apparently been eliminated by the burn and had not become re-established by that time.

Apparent densities of *Hemiphlebia* at the control sites were reasonably constant, with differences between Cotters Lake and Five Mile Road similar throughout the period. The Cotters Lake population remained localised, the greatest concentration of individuals (up to 3-5/sweep sample) being near the eastern end of the causeway. Greater densities occurred at Five Mile Road where, despite considerable patchiness, 6-12 individuals were found in some sweep samples. Transect counts confirmed the local distribution of populations and were also 'patchy'. The longest transect (of around 0.6 km) along the mown/unmown vegetation edge on the north side of Five Mile Road yielded 15-46 individuals in different years.

In virtually all samples, males outnumbered females substantially, with an overall bulked sample sex ratio (male:female) of about 4.3:1 (transects) or 2.6:1 (sweeping). Abundance trends of the two sampling methods were reasonably consistent at each site.

## DISCUSSION

Factors contributing to decline of dragonflies are predominantly associated with habitat change, and relatively small changes in exposure or in water level or quality have been implicated as harmful (VAN TOL & VERDONK, 1988), in addition to more extensive wetland drainage and impoundment. The local distribution of *Hemiphlebia* in Victoria at present is attributed to its extinction in parts of the Yarra Valley (and, possibly, elsewhere) through agricultural activities and associated pollution (see DAVIES, 1985), together with modifications of river flow and flooding regimes through dam construction. The species is clearly adapted to some degree of environmental fluctuation, reflected in seasonal drying out of the swamps in which it occurs.

Fire is employed commonly in Australia as a management tool for maintaining early seral stages, promoting germination of fire-adapted flora and to generate high quality vegetation as food for vertebrates, and this practice mimics natural lightning burns. Low intensity control burns are employed widely to reduce ground fuel, but the effects of such burns on ground-dwelling invertebrates, or on those of adjacent waterbodies, possibly subjected to sedimentation or run-off, are unclear.

The burning of an important aquatic habitat is unusual, but may have occurred naturally on numerous previous occasions at Wilsons Promontory. Indeed, the swamp was burned in 1951 and 1957. Cotters Lake has not been burned for

more then 40 years. The 1987 accident afforded an unusual opportunity to address the adverse effects on a significant insect species of a combination of direct destructive effect and increased habitat degradation by cattle and greater exposure.

The initial effect was clearly severe, and *Hemiphlebia* appeared to have been eliminated from the burnt area, as no adults were found there in the next two flight seasons. The subsequent gradual rise in numbers of adults is likely to reflect recolonisation from adjoining or nearby habitat rather than any residual resident population. *Hemiphlebia* is univoltine, and it is unlikely that larvae would have been present at the time of the burn. Unlike many Odonata, *Hemiphlebia* is a very weak flier and rarely moves more than a few metres when it is disturbed, but such short distances could account for the gradual restoration observed. Movement may have been aided by winds, but *Hemiphlebia* tends to 'shelter' during windy weather.

Recovery at the burnt site appeared to be virtually complete after five seasons. *Hemiphlebia* may have endured many such events in its long history, but mostly at times when its habitats were more extensive than they are now and the damselfly was, presumably, less vulnerable. Conservation of *Hemiphlebia*, despite its apparent security in several places, may depend on management and protection of increasingly isolated small areas of habitat.

Implications from the study reported here are:

(1) that careful mosaic habitat change is indeed possible;
(2) that even drastic change to some part of a habitat patch may be countered naturally if there is opportunity for re-colonisation, and the habitat is protected from additional damage and allowed to recover, and
(3) that *Hemiphlebia* cannot otherwise withstand this level of disturbance, so that a more widespread burn might indeed be catastrophic at Wilsons Promontory. Highly localised populations might then succumb.

Mosaic burning may be an important facet of habitat maintenance at Wilsons Promontory, since it is likely that the wetland systems on which *Hemiphlebia* depends could otherwise disappear as the heath progresses to dense scrub by succession. As with mowing, burning might be better employed outside the adult flight season in the belief (but not, yet, established fact) that the aquatic larvae might be less vulnerable. It also seems likely that male *Hemiphlebia* may be much more active than females, as their predominance in samples may not reflect a real departure from unity; if this is so, the females frequenting denser vegetation may be particularly susceptible to burns.

## ACKNOWLEDGEMENTS

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