RECOLONISATION OF LAGOON OF ISLANDS, TASMANIA, BY *BAUMEA ARTHROPHYLLA:* THE FIRST STEP IN REGENERATION OF A UNIQUE ECOSYSTEM?

by Carolyn J. Maxwell and Peter A. Tyler

(with four plates and three text-figures)

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Lagoon of Islands was a unique ecosystem. Damming the lagoon in 1964 caused the decline of the ecosystem, destroying the original vegetation and, eventually, rendering the lagoon eutrophic. While this took place the lagoon was colonised by a macrophyte not previously noticed in the lagoon. In an effort to restore acceptable water quality, restoration of macrophyte cover was encouraged by hydrological manipulation. Recent investigations have revealed that one of the original dominant macrophyte species is recolonising the lagoon, creating an alternative management option for the lagoon.

Key Words: Lagoon of Islands, ecosystem recovery, floating islands, *Baumea arthrophylla*, Tasmania, *Triglochin procera*.

INTRODUCTION

Lagoon of Islands is a small lake [9.17 km² at present water level — the value of 0.89 km² quoted by Tyler (1976a, b) was in error by a factor of 10; average depth 1.3 m] on the Central Plateau of Tasmania. It was once a unique ecosystem. When the lagoon was in its natural condition a cyclical-hydroseral process, unique in mechanism and in participating flora, was enacted upon its surface. The lagoon was covered with a floating mat of intertwined rhizomes of *Baumea arthrophylla* (Nees) Boeckler (formerly *Baumea rubiginosa* (Spreng.) Noeck) and *Chorisandra australis* K. L. Wilson (formerly *C. cymbaria* R.Br.), both members of the Cyperaceae (Wilson 1994). The emergent shoots of the reeds formed a dense cover over the surface of the lagoon. Here and there the mat was colonised by a caespitose sedge, *Carex appressa* R.Br., which in turn, as the sedge clump expanded, was colonised by shrubs and, eventually, trees, forming the eponymous islands. As the biomass of an island increased through accumulation of living and terrestrial plant material, the reed mat was eventually depressed so that a moat formed around the sinking island. The consequent waterlogging led to the death of island flora and the remains of the island accumulated in the resultant pool. The process was described and illustrated by Tyler (1976a, b).

We know of no other example of floating islands produced in this way or by these species though there are reports of floating islands which are formed by partly analogous (but not homologous) processes (Gopal *et al.* 2003, Shimizu 1986, Van Duzer 2004). The fact that one of the colonising shrubs, *Callistemon viridiflorus* (Sims.) D.C., is a Tasmanian endemic species (Curtis 1956, Stones & Curtis 1978) fortifies the uniqueness of Lagoon of Islands.

THE DEMISE OF THE LAGOON OF ISLANDS ECOSYSTEM

In 1964 the lagoon was dammed by the Hydro-Electric Commission (now Hydro Tasmania) with the aim of increasing its ability to provide riparian water and to create a trout fishery. The lagoon became a good trout fishery but was of scant value in fulfilling riparian rights.

After damming, the water level (fig. 1) initially increased but later declined to inadequate values to service riparian demand. Twenty years later, in another attempt to increase

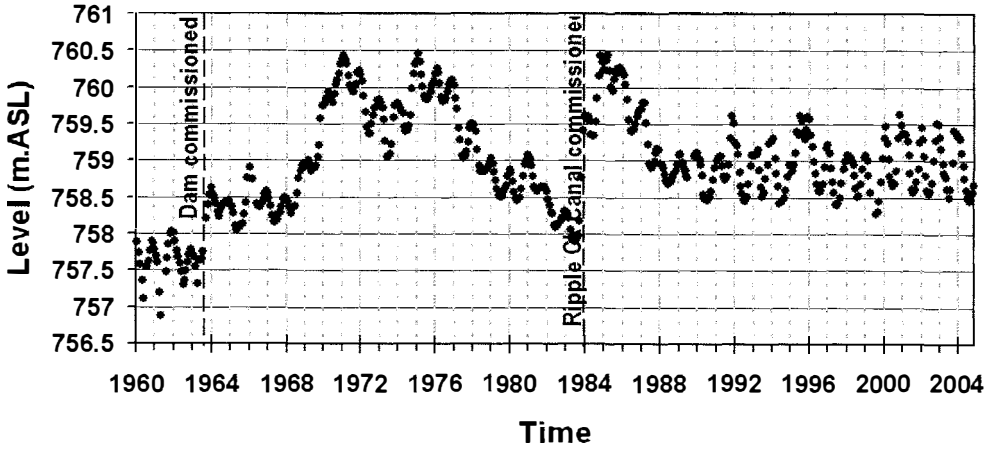

FIG. 1 — Fluctuations in water level between 1961 and 2004 showing the effects of damming and of diversion of Ripple Creek into Lagoon of Islands.

the water available for storage, a canal was constructed to divert the waters of nearby Ripple Creek into the lagoon. With the higher water levels the cover of emergent reeds became ever more sparse and, eventually, the reeds died. The Lagoon of Islands was no longer a swamp with emergent reeds but a lake dotted with the woody remains of island vegetation (Tyler 1976a, b). While these events took place the lagoon was gradually colonised by *Triglochin procera* R.Br. (Juncaginaceae) (the spelling *procerum* is frequently used). As this semi-submerged water plant increased its cover it seemed that it would eventually occupy the entire surface (pl. 1), as the original reeds once did. During 1987 and 1988 the original rhizomatous reed mat broke up and sections of its rotting remains floated to the surface in clumps, strewn along the shore by the wind (pl. 2).

WATER QUALITY ISSUES

The break-up of the reed mat brought the water and sediment strata formerly protected by the mat into circulation in the water column. No nutrient analyses were undertaken but there was the expectation that this would boost the nutrient status of the water column. Whatever the case, water quality declined until it was unfit for irrigation and, concomitantly, the quality of the fishery deteriorated seriously. By 1989 the lagoon was hypereutrophic, with a massive algal bloom (fig. 2). Seen from the air and from space the lagoon shone a brilliant green (see Landsat satellite image in Maxwell 2007). The bloom was not one of blue green algae but, most unusually, almost a monospecific bloom (pl. 3) of the desmid *Staurastrum excavatum* West & West (cf. Thomasson & Tyler 1971).

ATTEMPTS TO RESTORE WATER QUALITY

After the serious decline in water quality observed in 1988, during the period of higher water levels, the Hydro-Electric Commission and Inland Fisheries Commission initiated a number of in-lake and catchment management measures aimed at restoring water quality to acceptable standards for riparian use. These included setting a reduced maximum water level that encouraged the growth of the *Triglochin* in the hope that a dense population of macrophytes would restore equilibrium conditions and favourable water quality (Sanger 1992, 1994). Rea & Ganf (1994a, b) have since shown this was a feasible proposition because the growth of *Triglochin procera* can be directed via a physiological mechanism mediated by water depth. Following the change in operating level some improvement in water quality did occur (Sanger & Bobbi 1992, Sanger *et al.* 1993). However, by 1998 the lagoon was

PLATE 1
Extensive colonisation of Lagoon of Islands by Triglochin procera *(1988).*

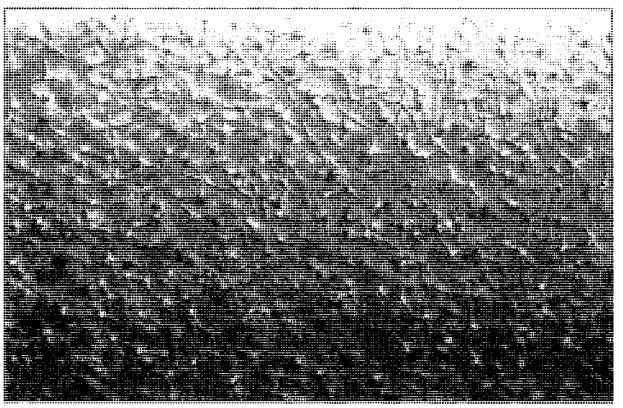

PLATE 3
An almost monospecific bloom of Staurastrum excavatum *in Lagoon of Islands, 1988.*

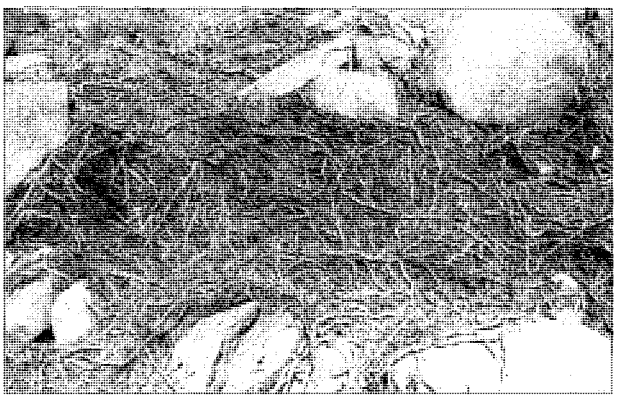

PLATE 2
Decaying rhizomes of Baumea arthrophylla *thrown up on the shoreline as the reed mat broke up (1988).*

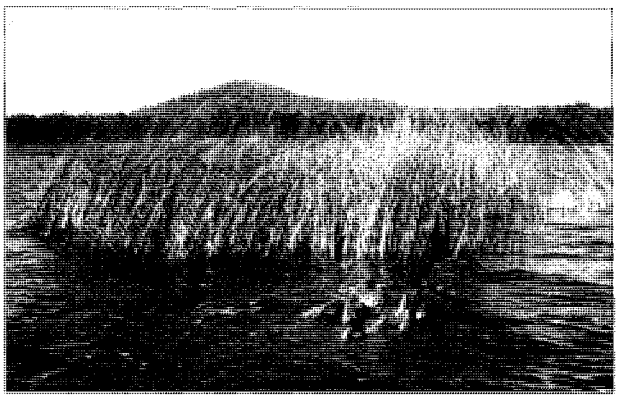

PLATE 4
Recolonisation of Lagoon of Islands by Baumea arthrophylla, *2003. The competing macrophyte* Triglochin procera *is in the foreground.*

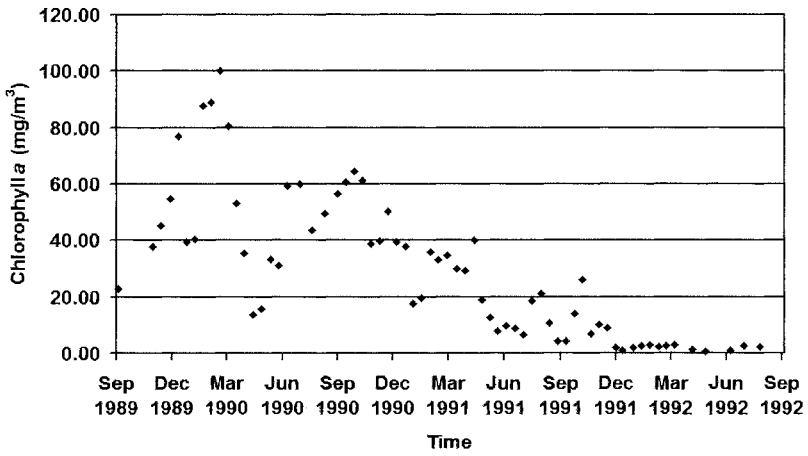

FIG. 2 — Algal biomass (as chlorophyll a) in Lagoon of Islands during the Staurastrum excavatum *bloom, September 1989–September 1992.*

again eutrophic (Maxwell 2007). Renewed investigations into abatement measures were initiated in 2003.

The renewed investigations revealed that *Baumea arthrophylla* has commenced a recolonisation of Lagoon of Islands (pl. 4). Examination of incidental video footage taken over the past decade indicates that recolonisation had commenced at least as early as 1998. At first the regrowth was limited to the western side of the lagoon. A bathymetric survey undertaken in November 2003 failed to locate *Baumea* in the central or eastern portions of the lagoon. However, recent surveys have shown that colonisation by *Baumea* is now widespread, but sporadic (fig. 3), and apparently accelerating.

When the lagoon was in its natural state the emergent reeds that grew all over the lagoon sprouted from a mat of their intertwined rhizomes floating about 1 m below the water surface as a "*schwingmoor*" (Tyler 1976a). It was assumed (Tyler 1976b) that the reeds were rooted in the sediments in the shallow waters of the shoreline and that from this original annulus they had colonised the rest of the lagoon by centripetal spread of their rhizomes, overarching the deeper waters, like a closing iris diaphragm. Such a process, the terrestrialisation of bogs and lakes, is well known in the northern hemisphere (e.g., Tallis 1973) and when the reappearance of *Baumea* was detected in 2003 its restriction to the shallow western rim of the lagoon appeared logical and to be expected. The more recent appearance of clumps of *Baumea* in the deeper, central parts of the lagoon now poses the question of whether the rhizomes are rooted in the sediments or on the remnants of the reed mat. Determination of the circumstances of this sporadic colonisation becomes a priority for the next period

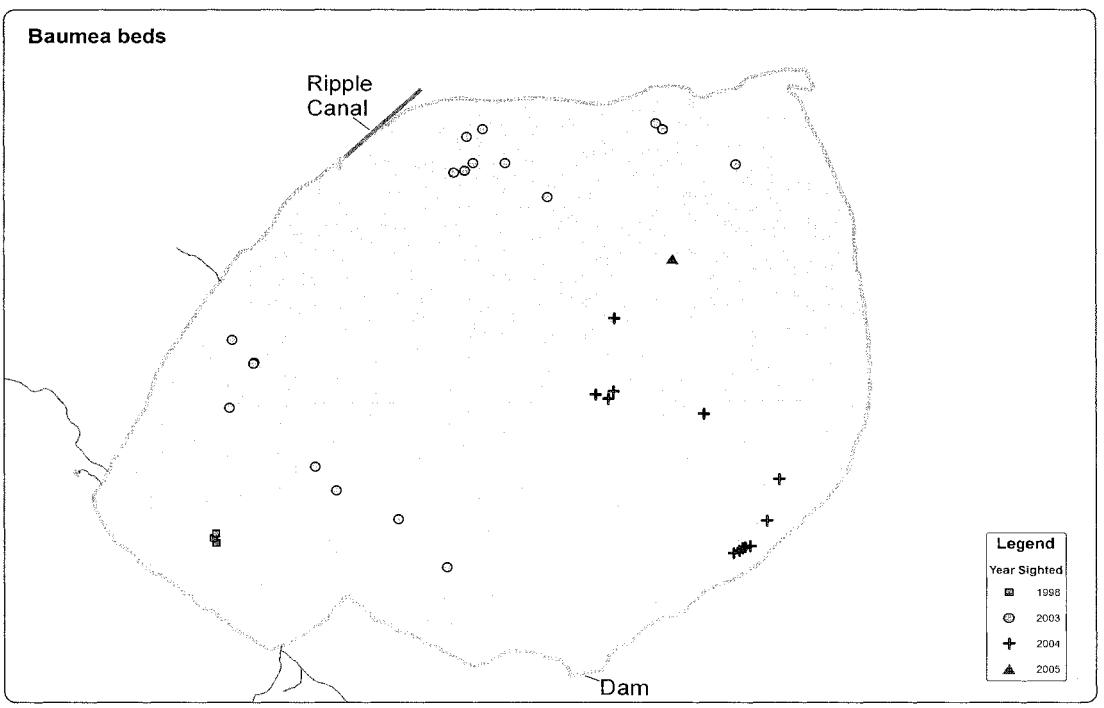

FIG. 3 — Map showing the distribution of Baumea *clumps throughout Lagoon of Islands.*

of low water levels. Continuing investigations suggest that the ecosystem is finely balanced but that the accelerating colonisation by *Baumea* has put the lagoon on a sure path to the desired stability which may be compromised by manipulation that disadvantages *Baumea*.

The reappearance of one element of the original reed bed (*Baumea*) raises the question of whether attempts at restoration of water quality should now be directed towards *Triglochin*, if that were judged to have the greater chance of success, or whether the option of permitting the return of *Baumea* should be taken. The intellectual appeal of the latter is the possibility that the entire hydroseral enactment could once again occur in Lagoon of Islands. For the present, the first step in this direction is the return of *Baumea* after an absence of more than three decades. *Naturam expelles furca, tamen usque recurret* – You may drive out Nature with a pitch fork but she always hastens back (Horace 65–69 BC).

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