The Last Lake

by Stuart Halse

Toolibin has become the focus of a massive effort to prevent yet another wetland from succumbing to salination. Prior to the 1930s and 1940s the northern Arthur River wetlands, east of Narrogin, were swampy freshwater lagoons, which contained extensive thickets of trees and frequently dried out. Now most of them are saline, they fill more frequently, and the trees they contain are long dead. Only Lakes Toolibin, Dulbinning and Walbyring still have living trees. These are healthiest and most dense in Toolibin, which contains thickets of swamp sheoak *(Casuarina obesa)*, paperbarks *(Melaleuca strobophylla)* and occasional flooded gums *(Eucalyptus rudis)*.

The thickets of trees in Lake Toolibin provide nesting sites for a very large number of waterbirds, including ducks, herons and related species, and cormorants.

Because of the extensive area of thickets, more species have been recorded breeding at Toolibin than in any other wetland in south-western Australia.

Historically , Lake Toolibin was a very popular venue for duck shooting because it contained large numbers of ducks and a good mixture of timbered areas and open pools. Shooters were able to get an unimpeded shot across the open pools, where dead birds were easily located after they fell into the water, while surrounding trees provided cover until the birds were within range. However, because of the importance of the lake to the Freckled Duck and other protected species such as the Great Egret *(Egretta alba)*, Yellow-billed Spoonbill *(Platalea flavipes)* and Rufous Night Heron *(Nycticorax caledonicus)*, it was closed to shooting in December 1974.

Public meeting

In the early 1970s it became apparent that, like other northern Arthur River wetlands, Toolibin was being affected by salt. Trees began dying along the western shore and showed a loss of vigour in some other parts of the lake. The process was occurring 30-40 years later in Toolibin than in some of the other Arthur River wetlands, like Taarblin, suggesting that the hydrology of the lake must have some features which make it comparatively resistant to salination. The same applies to Dulbinning and Walbyring, although they are not surviving as well as Toolibin.

The West Australian Field & Game Association and local citizens were very concerned about the decline of Toolibin and organised a public meeting at Narrogin on 25 August, 1976, which was attended by Jim Goodsell and Peter Lambert of the former Department of Fisheries & Wildlife. As a result of the meeting, the Northern Arthur River Wetlands Rehabilitation Committee (NARWRC) was formed to examine ways of reducing the salinity of the lake and to ensure it remained an important breeding area for waterbirds.


R. Compton

Freckled Duck

The NARWRC, which consisted of representatives from relevant Government Departments, finished its study in 1986 and its conclusions are summarised in a recently released report. Various members

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and associates of the committee produced detailed reports on the hydrology, hydrogeology, vegetation and waterbirds of the lake.

The problem

If nothing active is done to control salinity in the Toolibin catchment area, the saline water table will eventually rise above the floor of the lake. This may even happen in spite of remedial action. If it does, and even if it just happens for a brief period, there will be dramatic changes in the ecology of the lake. The reasons for this are explained in the box on p.20. All the trees will die, because of the salinity of the groundwater and also waterlogging.

It is always difficult to make predictions about the exact effects of environmental changes on animals but it can be said with absolute certainty that if the water table rises above the lake bed, fewer than half the 22 species of waterbird that currently breed at Toolibin will continue to do so. Freckled Ducks, Great Egrets, Yellow-billed Spoonbills, Rufous Night Herons, Great Cormorants (*Phalacrocorax carbo*), Great Crested Grebes (*Podiceps cristatus*) and several other species will abandon the lake as a breeding site. There are two reasons for this.

Firstly, the foliage of live trees provides cover to help conceal the nest from predators and protect it from the elements: some of the species require this. Secondly, young ducks, grebes and coots, which leave the nest immediately after hatching and accompany their parents about the lake, must have access to fresh or only slightly brackish water (<5ppt) for drinking. Older birds can be found in very saline water because they can drink it and excrete the salt it contains via their nasal salt glands as well as their kidneys. They also have the ability to fly to fresh water. For the first week or so after young birds hatch, their salt glands are not functional. This, combined with their lack of mobility, means that successful breeding can only occur in wetlands that are either comparatively fresh **at the time of breeding** or have pockets of fresh water, as a result of seepages or some other phenomenon, where the young can drink.

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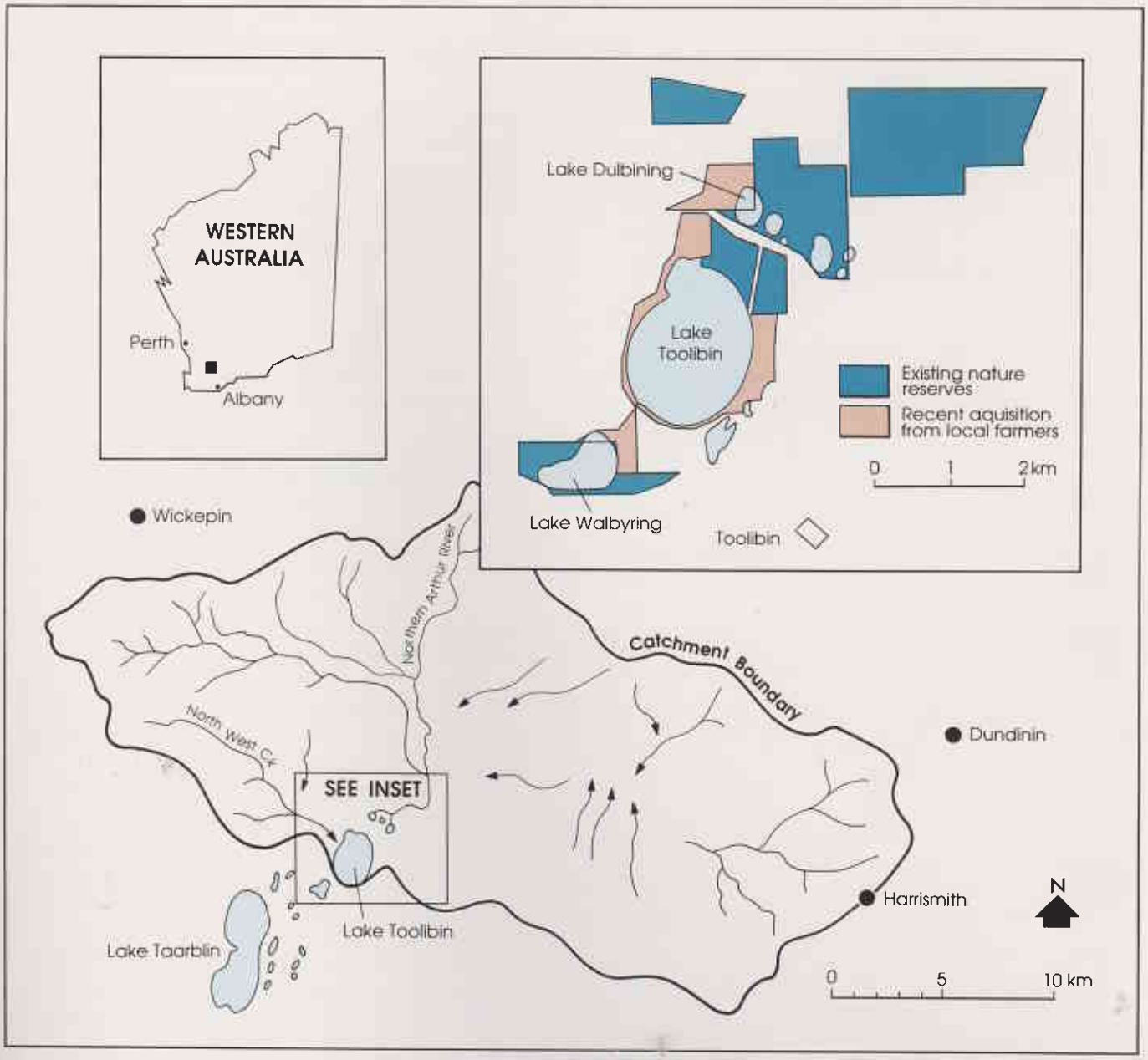

Juvenile Rufous Night Heron

J. Lochman

Causes of salinity in the Wheatbelt

What are the causes of salination in wheatbelt wetlands? Firstly, all rain contains a very small amount of salt. Over geological time this adds up, so that actually very large quantities of salt have been deposited on the wheatbelt landscape. Because rainfall is too low in the wheatbelt (it is 420 mm a year in the Toolibin area) to leach the salt into the underlying water table, it has accumulated in the soil profile.

Secondly, native vegetation transpires far more water during the course of a year than pastures and crops do. This is chiefly because pastures and crops die off in summer, whereas native vegetation continues to grow. Deep-rooted native trees remove moisture from the soil to a considerable depth as they provide themselves with water for transpiration. When native vegetation is cleared, less soil water is used. As a result more water moves down into the water table and groundwater levels rise.

It can take more than 30 years for groundwater levels to stop rising after a catchment area has been cleared. About one-third of the catchment area of Lake Toolibin was cleared by the 1930s, the remainder was cleared in the 1940s and 1950s. The water table has risen 12-15 metres as a result and is now within 1-2 metres of the lake bed. Salt that was stored quite deep in the soil profile is now dissolved in the groundwater, which is almost as salty as seawater. It is quite probable that the water table in the Toolibin catchment will continue to rise for several more years. A rising water table can cause salination in two ways. Firstly, since wetlands usually occur in the lower parts of the landscape, if the water table rises far enough it will come through the floor of the wetland, which will then become what is called 'a surface expression of groundwater level'. In other words, the water in the wetland will be groundwater rather than surface run-off, and will be saline. This dramatically changes the ecological character of the wetland.

The second way in which salination can occur, as has been happening at Lake Toolibin, is that the surface run-off into a wetland from agricultural areas becomes saline. This happens as low-lying farmland becomes salt-affected because of the water table rising close to the surface. In summer, salty water percolates through to the surface, where the water evaporates and salt is deposited. The salt is washed into the wetlands as surface run-off after rain. In this situation salinities are lower than when groundwater rises above the floor of the wetland; surface run-off wetlands usually remain brackish rather than becoming saline.

Clearing of native vegetation has also increased the quantity of surface run-off flowing into wetlands in the wheatbelt. This has led to the wetlands filling more frequently and, in some cases, they may hold water through summer, even when they are situated well above the water table.

A final point is that just like surface run-off lakes, the water table shows seasonal (and annual) fluctuations in level according to the amount of rainfall. For this reason, although lakes with a groundwater connection show less variation in level than surface run-off lakes, their water level does vary and they dry out if the groundwater level drops below the lake floor.

Different plant species can tolerate different levels of salinity and inundation. Many aquatic plants can withstand salinities greater than that of seawater and, of course, permanent immersion in water. However, no tree species can survive permanent flooding and not many can tolerate very salty water (mangroves are the best known exception).

Of the species growing at Toolibin the swamp sheoak is the most tolerant of salinity and inundation but it cannot withstand prolonged exposure to soil or water salinities >10 ppt (parts per thousand). The usual biological classification of water salinity is that <3 ppt is fresh, 3-10 ppt is brackish and >10 ppt is saline. Seawater is about 35 ppt.

Currently the salinity of water in Toolibin varies from <1ppt in winters when there is a lot of run-off and the lake is full to >10 ppt in the shallow pools remaining in the lake just before it dries out in the summers when it does so. Water flowing into the lake in the middle of winter is usually fresh (<1 ppt) but it can be quite saline (>10 ppt) during small flows at the beginning of winter and in spring when there is a lot of salt on the soil surface in the catchment. The salinity of the soil of the lake bed varies from about 1-3 ppt in most of Toolibin to 30 ppt on parts of the western shore where all trees have died.

This would lead to the death of more trees (although perhaps not all the trees) in the lake and would reduce both the number of species breeding and the number of pairs of many of the breeding species. In addition, as cover is lost and water salinity increases, the proportion of young hatched that are actually raised to fledgling stage would probably be reduced quite substantially. Thus, while the effect of an increase in saline surface run-off will not be as dramatic as the effect of a rising saline water table, it would nevertheless substantially reduce total waterbird population and probably prevent breeding by the species with the most salt-sensitive young.

Saving Lake Toolibin

There is no cheap or easy way to prevent the level of salinity in Toolibin increasing. If the water table continues to rise the only short-term method of saving the lake is pumping groundwater from under it, thus lowering the water table. As a first step, the NARWRC advised installing groundwater pumps along the western side of the lake. Currently, a trial pump is operating, which is discharging into areas that have already been damaged past repair by salt. As a second step, the NARWRC recommended that CALM buy a 200 m wide band of land on the western side of the lake from the adjacent farmer and plant trees. A transaction was recently completed adding 128 ha to the Lake Toolibin Nature Reserve, which now completely surrounds the Lake. Once planted, the trees will increase the transpiration rate locally and, therefore, act as a biological pumping scheme to lower the water table (the trees growing in the lake are one, too). The biological pump has

M. Lochman

W. Hughes/Lochman Transparencies

The Musk Duck is found in Lake Toolibin when it is full (top). Yellow-billed Spoonbill (right).

the advantage that the water is lost to the atmosphere instead of needing to be discharged downstream. The third step was to construct a drain to divert salt flows from the lake to the downstream areas.

In the long-term, good land management by farmers is an essential adjunct to pumping and tree planting around the lake if Toolibin is to remain a viable waterbird habitat. It is important that farmers prevent an increase in the amount of salt-affected land on their properties and re-vegetate areas that are already salt-scalded. This should keep the salinity of surface run-off in the catchment at its present level, or perhaps even reduce it. Unless the salinity of surface run-off is controlled, most vegetation in the lake will die in spite of pumping to drop the level of the water table.

It was farmers' earlier concerns with the problems of soil salinity, waterlogging and flooding on the flat farmland near Lake Toolibin which led to the formation of the Wickepin Soil Conservation District in 1985. What followed was a remarkable community effort: 569 ha of salt-affected land on eight farms was rehabilitated and the ABC National Tree Care Award was won. With the Department of Agriculture, Greening Australia, Alcoa, Wickepin Shire, local schools and farmers cooperating in a Commonwealth Employment Scheme project, 60 000 trees were planted and protected by 34 km of fencing, which was erected by farmers on a cost-share basis CALM has also planted 9 000 trees on Dulbinning Lake Nature Reserve to complement this work.

The Toolibin flats project has been a valuable lesson for all, emphasising the enormity of the task and pioneering detailed and advanced techniques for salinity rehabilitation. It is now being extended to the whole catchment involving all 50 farmers in the 500 sq km area which drains into Lake Toolibin.

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Why Save Lake Toolibin?

Having explained the causes of salinity in Toolibin, its consequences, and how difficult the situation is to remedy, it is necessary to emphasise why it is worth spending so much effort to save the Lake. There are two reasons. The first reason is waterbird conservation. Toolibin is special: it supports the greatest number of breeding species of any surveyed wetland in south-western Australia. Lakes with a large number of breeding species are very rare: of the 251 wetland nature reserves surveyed by the Royal Australasian Ornithologists Union between 1981-85 on which birds were found, 44% of them had no breeding species, 35% had from one to four breeding species, 17% from five to ten and only 4% had greater than ten breeding species. Toolibin had 22. The second reason is aesthetic: Toolibin is probably the most attractive lake in the wheatbelt (it is the last viable swamp sheoak wetland) and provides scenic variety in an area that consists mostly of farms and salt lakes.

Without breeding areas, populations of waterbirds in the South-west will rapidly disappear. Toolibin is one of the few areas in the South-west where such attractive species as the Great Egret and Great Crested Grebe nest and is the stronghold of the Freckled Duck. However, its importance is not limited to having several comparatively rare breeding species; it is equally important as a site where large numbers of several common species breed and are able to raise their young with a high success rate.

The existence of such high quality waterbird 'nurseries' is essential to maintaining a profusion of waterbirds in the South-west. Highly productive wetlands, however, are just as rare as wetlands with a high diversity of species. The outstanding value of Toolibin is that it possesses both attributes.

Lake Toolibin seen from the south-west corner.

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EDITORIAL

Anybody who reads tourist brochures in this State will appreciate that the tourist industry is, to a large extent, dependent on natural features and wildlife for its 'product'. Many people who are concerned with the natural environment are antagonistic to tourism, and it is certainly true that in the past there have been some insensitive tourist developments in the State. But, just as the farming community over the past ten years has become one of the greatest allies of conservation, so, increasingly, is the tourist industry. For example, in a recently published tourist industry report on tourism in the Kimberley, the need to preserve this environment was given top priority.

This report is indicative of the growing awareness in that industry of the symbiotic relationship between tourism and the protection and maintainance of our unique flora, fauna and landscapes. Rather than being despoilers, the tourist industry has the potential to become one of the strongest advocates for conservation in the broadest sense.

There is a great potential for synergism between those interested in the science of conservation and the tourist industry. One of the ways by which the tourist potential of any natural area can be enhanced without any cost to the environment is by providing information to the visitors on the natural science that makes that area special.

Landscope is one avenue by which we are attempting to provide an added dimension to the 'look it's lovely' tourist experience. Interestingly, while *Landscope* receives almost universal acclaim from the general public, there is ongoing, often vigorous, internal debate about how technical we should make the magazine. We would appreciate your views.

Cover Photo

'Now, just how do I find my way out of this Renoir landscape?'
Photographer **Richard Woldendorp** captured this lizard taking a sighting.