Landnote

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TYPHA (BULRUSH) MANAGEMENT

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BACKGROUND

There are many issues involved with bulrush management. These vary from community concern about lakes becoming dominated by bulrush, impact on wading bird habitat, loss of vegetation diversity and the fire risk during summer months with fire contributing to fringing vegetation loss.

In 1983, when work on bulrush management started, information was required on techniques for control on wetland nature reserves, the interaction between bulrush and midge larvae, and the plant's role in the nutrient balance of a wetland.

Most of the wetlands discussed in this document are on the Swan Coastal Plain - Western Australia.

GROWTH CYCLE

The growth cycle of *Typha* varies between sites but the basic pattern is:

- The plants start to come out of dormancy following the onset of winter rains.
- As temperatures increase in spring, there is rapid growth.
- Flowering occurs from November to January.
- Seed dispersal takes place in February and March.
- As the wetland dries out the plants die off, leading to large areas of dry *Typha* stands in mid to late summer.

ESTABLISHMENT

Typha spreads by two mechanisms.

Seeding Establishment

Each mature seed head of the bulrush contains in the vicinity of 300,000 seeds which are widely dispersed by wind. However there are few examples of large areas being colonised by seedlings.

Observations at Lake Forrestdale indicate that extensive seedling establishment on the drying lake bed is followed by very heavy mortality during the winter flooding of the lake.

Rhizome Growth

A very successful way in which bulrush becomes established is through shoot development from a gradually extending rhizome system. In mature stands the root mass becomes a dense mat. At Lake Forrestdale this mat is about 10 centimetres below the substrate surface.

Wetlands that seasonally dry out seem to favour the establishment of the bulrush. This is noted from observation of Lakes Kogolup, Thomsons and Herdsman.

Prior to 1988 Kogolup was a *Typha* dominated wetland but the depth of the water and the period of inundation of the *Typha* stands increased between 1988 and 1990. Most of the bulrush stands had disappeared at the end of that period.

At Thomsons Lake it appeared that in 1990 water was remaining in the lake for a longer period than previously. By September 1990 the fringing rush and bulrush beds were retreating and thinning out. Most noticeable was the impact on bulrush.

Mature stands of *Typha* tolerate water depths to 2 metres but around 30 cm is optimum. *Typha* is known to form floating mats in deep water lakes such as Lake Kununurra in the Kimberley.

Factors which research has shown to influence seedling survival, and may affect the 'health' and spread of a mature *Typha* stand include:

- water quality - turbidity, nutrient loading, salinity.
- water quantity - depth, period of inundation, flow.
- substrate structure - soil type, chemical composition, oxygen levels.
- light penetration - cover from vegetation, tannin levels in the water.

REASONS FOR CONTROL

The need to control *Typha* is due to its fire risk, its spread at the expense of native species and the need to be able to manage it to maintain waterbird habitat diversity.

Fire

On the seasonally inundated wetlands of the south west of Western Australia there is a time during summer when the above ground section of the plant dries

out. This material burns easily and fires can be quite intense. Fires lead to the loss of native vegetation where distributions overlap.

The native plants of most identifiable concern are paperbarks (*Melaleuca sp.*) with the loss of trees and thickets due to death of the plants. The cycle is that *Typha* spreads into the edge of the stands of paperbarks, there are fires, loss of vegetation, and further bulrush spread.

The objectives of control would be to prevent the spread of fires and to separate the native species from the *Typha*.

Protection of Species Diversity

As well as too frequent fire, inter species competition reduces species diversity. There is a tendency for *Typha* to become dominant.

Work is required on the relationship between *Typha* and other plant species as well as the identification of the characteristics of the habitat which favours *Typha* and the resultant distribution patterns. There are locations (eg. Loch McNess - Yanchep National Park) where a balance is achieved between bulrush and other plants (eg. *Baumea articulata*).

Waterbird Habitat Enhancement

Through bulrush management the availability of waterbird habitat for feeding, resting and nesting might be maximised. Islands of *Typha*, secluded waterways and large open bodies of water is one example.

Aesthetics

In certain areas it is justified to maintain corridors through the *Typha*. This may be for open water views, access to the water body or for bird watching.

OPTIONS FOR CONTROL

Control methods available are:

1) Alteration of water levels by increasing the depth of water and period of inundation.

   This can be achieved by physically deepening wetlands, pumping water in, preventing wetlands from draining, and managing drain inputs.

   Water level management is an option for wetlands such as Thomsons Lake and Herdsman Lake, however the total environmental impact needs to be investigated.

2) Providing a competitive advantage to other plants through rehabilitation programs.

An example is found at Herdsman Lake where an area adjacent to the Wildlife Study Centre had fire excluded for 9 years. The result is the rapid growth and spread of the swamp paperbark *Melaleuca rhaphiophylla*. The bulrush does not grow under the closed canopy of these paperbarks. This may be due to some form of allelopathy and/or competition for light.

3) Grazing.

There are examples where cattle and pigs have removed *Typha* from wetlands. Trampling by horses has also had some effect.

4) Chemical control through the use of herbicides.

5) Mechanical control.

a) **Hand held tools**

Traditional tools used for centuries in Europe include: scythe, sickles, grass hooks, rakes, forks, chain scythes, chain knifes and increasing use of mechanised forms of the above.

b) **Weed-cutting Boats**

First developed soon after the First World War. This technique has been the subject of development work by CALM and is discussed in more detail below.

c) **Harvesters**

An increase in the eutrophication of wetlands has led to an interest in the harvesting and use of aquatic vegetation. Problems have been associated with the economic application of this technique.

d) **Cultivation**

Ploughing, ripping of mature stands and seedlings appears to be an effective control where it can be applied. For mature stands the cultivation needs to penetrate to the complete depth of root mass, and cause major disruption.

INVESTIGATION OF CONTROL METHODS

The control and management of bulrush can involve both seedlings and mature stands.

Indications are that good control of seedlings can be achieved by dragging a metal bar or mesh over the area. Concerns regarding the type of machinery operating on the lake bed need to be kept in mind.

Three options for mature stands were considered:

Cultivation

An acceptable method where it has traditionally been used or where evidence supports its use. For Benger Swamp this continues to be an applicable control technique. For most other areas it is not considered an option because of the lack of wider environmental impact data.

Herbicide

The Western Australian Department of Agriculture has suggested the use of Amitrole sprayed at the rate of 1 litre per 100 litres of water plus wetting agent, as a control method for *Typha*.

In this assessment herbicide use was not considered because of concerns over the impact on the aquatic ecosystem of high conservation value areas.

Cutting Below the Water-line

The effectiveness of this technique has been the subject of overseas studies. Sale and Wetzel (1983) discussed the effects of cutting as follows:

> "Container and field experiments, in which *Typha latifolia* and *Typha angustifolia* were cut either above or below the water level, were conducted to determine the physiological basis for reports that the latter treatment was more effective as a control measure. In containers, measurements of oxygen concentrations within the aerenchyma of the rhizome both with an oxygen electrode and by gas chromatography showed that oxygen could diffuse very readily to plant parts growing in an anoxic environment if there was a small amount of leaf or cut plant stem growing above the water level. When all shoots were cut below water, the oxygen in submersed plant parts was rapidly consumed and anaerobic respiration resulted in the production of ethanol. .... The below-water biomass decayed rapidly under these conditions and the plants had much lower regenerative ability than plants cut above water where oxygen continued to reach the roots and rhizomes. In the field, three cuts during the growing season below water were sufficient to kill nearly all the underwater biomass; similar cuts above water reduced total biomass compared with uncut plants, but much of the underwater biomass remained healthy and able to regenerate."

A trial hand cutting operation was carried out at Forrestdale Lake in October 1985, using machetes and cutting as far below the water level as was possible. Four years later two sites where cutting had been done were still relatively free of bulrushes. A third site had returned to its pre-cutting density.

Hand cutting proved to be highly labour intensive, and the experience led to a further test carried out with an attachment to a hand-held, motorised 'whipper snipper'. This proved to be a failure with the bite of the blade being too narrow to cut through the mature green *Typha* and the motor being under-powered.

With the positive results from the initial hand cutting tests and the continued interest in finding a suitable control, it was decided to begin the construction of a bulrush cutting boat.

Many craft which have been developed in other parts of the world are large and cumbersome and are permanently in the water or are transported with difficulty.

A craft was designed which was light and easily transportable.

The design characteristics of the craft included:

- 16 foot aluminium punt with extra buoyancy tanks welded to each side. This provided a very stable working platform.
- Front mounted, 2 metre hydraulically driven, reciprocating mower blade which could be raised or lowered hydraulically.
- Propulsion by 2 electric outboard motors.
- Single operator centrally placed in the craft.
- Power for hydraulics and electricity supply from a 5 hp Honda motor.

Although the mower blade was successful, its efficiency was affected by the density of the stands and the thickness of the *Typha* stems. Propulsion also proved a problem with a lack of power to push into the stands of bulrush and frequent fouling of the blades and shafts. Electric motors burnt out.

Craft developed overseas employ slow moving paddle wheels. Fast moving machinery, such as propeller shafts, quickly foul.

A further modification involved an outboard motor fitted with a jet propulsion unit. This suffered the same problems of shafts and intake getting fouled with material and the cooling system being blocked. It appears that design changes may overcome these problems.

A major problem is the density of the *Typha* stands. They are often made up of dead material which has accumulated from previous years. Where stands of new growth only have been cut the boat performs well (Yangebup Lake, North Lake).

The craft also does a good job around the periphery of existing stands allowing the spread to be stopped.

Evidence suggests that late spring cutting is less effective than early spring. The best approach is to use the boat as early in the growing phase as is possible.

Another problem which arises into summer is the growth of other aquatic vegetation, which fouls propellers and affects cutting efficiency.

FUTURE ALTERNATIVES

Controls adopted depend on the management objectives of the area and the tolerable level of impact of the control technique. Cost effective solutions must be developed on a case-by-case basis.

Much of the development of controls overseas have applied to permanent bodies of water. There is more operational latitude available for the seasonal wetlands of Western Australia.

A range of techniques need to be investigated. If large areas of mature stands are to be controlled then the use of the boat alone is not the most effective approach. The best approach is to first thin out the stands.

Various methods are available for thinning *Typha* stands:

Fire

An option is to burn the beds of bulrush and then cut the new growth below the water at the time of flooding. A time frame would be to burn at the onset of good opening winter rains and then begin cutting new growth later the same year.

It has been noticed that dense stands will burn after a few days of fine weather in winter even though water is present. Hot burns would remove more material but the risk to fringing vegetation and operational personnel is significant. Some preparation may be required to break large stands into manageable sizes.

The burning program would depend on the amount to be burnt and the season. Some consideration should be given to the likelihood of birds nesting in the stands (eg. reed warbler, little grass bird).

Burning should also be judged against whether other species of reed which might be considered to be 'natural' are present. For example, at Thomsons Lake both *Typha* and *Baumea* are present. Little is known as to the effect of fire on *Baumea*. There may be an argument to use fire in any case to improve the strategic break up of the stands of the bulrush and the rush.

This technique would be immediately applicable to Forrestdale Lake. This would improve fire control and even without considering cutting, there may be some benefit in burning several blocks of *Typha* for this purpose.

Dry Cutting

One suggestion is to rotary slash stands to lake bed level immediately prior to the onset of winter rains to see if anaerobic breakdown occurs prior to the start of the growth period. This technique might also be applicable to areas where partial or complete water level control is possible.

If the slashing does not prevent the new growth it will at least facilitate the operation of the boat.

To be borne in mind regarding the use of machinery on a lake bed, is the impact of compaction of the substrate. It has been observed that *Typha* seedling establishment is favoured in wheel ruts on lake beds, in all likelihood because airborne seeds collect there.

Slashing should certainly be considered where *Typha* as a single species is spreading into paperbark stands.

OVERVIEW

Eradication

The majority of calls for the large scale control of *Typha* appear to be associated with human perceptions rather than meeting defined environmental criteria.

The idea of total eradication of the plant from wetlands mainly comes from those who believe that it is aesthetically unpleasing or poses a severe fire risk to private properties. This justification then draws on the unsubstantiated concern that the bulrush provides habitat for nuisance species (eg. midge) and the acknowledged concern that wading bird habitat is being, or has the potential to be, lost.

It is considered that in those wetlands where the bulrush is well established total eradication is not feasible or, in a number of cases, desirable. It is best to prevent it becoming established in the first place.

Equally, it should be noted that controls (apart from water level modification) may need to be ongoing because of the reintroduction of seed from other areas and the spread by rhizomes from existing stands.

The main precursor to the control of seedling establishment in areas under the management control of CALM is to monitor the spread and survival of the seedlings.

Whilst the spread of *Typha* poses a potential risk to wading bird habitat, the only area known where a change in previous management has the greatest possibility for the rapid loss of this habitat is at Benger Swamp. Continued cultivation is able to maintain the status quo.

Research

The aims contained in a proposal put to CALM in April 1990 by researchers from Murdoch University, indicate the types of questions to be addressed:

1) Ascertain the extent of the *Typha* problem on the Swan Coastal Plain, the distribution of *T. domingensis* and *T. orientalis* and their current status at all major metropolitan wetlands.

2) Determine the effectiveness of the cutting technique on *Typha* at selected wetlands using small scale field experiments established by hand.

3) Determine how habitat variables such as water regime, nutrients, sediment type and light availability influence the effectiveness of the cutting technique by considering these variables in the selection of field experiment sites.

4) Determine what type of macroinvertebrate communities are associated with stands of *Typha* and how similar or different these are to the communities present within stands of *Baumea* or nearby open water.

5) Ascertain the effect cutting has on macroinvertebrate communities.

6) Monitor the effectiveness of CALM's cutting machine at selected wetlands in field experiments and normal operations, and investigate its potential for integration with other control techniques, eg. herbicides and fire.

7) Examine directly the effects of cutting on *Typha orientalis* under controlled glasshouse conditions to accurately assess the species response in terms of internal oxygen supply and rhizome degeneration.

8) Integrate data from the above investigations into management recommendations aimed at maximizing the efficiency and flexibility, and minimizing the environmental impact of the cutting technique.

Other questions might relate to:

- Studies on the optimum balance of *Typha* to maximize water bird habitat.
- Interaction with other species of rush, etc.
- Studies on changing the water regime as a control method. Interac tion between the plant and the nutrient balance of a wetland.

There is some research currently under way by Murdoch University (Western Australia). Examples of this research are water regime alteration research by A McComb and R Froend, and macroinvertebrate communities within *Typha* and *Baumea* stands by J Davis.

There are important questions on control methods to be answered through correctly structured trials.

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