TRENDS IN AQUATIC WEED CONTROL ON HYDRO-STATIONS

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Summary

This paper reviews the experience gained up to nearly the end of the 1969 weed season on the Waikato hydro lakes. The art of mechanically controlling aquatic weed throughout the world and in New Zealand has yet to reach a stage where it can be completely relied on. Chemical and biological controls also have disadvantages. The forces of nature are so formidable and the total length of shoreline for eight lakes so great that the only effective means of control appears to be by natural forces. Environment control, both in a limited and more forceful form, holds the best prospects. Complete co-ordination of all aquatic facilities will be needed for the best to be obtained from the hydro lakes. New Zealand has a very large monetary stake (\$130,136,609) in the Waikato hydro chain; this cannot be jeopardized by weed. The views expressed by the writer are not necessarily those of his Department.

"MENACE" CHARACTERISTICS

For the 1968 weed season, the greatest potential menace was hornwort (*Ceratophyllum demersum*). Three stations, Ohakuri, Atiamuri and Whakamaru, were likely to be infested (Fig. 1) at any time over the months December to June. Ohakuri was let off lightly, but Atiamuri had a persistent influx (Fig. 2). A twenty-four hour vigil and an around-the-clock clearing of the screens kept the screens from collapse, but the station output was seriously affected.

Whakamaru remained quiet until June when wind and water combined, caused four acres of thickly packed hornwort to be caught on the boom. 1,000 tons was removed in four days. The station was reduced in load but no damage was done.

Ohakuri suffered later in February, 1969, after four years of relative quiet, when a strong east-south-east wind drove the hornwort under and over the boom, causing a three-day 50% drop in output.

Hornwort has established itself as a weed of high nuisance value.

Further upstream at Aratiatia, after surviving a peak of 210 cu. yd/week, a month previously, this station found that the massive intake screens had been seriously bent, and three sections had been forced into the surge chamber tunnel — an ideal textbook example of the power of unbalanced water pressure.

From 1966 to 1968 the predominant weed variety had changed from *Canadian pondweed* (*Elodia canadensis*) to lagarosiphon (*Lagarosiphon major*). Lagarosiphon, predominant only in Aratiatia, and second in place to hornwort in other waters as regards virility of growth, had shown itself to be just as perilous. This has also been found in Rotorua, where great beds will break loose during storms or lake disturbances. Lagarosiphon is also a weed of high nuisance value.

FIG. 1: Waikato River Electric Power Development, locale and weed types (based on Internal Affairs Dept., Lands and Survey Dept., 1966, 1968).

Downstream at Lake Maraetai, all was quiet for 1968, but in July, 1968, the first ominous reports of floating hornwort were reported.

Lake Maraetai is the most interesting weed study lake at the moment. Four weed types are competing for dominance — Canadian pondweed, long established, lagarosiphon as a minority, hornwort moving downstream and egeria (*Egeria densa*) moving upstream by some means.

Maraetai I has submerged intakes 180 ft down, and, if weed finds its way to these, serious trouble is envisaged.

Maraetai II is a conventional surface screen station and will need attention if weed is still present at its opening.

In all, Maraetai, Waipapa, Arapuni and Karapiro have been (from existing records) Canadian pondweed lakes. Arapuni and Karapiro have been weed conscious over the years (Widgery, 1966) with Karapiro having free-falling weed choppers to deal with the weed. Old Arapuni hands can remember weed beds in front of the screens solid enough for a man to walk on. No identification has been made, however.

Both Arapuni and Karapiro can be said to have survived the years, and over the last five years had little trouble. Mention has been heard from overseas that Canadian pondweed has a 5- to 10-year growth cycle. Canadian pondweed can be said to be a weed of limited nuisance value.

Gradually working its way upstream from the dam at Karapiro is egeria. This weed has closed down a sailing boat club at Huntly.

After the experience of Aratiatia with lagarosiphon, a close watch is being kept at Karapiro for trouble. Over two seasons, although luxurious beds of it exist immediately upstream of the dam, no reports are returned of it finding its way on to the screens. A few small pieces were collected on cooling water screens. On this evidence, egeria appears from the hydro-electric generation point of view, to be worth while. Given that weed is necessary to keep the balance for marine life, then the deliberate establishment of egeria might be justified. It seems on present trends there might not be any choice, as, from a slight growth at the Mangakino landing in 1966, it is predominant over all the other types existing in Lake Maraetai, and extends now for about 100 acres (Table 1).

The density of the beds at Mangakino are such that they are stifling swimming, boating and sailing. Hornwort can at least be destroyed by de-watering when cornered.

The rooted egeria might be a different proposition. The resurgence of the egeria beds at Maraetai for the 1970 season will be watched with great interest, as during February, 1969, this lake was lowered 30 ft for a considerable time, for construction purposes.

One cannot say egeria is safe, as all aquatic weeds are a potential source of peril. Another weed likely to become a nuisance is *Ludwigia peploides* ssp. *montevidensis*. This is firmly established in the Lower Waikato.

TABLE 1: LAKE MARAETAI: WEED TYPES

Area No.	Left Bank			Right Bank			
	Acres (1968)	Weed (1968)	Weed (1966)	Area No.	Acres (1968)	Weed (1968)	Weed (1966)
1	76.8	Ecab	Adeh	1A	31.1	Eac	Abdg
2	45.4	Cab	Ac	2A	70.5	Cab	Abdg

Total area weed: 234.6 acres. Lake area: 1,248 acres.

Egeria: 1966, 1 acre; 1968, 108 acres.

Salvinia (*Salvinia natans*) is reported in Western Springs and at Auckland. It has also been seen in several private ponds within reach of the hydro lakes. This is the weed of Lake Kariba fame.

ENVIRONMENT CONTROL

HORNWORT

Arber (1920) has said that "In the genus *Ceratophyllum* the aquatic habit seems to have reached its ultimate expression". It is a plant with no roots and, although there is a radicle in the embryo, it never develops (Carr, 1967).

How to eradicate and control this weed that has such a range of growing habits — in mud 20 ft down, in amongst other aquatic weeds, attached to submerged trees in fast-flowing water?

Poison a shallow bay full of the weed, and immediately it will be seeded again from pieces broken off in the fast-flowing water. It is so brittle that wherever there is hornwort the natural movements of water cause small pieces to be floating, and its presence can be detected by these pieces alone.

The only chink in its armour visible at the moment is the fact that it floats and has no roots. With suitable wind conditions, it will be blown into the lake shallows. If the water can be dropped while the weed is pinned against the shore, then the wind and sunshine will soon dry out the weed, like water, in blotting paper. An aquatic plant is particularly prone to this treatment. De-watering can be substantial or limited. If a 15 ft drop can be tolerated, then this gets well into the natural habitat zone. Some of the weed remains untouched as it floats down with the water. However, given plenty of submerged debris, a good kill is assured. With hornwort it is a kill to the death, as it has no roots to regenerate from.

Nature has unfortunately given hornwort a good protection against eradication by this means, as there is always a piece left in the water. Its resurgence rate appears to be very fast.

LIMITED LOWERING

Limited lowering can be resorted to. This forces hornwort down into the lake by, say, a 5 ft drop in water level during the peak growing period. When the time is ripe, the water is raised again and the weed has to readjust itself. When it again breaks surface and has reached the break-away stage, the water can be lowered and raised in cycles and continuous attrition of the weed maintained.

De-watering is the only way that every bay, every submerged tree, and every inlet can be searched out with existing hydro equipment, and the established staff.

By de-watering and planned cycling, the maintenance engineer can make his presence felt in every nook and cranny. He is then able to concentrate on the ever-pressing problem of keeping the plant running.

1969 SEASON

During December of 1968, decisions had to be made for the safety of the six stations that were obviously to be affected by weed. Waipapa and Maraetai lakes at this stage had a full bloom of hornwort in addition to the stations of 1968.

Limited lowering (4 ft) of Atiamuri in 1968 had proved the de-watering technique. A world-wide search for reliable mechanical equipment had produced no magic wands although worthwhile leads had been noted.

Fortunately, in conjunction with the lowering of Lakes Maraetai and Waipapa for construction purposes, each affected lake was able to be lowered (Table 2) except Ohakuri and up to May, 1969, it could be said that control of the weed had been established (Fig. 2).

TABLE 2: LAKE LOWERINGS, 1969

Lake	Range (ft)	Month	Days
Whakamaru	15	Dec.-Jan.	15
Aratiatia	14	Jan.	8
Atiamuri	11	Jan.-Feb.	30
Maraetai (C) *	30	Feb.	20
Waipapa (C)	21	Feb.	30

*Construction purposes.

1969 also saw the first flood-relief operations at Karapiro and Arapuni (as a result of Cyclone Gazelle) (*Wahine* disaster). Both of these lakes are scheduled for a lowering of several feet when cyclones of the magnitude of Colleen threaten to flood the Waikato basin.

Future weed seasons will require a full programme of co-operation between engineers, botanists, wild life officers and the public for the best to be obtained from the hydro lakes (Lantz, 1967).

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