CONSERVATION
TE PAPA ATAWHAI

CONSERVATION ADVISORY SCIENCE NOTES

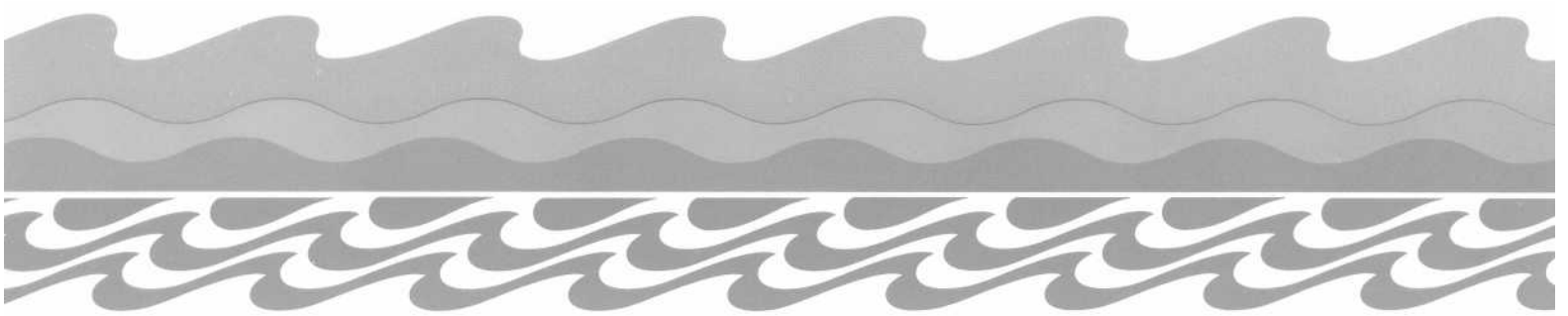
No. 27

MANAGEMENT OF RIPARIAN MARGINS OF THE LOWER RANGITAIKI RIVER TO ENHANCE WHITEBAIT SPAWNING SUCCESS

(Short Answers in Conservation Science)

This report is published by Head Office, Department of Conservation, and presents the results of scientific services or advice purchased from a consultant outside the Department or provided by Departmental scientific staff. All enquiries should be addressed to the CAS Coordinator, S&R Division.

Department of Conservation, P O Box 10-420, Wellington, New Zealand



ISSN 1171-9834

Reference to material in this report should be cited thus:

Mitchell, C., 1993.
Management of riparian margins of the lower Rangitaiki river to enhance whitebait spawning success.
Conservation Advisory Science Notes No. 27, Department of Conservation, Wellington. 6p.

Commissioned by: Bay of Plenty Conservancy
Location: NZMS

Management of riparian margins of the lower Rangitaiki River

to enhance whitebait spawning success

Report prepared for the Department of Conservation by:

Charles Mitchell and Associates
Te Manu Road, RD 2
Rotorua

Introduction

Many flood protection works on the lowlands of New Zealand are inadequately designed. Poor design affects the performance of the floodway and results in ongoing maintenance costs.

The lower Rangitaiki River is an example of poor floodway design. The river was diverted directly to the sea in 1934 and the floodway was not made large enough. To maintain hydraulic capacity of the floodway the berms must always be maintained in as smooth a condition as possible. Only in this way the river can fulfill it's engineered function, to be an efficient channel sluicing floodwaters out to sea. Whether such engineering goals are compatible with biological and aesthetic values is a point worthy of discussion. When rivers become accepted as more than simple gutters, society will have to consider the costs of providing adequate floodplains. Vegetation succession can then run it's course and a myriad of biological and water quality values can be restored.

The present need to maintain smooth berms requires that only grass be allowed to grow. Economics prohibit the use of paving or linings. Unfortunately, in a climate where trees are the natural climax community, grassed berms demand continual maintenance. Grass will only persist if the area is continually mowed, sprayed or grazed.

Grazing is the preferred option as some return is possible from leasing the land to farmers. Mowing and spraying are expensive. However grazing also has costs. These are environmental costs and arise from the way in which stock have to be managed. Grass on river berms is usually controlled by short periods of heavy grazing. As dairy farming is the dominant farming on the more fertile lowlands, cattle are most commonly grazed on river berms.

Grazing animals are selective. They eat vegetation in a sequence of decreasing palatability and availability. Farmers control grazing to maintain communities of fast growing plants, by stocking animals at high densities for short periods, even the least palatable plants are eaten or trampled by this approach. Fast growing grasses and clovers will dominate vegetation exposed to such intermittent heavy cropping. It is not possible to manage cattle so as to leave patches of native vegetation uneaten, in the interests of conservation or as river bank protection.

The environment created by grazing for vegetation control has a number of characteristics:

1. The communities of native plants expected on the riparian margins of New Zealand rivers are severely reduced or eliminated. Cattle are capable of uprooting even substantial plants such as flax bushes. Native plants such as *Typha, Baumea* and *Phormium* are reduced to thin bankside strips, protected by deep water or soft sediments. Fast growing, unpalatable trees such as willows, can gain a foothold if grazing is sufficiently lax for a period. Willows shade the ground heavily in summer and suppress even grasses. Their autumn leaf fall also smothers any understory plants. Combined with grazing, the result is bare ground beneath these trees.

2. As intended, the overwhelmingly dominant vegetation along grazed berms is pasture grasses. Stock graze dung patches less heavily and so a series of green patches interspersed with shorter, more open grass develops. Less palatable plants such as Juncus can form stands in wetter areas. The ring form of some of these plants, where the centre plants have died, suggests they can be a considerable age.

3. Cattle are heavy animals, supported on hooves proportionally smaller than the human foot. They actually have a higher weight loading than a bulldozer. Trampling along the river banks greatly accelerates the rate of bank erosion. Sloping vegetated banks are replaced by vertical or overhanging earth margins prone to repeated slumping as the soft, water saturated soils collapse under trampling. The process is accelerated by the need for cattle to drink and by the tempting presence of refuges of more palatable plants along the waters edge. Sheep or even goats are far less destructive animals to use for vegetation control on sensitive sites such as river banks.

Environmental impacts of grazing riparian margins

1. A riverbank of grass in no way duplicates the natural margins of New Zealand rivers. The major plants and associated animals of this habitat have been eliminated. These losses have been total throughout much of New Zealand.

2. Bank collapse by cattle trampling increases the sediment load in the river. This impacts upon the bottom fauna and water quality of the river and the effect extends out to sea. The accelerated loss of soil cannot be considered a sustainable practice in terms of Resource Management Act.

3. Owing to a peculiar life cycle, one species of native fish, whitebait (inanga, Galaxias maculatus) will spawn only in the lower reaches of tidal rivers. On rivers modified by flood control works the intertidal zone where whitebait spawn commonly lies within the berm of stopbanks. Whitebait eggs are laid beneath terrestrial vegetation flooded by spring tides and remain developing on the bank for a month until the next series of tides flood them and they hatch.

Although this is an admirable strategy for avoiding aquatic predators of whitebait eggs, it has certain limitations in modern New Zealand. Vegetation management for flood protection purposes has a direct impact upon the survival of developing whitebait eggs. Whitebait eggs are adapted to the terrestrial environment but still need a moist, cool atmosphere in which to develop. This environment is only provided beneath a thick mat of vegetation. DOC funded studies have shown that egg survival in grazed pasture is lower than in fenced off

areas. Whitebait have been found to select clumps of tall vegetation, such as rush clumps, to spawn within.

The managers of river banks need to consider the demands of this fish, which supports the popular whitebait fishery and should attempt to balance these demands within the requirements of flood control.

Studies into vegetation management of whitebait spawning grounds.

Since 1989 DOC has supported research into the effects of controlling grazing on a whitebait spawning ground on the lower Kaituna River. This research is still in progress but has been very informative to date:

For the first two years after fencing the number of whitebait using the spawning ground increased dramatically. However by the third year there was an obvious decline. Over the past two years no spawning has been found within the fenced off enclosure. The spawning sites had gradually been invaded by dense growths of *Glyceria maxima,* resulting in a apparently impenetrable pack of stems. This year the surrounding land has been used for maize cropping instead of being grazed heavily over the drier summer months. Whitebait were found to have spawned in the grasses around the fenced off enclosure but not within it.

These results have to be considered within a context of the natural history of New Zealand. A few whitebait spawning grounds have been discovered amongst relatively unmodified vegetation in the remoter parts of New Zealand. The vegetation was dominated by trees or by megaherbs such as *Typha.* Shading by these tall plants reduces the density of the ground cover plants amongst which the whitebait spawn. The winter dieback and partial collapse of *Typha* stands must also be an implicating factor. Fish spawn within denser clumps of vegetation or within debris or leaf litter mats which develop on the forest floor.

It is now thought that simply fencing off previously grazed pasture, allowing regrowth of introduced plants such as *Glyceria*, will eventually result in a vegetation layer of such density that whitebait are unable to swim into it to spawn. However the process of vegetation succession will, given enough time, finally lead to woody vegetation. If willows establish then the resulting plant understory will be too thin for useful whitebait spawning habitat (although I have seen evidence for whitebait spawning amongst a twig and leaf litter mat beneath willows protected from grazing). Alder trees with an understory of wandering jew *(Trascandentia)* have been found to be heavily used for whitebait spawning. This could be a quickly established, self maintaining substitute for native vegetation. Native plants would eventually establish beneath the alder trees and replace the exotics.

Management of the riparian margins of the lower Rangitaiki River

It has been made obvious that the flood berms of the lower Rangitaiki River are far too small to be allowed to support a stable, woody plant community. But discussions with river control engineers from the Bay of Plenty Regional Council, Messers Bruce Crabbe and Tony Dunlop, on 14/4/93 indicated that they were prepared to consider a vegetation regime which could support whitebait spawning within the primary requirement of flood protection.

It is intended here to recommend a practical vegetation management regime which should enhance whitebait spawning success. However it must also be emphasised that the recommendations are tentative. This site is viewed as an extension of the small scale experiments on the lower Kaituna River. Allowances should be made for the experimental nature of the work. The work has relevance for a huge number of whitebait spawning grounds around New Zealand.

The banks of the Rangitaiki River below the SH2 bridge are used for whitebait spawning. Whitebait eggs were first found in this area on 30/4/87. Eggs were found in patches extending 200 m downstream from the bridge. Egg laying sites were concentrated at spring tide level along the thickly vegetated sides of small embayments in the river banks. Mats of creeping bent *(Agrostis stolonifera)* were favored. More eggs were found on the stopbank berm. Here they had been laid within clumps of rush *(Juncus gregiforus),* and around damp patches where *Juncus articulatus* and *A. stolonifera* were the dominant plants. The area was examined again in April 1991 and small numbers of eggs were found only on the stopbank berms. Bank erosion had eliminated the small vegetated embayments. On 14/4/93 the same area was carefully searched. Only one small patch of eggs, protected within the fenced off area beneath the SH2 bridge was found. The river banks and the environment for spawning whitebait had changed considerably over a 6 year period.

The lower Rangitaiki River is not a natural river bed. It is a cut made in 1934 through sandhills, to divert the Rangitaiki river out to sea. The Rangitaiki formerly joined the Tarawera River and this diversion allowed the drainage of a large area of wetland. Subsequent calculations by engineers indicate the floodway cross-section is inadequate or marginally adequate. Therefore it has been policy to carefully control vegetation in the floodway to present a minimal impediment to floodflows. As has already been outlined, grazing is the simplest, most cost-effective approach to vegetation control.

In 1988, Matahina Dam was rapidly dewatered following the Edgecumbe earthquake. Bank erosion and collapse appeared to accelerate markedly following these events. The process of slumping and erosion has continued, the foundations of the stopbanks are threatened in some areas. River engineering staff at the Bay of Plenty Regional Council have proposed a series of measures to combat this erosion:

Rock riprap backed by synthetic ground cloth will be laid against severely eroded sections. Remaining areas will be stabilised by trialing a mat of interlaced tyres. Sediment and vegetation will eventually bind this flexible mat in place.

The work will be undertaken as part of Regional Council responsibilities for river control works without applying for a resource consent under the Resource Management Act. It is suggested that these river works be managed to enhance whitebait spawning success.

DOC RECOMMENDATIONS

1. That the berm stabilisation works be evaluated for their effect on whitebait spawning over autumn 1994.

2. That the Regional Council go ahead with immediate repairs to the few most seriously eroded sites on the true left bank below the road bridge. Given that the right bank is already well protected by riprap, no repairs should be made to this bank with the exception of the area around the mouth of Reids Central Canal. This area could be used for a trial of interlaced tyres. Until it is shown that whitebait will use the existing riprap reinforced berms no further riprap should be placed along either bank.

3. That a trial be made of vegetation management over this vulnerable section of river, both to reduce bank erosion and to provide optimum spawning habitat for whitebait.-The following facts frame the realities of any vegetation management trial:

    a. Owing to flood control priorities only grass or other low vegetation can be permitted to grow.

    b. Grazing is the only practical vegetation control method. The land has already been leased for grazing. Sheep are unlikely to be available for vegetation control.

    c. It is not realistic to consider replanting the berms with dwarf flaxes or other specialised vegetation. Once grazing is halted to allow these non-browse resistant species to establish, the Regional Council will be faced with an ongoing and expensive struggle to halt the natural reversion of the berms back to scrubland.

    d. Whitebait will spawn amongst exotic pasture grasses provided that they are of the correct length. They must not be grazed off too short yet neither should they be allowed to grow too long and rank. Grass protected from grazing for 5 years was avoided by whitebait because it was apparently too dense for the fish to penetrate and carry out normal courting and spawning behavior.

Therefore it is recommended that a trial be conducted to establish the optimum times for grazing the river berms. Few whitebait now spawn in this area.

Obviously grazing should not be permitted over the peak spawning and incubation period for whitebait eggs. Whitebait largely spawn on spring tides during late March, April and May. Although there is also some spawning on virtually every month of the year, the majority of eggs will be developing on the bank and vulnerable to stock grazing and trampling from late March until the end of June. Grazing could be allowed only from July until the end of January, allowing two months for vegetation recovery before the spawning season. This grazing regime should be trialed on one bank of the river. Observations would also be made on the effect of spelling the vegetation for 5 months each year on bank erosion rates.

There is an alternative grazing strategy to allow a longer recovery period for the vegetation. It is known that spelling the grass for the whole growing season results in a sward acceptable for whitebait spawning. However this would only allow a grazing period of 4 months. The

alternative is to spell the berm for a full year followed by a year of unrestricted grazing. If it were found the best strategy, then spawning grounds could be subdivided by fencing to allow this pattern of biannual grazing. It is known that whitebait will move their spawning sites to select the optimum thickness of vegetation.

If the other bank was dedicated for a biannual grazing experiment, a result would be available far more rapidly if the berm could be subdivided by a fence. Observations could also be made on the effect on bank erosion rates, of spelling the vegetation on a biannual basis.

It is recommended that this vegetation management experiment be conducted over 4 years with an annual inspection to determine the extent and sites chosen for whitebait spawning. It should then be possible to formulate a management guide for grazing river banks to optimise whitebait egg survival.

Input required from the Regional Council

1. Acceptance that this experiment is relevant to the environmental protection objectives of the Council.

2. To negotiate with and gain the cooperation of the lessees of the berms for the duration of the experiment.

3. Construct a wing fence subdividing one berm in half.

4. Provide and hang one gate so that stock can be moved onto either half of the berm.