

NEW ZEALAND FRESHWATER FISHERIES MISCELLANEOUS REPORT NO 67

**GRASS CARP PRODUCTION AT WAIUKU  
PROPOSAL TO ELECTRICORP**

by

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**Confidential to client**

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*Servicing freshwater fisheries and aquaculture*

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## NEW ZEALAND FRESHWATER FISHERIES MISCELLANEOUS REPORTS

This report is one of a series initiated in January 1989, and issued by the Freshwater Fisheries Centre, MAF Fisheries. The series was established to ensure that reports prepared for clients, tribunal hearings, internal use, etc., are collected together and available to future users. They are for limited circulation, and some may be confidential.

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MAF Fisheries is the fisheries business group of the New Zealand Ministry of Agriculture and Fisheries. The name MAF Fisheries was formalised on 1 November 1989 and replaces MAFFish, which was established on 1 April 1987. It combines the functions of the former Fisheries Research and Fisheries Management Divisions, and the fisheries functions of the former Economics Division of MAF.

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## 1. SUMMARY

Electricorp Northern Hydro group consider that grass carp may provide a viable and economic plant control option in some hydro lakes. The only supplier of grass carp is the MAF Fisheries Freshwater Fisheries Centre at Rotorua. MAF Fisheries cannot guarantee to supply any grass carp to Electricorp. Fish production is limited by:

1. The limited pond and hatchery facilities at Rotorua
2. Unfavourable growing climate

This proposal seeks to overcome these limitations and assure Electricorp of future supply by:

1. Moving broodstock to an existing fish farm with a favourable climate.
2. Producing triploid grass carp which will then be available for Electricorp use.

The total set up costs are \$32,500

The annual running costs will be \$17,700.

About 10,000 fingerlings could be produced each year from the existing ponds. There is space to construct additional ponds to boost production.

One third of the fingerlings produced would be retained by the land owner, one third by MAF Fisheries and one third by Electricorp.

## 2. INTRODUCTION

Grass carp (*Ctenopharyngodon idella*) are widely used for aquatic plant management overseas. In the United States, grass carp are used to control *Hydrilla*, water milfoil and other pest species. Grass carp have been successfully used in New Zealand to eliminate aquatic plants from two small lakes and to control plants in variety of industrial and agricultural situations.

Electricorp Northern Hydro group consider that grass carp may provide a viable and economic form of plant control in some hydro lakes. The primary advantages of grass carp are

- (i) they offer biological control,
- (ii) they are wide ranging,
- (iii) in some circumstances they can be cheaper than alternative plant control methods, and
- (iv) the effects can be long term.

However, grass carp are not a panacea for plant control problems. The disadvantages are

- (i) they eat native weed,
- (ii) the results are difficult to predict,
- (iii) fish may emigrate from the target area, and
- (iv) unauthorised removal must be prevented.

In the past, the idea of using grass carp aroused much public opposition.

To allay public fears of naturalisation, MAF Fisheries have developed techniques to produce sterile triploid fish (which have three sets of chromosomes instead of two). Triploid fish are produced by subjecting eggs to high pressure shortly after fertilisation. This treatment induces triploidy in 90-95% of developing embryos.

The Department of Conservation and MAF are jointly responsible for authorising the release of fish species to new waters. They have agreed that only triploid fish may be released. As a result, each fingerling must be individually tested before it is released. This costs \$1-5 per grass carp.

The only supplier of grass carp in New Zealand is the MAF Fisheries, Freshwater Fisheries Centre at Rotorua. The centre has very limited facilities. Furthermore, grass carp are warm water fish and the climate at Rotorua is unsuitable for grass carp maturation. Breeding has failed in two of the last three years. It is unlikely that the centre can produce more than 5-10,000 fish per year.

About 40-100 fish per ha are required for plant control in most lakes. The stocking density depends on the aims of control, (complete or partial control) the plant species present and the water temperature. At present we cannot accurately predict the exact stocking density required in any particular lake. Even at low stocking densities, MAF

Fisheries would be unable to produce the large numbers of fish required to have a significant impact on the plant biomass of any of the existing hydro lakes.

This proposal is to establish a second grass carp facility at Waiuku. The aim is to produce triploid fish as a joint venture between the land owner, MAF Fisheries and Electricorp. MAF Fisheries will provide the broodstock and breeding expertise. The landowner, Mr J Patterson, has already built broodstock and fry rearing ponds and will maintain the stock throughout the year. There is an existing water right and fish farm licence. Electricorp are asked to provide capital for equipping the hatchery and part of the costs of spawning and maintaining the fish.

### 3. PROPOSAL SUMMARY

#### 1. Site Description

The site is 15 km north west of Waiuku at Pollock (Map 1). The land owner, Mr J Patterson has built five small ponds 1-1.5 m deep, total area of 0.4 ha, in a small valley draining into the Manakau harbour. The ponds were built to grow on triploid grass carp for resale to drainage authorities. There is space available for further pond construction should induction be successful. The existing ponds could hold 2-30,000 grass carp depending on size.

## 2. Stock Availability

Diploid broodstock are available from the Aka Aka drainage system about 25 km to the south of the farm. MAF Fisheries staff will attempt to catch 6-10 broodstock from the drains and transfer these to Pollock.

## 3. Schedule and estimated costs to Electricorp

If induction (scheduled for mid November) at Rotorua is successful, then:

(a) Surplus fry will be transferred from MAF Fisheries ponds at Rotorua for growing on at Pollock. This would cost an additional \$1500. Fingerlings would be available to Electricorp by 1992.

(b) Broodstock will be transferred from Aka to Pollock in January 1991.

(c) A power supply needs to be led to the pond to supply aerators. The quote cost for this work is \$11,000.

(c) Induced spawning will be attempted at Pollock in December 1991.

If this years spawning induction at Rotorua is unsuccessful, then we will endeavour to catch broodstock from Aka Aka at the beginning of December (cf January 1991), and induce

spawning immediately. The costs are identical regardless of when induction is attempted.

Initial set up costs are:

Movement of broodstock from Aka Aka to Pollock	10990
Improvement of ponds to hold fry	14716
Construct hatchery and spawning tanks	<u>6800</u>

32506

Annual costs are:

Annual maintenance of broodstock and fingerling	7000
Occasional visits by MAF Fisheries staff	2000
Annual broodstock induction	<u>8710</u>
	<u>17710</u>

#### 4. Clauses of Contract.

MAF Fisheries will retain ownership of the broodstock and spawning equipment.

Mr J Patterson retains all rights over land, ponds and fixed assets eg fencing and power supplies.

MAF Fisheries will use their best endeavour to induce spawning and produce sufficient fry for Electricorp use but cannot guarantee fry production.



The number of any fish produced will be jointly assessed after one year. Ownership of the fish (other than broodstock) will be split three ways between Mr J Patterson, Electricorp and MAF Fisheries. Each party will have the right to dispose of fish as they see fit without let or hindrance from the other parties.

This proposal does not include:-

- (a) The costs of preparing Risk Assessment Reports prior to stocking fish for plant control.
- (b) The costs of triploid certification.
- (c) Any third party costs (eg DOC, Regional Council fees).
- (d) The construction of additional fish ponds.

#### 4. PROCEDURES FOR STOCKING GRASS CARP

The transfer or release of any live aquatic life is controlled by the Conservation Law Reform Act 1990, Section 26ZM (appendix 1). In brief, permission is required from the Department of Conservation and from MAF before fish can be released.

DOC require that proposers advertise their intention to release grass carp on two consecutive Saturdays, allow 40

working days for submissions on the release, prepare a Risk Assessment Report.

The report must contain information on:

- (a) The aim of plant management
- (b) A description of the catchment
- (c) Physical and biotic features of the trial area
- (d) Security and a description of the areas into which the fish might escape
- (e) The presence of any rare or endangered species of animals or plants
- (f) Possible affects on other public interest, e.g., waterfowl, fish or other amenity values.

Only individually certified triploid fish may be stocked into any water. Triploid fish are identified by taking a small blood sample from the branchial vein and measuring the size of blood cells with a Coulter Counter. MAF Fisheries is responsible for testing fish. The costs of testing fish (\$1-5 per fish) will be recovered from users.

## 5. SPAWNING GRASS CARP

Grass carp are warm water fish that originate from large rivers in northern China. In nature, the fish move up river during the monsoon season (early spring) and spawn downstream of obstructions in turbulent water.

The eggs float downstream for about 36 hours, before the larvae hatch out. Larvae continue to develop for a further 48 hours or so, until the gut and mouth parts are developed. In the early stages of development fry feed on small zooplankton, but when they reach 20-50 mm fry switch to plant material. Growth to maturity can take two to five years depending on temperature and conditions. Males usually mature before females.

In mature females, eggs develop through several phases that greatly increase the size and food reserves of the cell. The maturation process is determined primarily by the mean and seasonal temperatures of water and probably the condition of the female in the year prior to spawning.

Ovulation is triggered by specific environmental cues such as a drop in temperature, turbulent water, presence of other fish, pheromones and so on. These conditions stimulate a surge of hormones from the pituitary gland, which causes ripe oocytes to be released from the ovary into the body cavity.

In artificial or induced spawning, we aim to simulate this surge of hormones by:

- (a) Bringing the females into good condition by early spring.
- (b) Injecting synthetic or natural gonadotrophin (hormone) to force ovulation and spermiation.

During induction, there is no external sign that ovulation has occurred. The eggs remain viable for a limited period, probably about 1 hour 8-14 hours after hormone injection. If fertilisation is too soon or too late, the eggs begin development then die 12 to 14 hours after fertilisation.

Mature females can produce 70-100,000 eggs per kg body weight over 5 kg. Few fish have to be induced each year to produce large numbers of fry. However, females are extremely susceptible to stress and can spontaneously resorb the ova if badly handled or stressed in other ways.

It should be evident that spawning grass carp is not a straight-forward affair but carries a risk of failure.

The risk can be minimised by using well conditioned broodstock and reducing the stress levels.

6. ESTIMATE OF INITIAL COSTS TO ELECTRICORP TO SET UP GRASS CARP SPAWNING FACILITY AT POLLOCK

1. Movement of grass carp from Aka Aka to Pollock

Labour	9379
Accommodation	450
Transport	<u>70</u>
Total	<u>10990</u>

2. Improvement of ponds to take brood stock and fry

Electricity connection	11000
Wiring to ponds	2000
Aerator pumps	<u>1716</u>
Total	<u>14716</u>

3. Hatchery Construction

Equipment water storage etc	3500
Labour	<u>3300</u>
Total	<u>6800</u>

## 7. ANNUAL MAINTENANCE AND BREEDING COSTS ELECTRICORP

1. Induce brood stock

Labour	7710
Miscellaneous stores	<u>1000</u>
Total	<u>8710</u>

## 2. Maintenance

Annual fee to J Patterson	5000
Feed	700
Power	400
Water testing	500
Service by MAF staff	2000
Miscellaneous	<u>400</u>
Total	<u>9000</u>

## 8. RISK ASSESSMENT REPORTING

Current MAF Fisheries charges are:

Labour	\$650 per day
Travel	20c per km
Accommodation	\$70 per night
Other items (motel fees) at cost.	

I estimate three to five days are required to produce a small Risk Assessment Report on the stocking of grass carp to a new catchment.

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device erected in those waters for the purpose of preventing or controlling the movement of fish upstream or downstream or on entry to any land within a specified distance of any such device:

“(c) Prohibit or impose restrictions or conditions on fishing in any waters or in any specified part or parts thereof, or on the taking of any species of fish therein, or on the methods of fishing in such waters:

“(d) In the case of freshwater fish (other than sports fish) exempt communities either wholly, partially, or conditionally, or in respect of any specified waters, from the operation of any such prohibition, restriction, or other condition in the notice.

“(2) Any Fish and Game Council may request the Minister to issue a notice under subsection (1) of this section.

“(3) Notwithstanding subsection (1) of this section, the Director-General shall not impose any prohibition, restriction, or other condition that relates to the taking of sports fish from any waters in any area within the jurisdiction of a Fish and Game Council without prior consultation with that Council, nor restrict entry to any area without prior consultation with the appropriate Catchment Authority (being any public body established for the purpose of soil conservation and water management under any enactment) or any Government agency that has statutory control over the land involved.

Cf. 1983, No. 14, s. 70

“26ZM. **Transfer or release of live aquatic life**—(1) No person shall transfer live aquatic life or release live aquatic life into any freshwater, except in accordance with this section.

“(2) The prior approval of the Minister of Fisheries shall be required for the following:

“(a) The movement of live aquatic life between sites where the species already exists:

“(b) The movement of live aquatic life between the islands of New Zealand.

“(3) The prior approval of the Minister of Conservation shall be required for the following:

“(a) The transfer of live aquatic life to or the release of live aquatic life in a new location where the species does not already exist (including the transfer of a new species to or the release of a new species in an existing or a new fish farm):

“(b) The transfer of a species of live aquatic life to any land or water managed or administered under this Act or

any other Act specified in the First Schedule to this Act.

“(4) The following provisions shall apply where the approval of the Minister of Conservation is required under subsection (3) of this section:

“(a) The applicant shall advertise, on at least 2 consecutive Saturdays in at least one newspaper circulating in the area concerned, the intention to transfer or release live aquatic life:

“(b) Every advertisement under paragraph (a) of this subsection shall state that submissions or objections in respect of its subject-matter should be sent to the Director-General:

“(c) The Director-General may require an applicant to provide an environmental impact assessment report before granting approval.

“(5) Nothing in this section shall apply to the transfer of any existing species to any existing fish farm.

“(6) Except where the Director-General or the Director-General of Agriculture and Fisheries requires it to comply with this section, nothing in this section shall apply to the transfer by a Fish and Game Council of sports fish to another location within the same island in New Zealand where the species is already present.

“26ZN. **Fishing rights not to be sold or let**—(1) Every person commits an offence against this Act who sells or lets the right to fish in any freshwater.

“(2) Subsection (1) of this section shall not apply to the selling or letting of fishing rights on any licensed fish farm to the general public.

“26ZO. **Occupier may fish without licence**—(1) Subject to this Act, any person who is the lawful occupier of any land may fish on such land or waters within such land without a licence or payment of fee, within the period and upon such terms and conditions, as may be specified in any notice issued pursuant to section 26ZL of this Act, or in any District Anglers Notice applying, or in any regulations made under section 48 or section 48A of this Act, without being liable to any penalty for so doing.

“(2) For the purposes of this section, the term ‘lawful occupier’ includes the owner of the land and any person who has the right to occupy the land pursuant to a written agreement for a period of not less than 6 months; but does not include the manager of a marginal strip.

