CONSERVATION
TE PAPA ATAWHAI

# CONSERVATION ADVISORY SCIENCE NOTES

**No. 18**

MANGEMENT OPTIONS FOR DWARF INANGA

(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 0 Box 10-420, Wellington, New Zealand**

ISSN 1171-9834



Reference to material in this report should be cited thus:

Rowe, D., 1993.
Management options for dwarf Inanga.
Conservation Advisory Science Notes No. 18, Department of Conservation, Wellington. 3p.

Location: NZMS

Dr R Pierce
Department of Conservation
P O Box 842
WHANGAREI

CAS Coordinator
S & R Division
P O Box 10420
WELLINGTON

**UNPROGRAMMED SCIENCE ADVICE**

**Client:** Dr Ray Pierce, DoC, Whangarei
**Person Supplying Advice:** Dr David Rowe
**Advice Sought:** Management options for dwarf inanga

**Restrictions on Use of Information:** Nil

**MANAGEMENT OPTIONS FOR DWARF INANGA**

**Background**

Dwarf inanga were once much more abundant than they now are. Although the historic observations of abundance are descriptive, it is clear from these (Table 1) that schools of juvenile fish were once readily observable around lake margins.

TABLE 1. RECORDS OF MAXIMUM ABUNDANCE

| REFERENCE | LOCATION | RECORD |
|---|---|---|
| Cudby & Ewing (1968) | L. Taharoa | Many large schools of galaxiids around lake margins |
| Cudby et al (1969) | L. Taharoa | Numerous shoals in shallows |
| A.Parker (pers. comm.) | L. Waingata | Large schools seen from boat, all around shoreline, outside weed beds |
| B.Wilson (pers. comm.) | L. Ototoa | large schools every 10 or so metres around the shoreline |

Such high densities of juveniles are present now only in Lake Ototoa, where this species was recently introduced. Catch rates from the various lakes support our observations of juvenile abundance in North Kaipara Head lakes and indicate that this species is no longer abundant, but common in 4 lakes, and rare or extinct in the remaining 8 (Table 2).

TABLE 2. CURRENT STATUS OF DWARF INANGA

| Lake | abundant | common | rare | extinct | cause of decline |
|---|---|---|---|---|---|
| Waikere | | | + | | trout? |
| Taharoa | | | + | | trout |
| Kai Iwi | | | + | | trout |
| Rototuna U. | | | + | | ? |
| Rototuna L. | | | | + | drained |
| Rotopouua | | + | | | |
| Humuhumu | | + | | | |
| Rotootuauru | | | + | | ? |
| Rotokawau | | | + | | ? |
| Waingata | | | | + | trout? |
| Kanono | | + | | | |
| Kahuparere | | + | | | |
| Ototoa (stocked) | + | | | | |



NIWA - Ecosystems
100 Aurora Terrace, Hillcrest, Hamilton, P0. Box 11-115, Hamilton New Zealand
Telephone +64-7-856 7026, Facsimile +64-7-856 0151

The main cause of the extinction/rarity of dwarf inanga in 4 lakes is thought to be trout predation. However, although trout predation was undoubtedly responsible for an initial decline in dwarf inanga densities, it is apparent that it cannot reasonably account for the low densities of dwarf inanga in the trout lakes today. For example, dwarf inanga become extinct in Lake Waingata following trout stocking at over 2000 $fish/km^{-2}$, but dwarf inanga did not become extinct in Lake Taharoa or Waikere, where initial trout stocking rates exceeded those in Lake Waingata by 2-7 times. In addition, dwarf inanga are still present, if rare, in Lakes Taharoa and Waikere today, despite over 20 years of trout stocking. Moreover, dwarf inanga are abundant in Lake Ototoa which is also stocked with trout. Current trout stocking rates in Lake Taharoa and Ototoa are now relatively low, and not dissimilar, ranging between 500-1000 $fish/km^{-2}$. Trout predation is therefore unlikely to account for the current "order of magnitude" difference in dwarf inanga densities between these lakes.

The role of trout in the decline of dwarf inanga is therefore enigmatic at present. Furthermore, our survey work is revealing that other factors are responsible for the decline of dwarf inanga in other lakes, and may have compounded the effects of trout predation in others. For example, the low density of dwarf inanga in Lake Rototuna, Rotootuauru (Swan), and Rotokawau cannot be attributed to trout predation as trout have not been stocked in these lakes. Predation by stocked eels when they grow beyond the size needed for piscivory, fundamental differences in water chemistry and/or hydrology, or reductions or changes in littoral flora could individually or collectively have contributed to the decline of dwarf inanga in these lakes, and may be compounding the effects of trout predation in others. In the Kai Iwi lakes, the presence of mosquito fish, which are known predators of fish eggs, may also be compounding the effects of trout predation or dwarf inanga.

**Implications for rare species recovery programmes**

Identification of the main factors responsible for the decline of dwarf inanga will be essential if recovery programmes for this species are to succeed. However, lake scale manipulations will be needed to determine the influence of individual factors on dwarf inanga. The attached outline of a proposal describes several sequential trials in two lakes which would help elucidate the role of trout, mosquito fish, and littoral plants on dwarf inanga. Because *Hydatella inconspicua,* a rare species of aquatic plant confined to Northland lakes, is also rare in these lakes, there is an opportunity to also focus research on this species as well.

**Proposal outline for future work on dwarf inanga and *Hydatella* in Northland lakes**

Three high-priority conservation issues have been revealed by surveys of aquatic plants and fish in Northland dune lakes:

(1) Dwarf inanga (*Galaxias gracilis*), one of NZ's rarest native fish, is confined to Northland dune lakes and is in decline. Trout predation has reduced its densities in Lake Waingata, Waikere, Taharoa and Kai Iwi but other environmental factors are responsible for its decline in other lakes, and may have compounded problems caused by trout. The respective role of trout predation and "other" environmental factors in the decline of dwarf inanga is therefore unknown at present.

(2) One of NZ's rarest aquatic plants (*Hydatella inconspicua*) is confined to the dune lakes. It is no longer abundant in all lakes where it occurs and is in decline. It is now rare in Lake Waingata which has been invaded by the exotic macrophyte *Elodea canadensis.* Changes in the littoral zone due to *Elodea* may have contributed to its decline, and/or be limiting its recovery.

(3) Most Northland dune lakes are still free of the invasive exotic macrophytes which have caused problems in other lakes further south. However, *Elodea canadensis* is present in Lake Waingata and Phoebes Lake in the Poutu Group, while *Egeria densa* is present in Lakes Omapere, Rotoroa and Owhareiti further north. Increased use of the Poutu lakes is likely to result in the spread of *Elodea* to other dune lakes unless the two existing infestations are eradicated.

Although research to identify the environmental factors threatening dwarf inanga and *Hydatella* is continuing, there is now sufficient information for limited management trials. For example:

- As trout are no longer stocked into Lake Waingata, dwarf inanga could be reintroduced. If densities return to pre-trout levels, then trout predation can be identified as the main factor responsible for their decline in this lake. However, if dwarf inanga densities remain low, then the problem is due to other factors such as *Elodea* or water quality.
- Removal of *Elodea* and recovery of native fringing plants may allow full recovery of dwarf inanga in Lake Waingata.
- The removal of *Elodea* would also create an experiment to determine the effect of *Elodea* on *Hydatella.*
- In addition, transplantation experiments with *Hydatella* could be undertaken in places where seed banks are impoverished. Such experiments are needed to develop management techniques for recovery plans.
- Water quality is not high in Lake Waingata, and dwarf inanga may also be limited by high turbidity and poor water quality in summer months. If trout stocking can be suspended in Lake Waikere and trout predation pressure removed then the recovery of dwarf inanga could be monitored. This would determine the effect of predation on dwarf inanga in a clear lake, with good water quality. Lake Waikere is on a DOC estate and the long term protection of this species can be secured more easily on this lake than on any other. However, it would be prudent to confirm that trout predation is in fact the main limiting factor before any management plan for the protection of dwarf inanga is completed.

Trials such as those outlined above would greatly assist the management of the rare species in the dune lakes. The fact that so many management questions can be addressed in only 2 lakes, and principally in Lake Waingata, means that the expenditure of resources can be minimised, and studies on these rare species focused through lake recovery plans. Weed elimination using grass carp is a proven technique and is cost effective. It would pave the way for later weed-elimination/lake recovery programmes in other Northland lakes infested with exotic macrophytes. Because of the opportunities presented here it is proposed that DOC liaise with the Fish and Game Council and Regional Council to gauge their support, advice, and where possible their participation, and that funding be sought for management trials from the DOC Science and Research budget.

**References**

Cudby, E.J. & N. Ewing. 1968. Lakes Taharoa and Kai Iwi - Northland. Unpublished Report to Secretary for Marine, Marine Department, Wellington. 7p.

Cudby, E.J.; Ewing, N. & R. Wilkinson. 1969. Lakes Taharoa and Kai Iwi - Northland (24th March 1969). Unpublished Report to Secretary for Marine, Marine Department, Wellington. 6p.

David Rowe
Scientist