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NEW ZEALAND FRESHWATER FISHERIES MISCELLANEOUS REPORT NO. 94

**OBSERVATIONS ON JUVENILE RAINBOW  
TROUT AND BROWN TROUT IN THE  
LOWER WAITAKI RIVER 1989-90**

by

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## NEW ZEALAND FRESHWATER FISHERIES MISCELLANEOUS REPORTS

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## 1. INTRODUCTION

Early surveys of the mainstem Waitaki River (pre-1986) were made using electric fishing gear (Bloomberg and Deverall in prep). Very limited captures of juvenile rainbow trout were made during these investigations. We were uncertain if trout were scarce or whether the electric fishing techniques or equipment were inadequate.

As rainbow trout are an important component of the Lower Waitaki River fishery and as there is uncertainty whether or not stocks could be maintained in a future residual river, additional surveys were undertaken to determine the distribution and abundance of juvenile rainbow trout in the mainstem Waitaki River. We also hoped to assess the habitats used and the extent of behavioural interactions between juvenile brown and rainbow trout.

Preliminary electric fishing was done from September to December 1986 but few rainbow juveniles were caught (Appendix I). These results prompted us to use direct underwater observations from 1989 to 1990 to assess occurrence and relative abundance in the mainstem Waitaki. Some drift netting and additional electric fishing was also done. Underwater observations of juvenile trout in Waitaki tributaries and in other rivers (Tekapo, Rai and Pelorus) were made for comparison with the Waitaki over the period 1988-89.

## 2. METHODS

### 2.1 Visual Observation

All underwater observations were made using snorkel gear including a wet suit, mask, snorkel and usually fins. Observers used some of the techniques described by Fausch and White (1981) and Cunjak and Power (1986). Divers crawled slowly upstream and counted all juvenile salmonids observed at each site. We usually worked singly, but sometimes in pairs. Subjective assessments of physical habitat and biological conditions were made before and during each dive. Braid size and location, area observed, water depth range, water velocity range, periphyton cover, instream cover, bank cover, water surface character and invertebrate abundance were also noted. We used reasonable precaution at all times to avoid startling fish.

### 2.2 Drift Netting

A small-mesh gill net (20 m x 38 or 50 mm mesh size) was pulled or drifted downstream through the entire water column by two people to capture 1+ or older fish. In most instances, an entire channel was sampled, but frequently the margin of a larger braid was netted. Water character (riffle, run, pool or backwater) was noted and length of netting run was estimated. All captured fish were measured (fork length) and most weighed. Scale samples were used to determine ages of some fish. Four areas received concentrated effort - Kurow, Duntroon, Ferry Road and between the mouth and main highway bridge.

### 3. RESULTS

#### 3.1 Dive Observations-January to March 1989

##### 3.1.1 Waitaki River

Preliminary observations of juvenile (0+ and 1+) brown and rainbow trout in January 1989 suggested fish were most abundant in the upper reaches of the Lower Waitaki River (Table 1). Young brown trout (0+) were seen more frequently than young rainbows (0+). However the fish were generally scarce at all sites and older fish (1+) were only common at the mouth of the Awakino River.

##### 3.1.2 Other Locations

Juvenile fish were abundant at several sites in the Tekapo River and the Awakino River (Table 2). These observations reassured us that we would see the fish if they were present. Fish were typically located in areas of reduced depth (<0.5 m) along channel margins in areas with plentiful instream cover in the form of substrate, turbulence, macrophytes or some combination of these.

#### 3.2 Dive Observations- January to March 1990

##### 3.2.1 Juvenile Trout

Fifty-six sites covering 2840 m<sup>2</sup> were observed at 4 major areas in the mainstem Waitaki and Hakataramea rivers for a total of 464 minutes by two divers during 1990. Forty-six 0+ rainbow trout and 56 0+ brown trout juveniles were seen (Table 3).

##### 3.2.2 Juvenile Trout Habitat

Observations suggested poor juvenile trout habitat was present in the Waitaki River. We rated sites as either low, medium or highly suitable for juveniles. Of 34 sites rated, 15 were classed as low; 3 as low-medium; 13 as medium, 3 as medium-high and only one as high. Downstream sites (below SH 1) on the Waitaki were not rated at the time of observation but were similar or poorer than the upstream sites.

##### 3.2.3 Macro-invertebrates

Slow diver movements (upstream crawling) and minimal water depth, allowed observation of caddisflies, mayflies and snails if present. Most sites appeared to have poor macro-invertebrate populations. Snails were the most commonly noted macro-invertebrate.

### **3.3 Small-Mesh Drift Netting**

Large juvenile trout (1+) and older fish were netted in four areas on the lower Waitaki (Kurow, Duntroon, Ferry Road and mouth) during the summer of 1990 (Table 4).

Many more brown trout (2x) than rainbow trout were captured. Most of the brown trout were captured in one area (Kurow) and catch rates (brown trout per km of drift netting) declined downstream.

Few rainbows were captured at any site and catch rates were uniform at upstream and downstream locations. A small sample of rainbow trout were aged by scale reading. Fish of lengths 171 to 286 mm were found to be aged 1+.

## **4. DISCUSSION**

We desired to assess relative abundance and general distribution of rainbow and brown trout. With the physical constraints we faced—large flows and extended river length—we decided direct underwater observations would best fulfil our requirements. We decided it was preferable to sample many sites and interpret these occurrences, rather than use more intensive sampling of fewer sites with capture techniques. In addition, we could view many habitat conditions more directly than with out-of-water techniques.

### **4.1 Trout Habitat**

We observed that juvenile trout habitat in the mainstem Waitaki is widespread but of poor quality. Areas of appropriate water depth and velocity for juvenile trout are abundant and most braids have at least a one or two metre marginal strip along each bank that could be classed as juvenile habitat. However, instream or bank cover appears non-existent in these uniform stream margins. Instream boulders or macrophytes were missing from a majority of the sites we sampled in the mainstem.

A lack of cover (other than water surface turbulence) could be a constraint on juvenile numbers in the mainstem Waitaki (Appendix I) as it is in some other systems (Gordon & MacCrimmon 1982). The lack of resting areas and hiding areas adjacent to feeding areas is particularly important from an energetic point of view. Obtaining food, while expending minimal effort, would appear to be difficult at most of the observed locations in the Waitaki.

### **4.2 Brown Trout/Rainbow Trout Interactions**

Detailed observations were not made of trout behaviour. Early observations in the Awakino River and Maerewhenua River showed no obvious difference in stream locations occupied by juvenile brown and rainbow trout. However, brown trout were larger on average than rainbows, so when both species were present, brown trout should tend to have the most dominant position (Jenkins 1969). This was noticeable in the early observations in the

Awakino River when brown trout would display aggressive behaviour towards rainbows and maintain positions in selected areas in some cases. Observations in the mainstem Waitaki were too limited to determine any differences in behaviour.

The mainstem observations suggest both species are found in similar locations and could compete for similar niches. The overall lack of suitable habitat (i.e. only 9 sites had observations with multiple numbers of trout, 6 of those probably had both species present) makes an evaluation of interactions difficult. Other studies (Gatz *et al.* 1987, Glova 1987) suggest rainbows would be disadvantaged in interspecific competition.

The low numbers of rainbow juveniles seen in the Waitaki can be attributed to one of several possibilities: 1) an unusual year, 2) poor observation and/or sampling techniques, and/or 3) the normal situation. We believe that the third possibility is the most probable case. The most likely explanation must be that habitat quality or food supply will support only low densities of juveniles in the mainstem and this is the "normal" rainbow population situation with most 0+ juvenile rearing occurring in tributary "nursery" streams (Gordon and MacCrimmon 1982; Sopuck 1978).

It would appear that little or no rainbow trout spawning occurs in the mainstem Waitaki because of the few 0+ fish sighted.

#### **4.3 Other Rivers**

The original intention of observations in other rivers was to determine habitat features or behavioural interactions that could be related to the lower Waitaki or an eventual residual river. Our aims were reduced after difficulty finding juvenile rainbows at most sites checked in the Rai/Pelorus system. We also concluded that major physical differences between the Tekapo River (a lake tributary) and the lower Waitaki (a large river with no lakes directly accessible) made comparisons of finer details invalid. Any further biological conclusions related to a residual river would therefore be unwarranted. The large numbers of juveniles seen in the Tekapo was encouraging however and indicated our observation technique was satisfactory.

### **5. SUMMARY**

Our observations generally suggest that juvenile rainbow habitat in the mainstem lower Waitaki is less than optimal. The very small numbers of trout observed throughout the mainstem compared to the tributaries reinforces the importance of the tributaries in maintaining the Waitaki adult rainbow population. With this finding, any future hydro-development even with a residual river must provide rainbow spawning, incubation and juvenile rearing (fry to 1+) habitat comparable to that provided by the Maerewhenua, Hakataramea and Awakino Rivers. Some allowances for the dominance of brown trout juveniles over rainbow juveniles must also be made.



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TABLE 1. Fish counts from standardised crawl dives in the mainstem lower Waitaki River, January 1989.

Date	Location	0+ trout			1+ trout			Other
		RT	BT	Unknown	RT	BT	Unknown	
05.01.89	Awakino mouth 82 m	4	9	-	15	11	5	
05.01.89	Pumphouse (upstream of Kurow) 100 m	7	15	1	0	0	-	50+ QS, 7 large adult RT in mainflow. Several more 0+ RT seen outside time. Numerous QS.
05.01.89	Hakataramea mouth 100 m	1	18	7	0	0	-	~ 12 adults seen - mostly BT.
05.01.89	Penticotico mouth 70 m	0	14	-	2	0	-	~ 70 QS. ~ 6 1+ BT seen outside time.
06.01.89	Maerewhenua mouth 85 m	0	11	1	0	2	-	3-4 0+ RB seen outside time ~ 50 QS.

TABLE 2. Fish counts from standardised crawl dives in other rivers, January through March 1989.

Date	Location/Length	0+ trout			1+ trout			Other
		RT	BT	Unknown	RT	BT	Unknown	
06.01.89	Awakino River at forks bridge 33 m	32	51	-	11	18	-	
23.02.89	Tekapo River near mouth 175 m	19	-	-	-	-	-	
23.02.89	Tekapo River near old trap site 15 m 5 min	9	4	-	1	-	-	10 min in backwater, ~ 110 0+, ~ 10:1 BT:RT
24.02.89	Tekapo River 1 km below Maryburn 100 m	20	4	2	2	-	-	
07.03.89	Maryburn 60 m	5	18	9	0	16	4	

TABLE 3. Summary of crawl dive observations in the lower Waitaki and Hakataramea rivers, 1990.

	Lower Waitaki River			Hakataramea River	Total
	Lower	Middle	Upper		
Number of sites	12	4	32	8	56
Number of fish observed					
Rainbow trout	0	0	12	34	46
Brown trout	2	1	20	33	56
Unknown	-	-	2	0	2
Quinnat	36	0	28	10	74
Smelt	65	0	0	0	65
Total area (m <sup>2</sup> )	552	380	1473	435	2840
Observation time (min)	249	23	134.5	47.5	464
Area/fish (m <sup>2</sup> /fish)					
Rainbow trout	-	-	123	12.8	-
Brown trout	276	380	74	13	-
Quinnat	15	-	53	44	-
Smelt	9	-	-	-	-

TABLE 4. Numbers of rainbow and brown trout captured and number per km drifted with small mesh-gill nets in the lower Waitaki River, summer 1990.

	Kurow	Duntroon	Ferry Road	Mouth	Total
Rainbow	8	11	0	5	24
Brown	40	8	0	1	49
Total	48	19	0	6	73
Length of drift (m)	1450	1225	460	930	4065
No. of sets	15	11	6	8	40
Rainbow trout per km drifted	5	9	0	5	6
Brown trout per km drifted	28	7	0	1	12

TABLE 5. Mean lengths of 1+ rainbow trout drift netted at three sites in the lower Waitaki River.

Date	Site	No. of fish	Species	Mean Length	S.D.	Range
09.02.90	½ km above mouth	5	RT	197.2	(25)	171-225
01.02.90 and 16.01.90	Kurow	8	RT	227	(27)	185-260
15.03.90	Duntroon	1	RT	286	-	286

APPENDIX I. Numbers of juvenile rainbow and brown trout captured by electric fishing in the mainstem (M) and tributaries (T) of the lower Waitaki River, September-December 1986.

	Rainbow	Brown
29.09.86		
(M) Welcome St.	0	3
(M) Jacksons Rd St.	0	8
(T) Penticotico St.	0	0
(T) HalaR. (Gorge)	0	0
30.09.86		
(T) Maere. R. (Beaties Brdg)	0 (1-1+)	0
(T) Maere. R. (Tokarahi)	0	0
(T) L. Maere. R.	0	0
(T) Duntroon St.	0	0 (1-1+)
(M) Mainstem (near causeway)	0	7
(M) Mainstem (Otekaieke)	0	1
(M) Mainstem (Gouldings Rd)	0	1 (3-1+)
(M) Ferry Rd (Inner)	0	0
(M) Ferry Rd (Outer)	0	0
22.10.86		
(T) Maere. R. (Wright's Brdg) West Branch	0	0
(T) Maere. R. (Tokarahi)	0	0
(M) Mainstem (near Kurow Ck)	0	0
(T) Haka R. (Gorge)	0	0
(T) Haka R. (Balmoral Brdg)	0	0
(M) Ferry Rd. (Outer)	0	3
10.11.86		
(M) Welcome St.	0	8
(M) Ferry Rd. (Inner)	0	31
(M) Ferry Rd. (Outer)	0	9
02.12.86		
(M) Mainstem (Jardine Rd.)	0	1
(M) Mainstem (Gauldings Rd.)	0	3
(M) Mainstem (at Duntroon St.)	0	8
(T) Duntroon St.		
(T) Maere R. (Beatties Brdg)	6	4
(T) Maere R. (mouth)	0	2
(M) Mainstem (by Doctors Ck)	0	8
(M) Mainstem (Kurow Ck)	1	1
(T) Kurow Ck		
(M) Mainstem (3 kms above Kurow)	6	4

APPENDIX I. (Contd.)

	Rainbow	Brown
02.12.86 (contd.)		
(M) Mainstem (5 kms above Kurow)	1	1
(M) Mainstem (Kurow Brdg)	2	2
04.12.86		
(M) Mainstem (pylons above Kurow)		
23.12.86		
(M) Mainstem (3 kms above Kurow)	4	4
(T) Awakino R. (MRB)	20	1
(M) Mainstem (Kurow Ck)	0	1
(M) Mainstem (Doctors Ck)	0	3
(M) Mainstem (Duntroon St)	0	6
(M) Ferry Rd. (Inner)	0	7