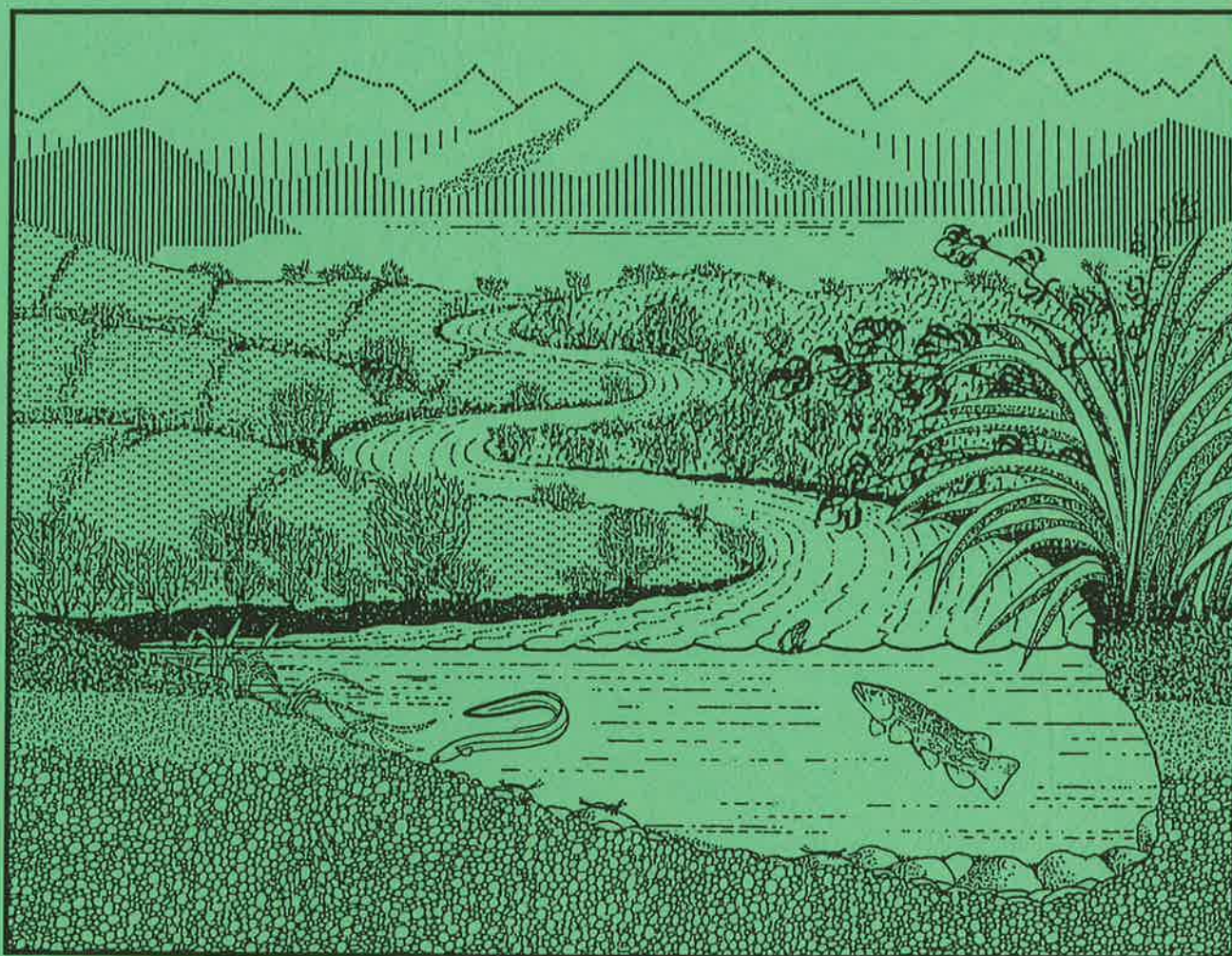


New Zealand Freshwater Fisheries Report No. 106

Angling postal questionnaires schemes
on the lower Waitaki River,
1980/81 and 1981/82



MAFFish

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1980/81 and 1981/82

by

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Report to: Electricorp

Freshwater Fisheries Centre

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NEW ZEALAND FRESHWATER FISHERIES REPORTS

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SUMMARY

Two postal surveys of angling in the lower Waitaki River (below Waitaki dam) were undertaken in 1981 and 1982. They indicated that about 4400 anglers fished the river on 46 000 days to catch 1800 salmon, 14 000 brown trout, and 10 000 rainbow trout annually. Comparison with other studies suggests that the surveys may have over-estimated trout angling effort and catch, possibly by a factor of two or three.

Most of the anglers surveyed fished both for salmon and trout. Just over 50% of Waitaki Valley Acclimatisation Society and 20% of Otago and South Canterbury Acclimatisation Society adult licence holders fished the lower Waitaki River each season. Almost 40% of the anglers travelled more than 80 km to fish the river.

The average angler on the Waitaki River fished for about 10 days per season, with a small proportion of the anglers fishing much more often. The catch distribution was skewed similarly, with 71% of salmon anglers and 32% of trout anglers catching nothing. Anglers reported catch rates of about 0.11 salmon per day and 0.79 trout per day. Children spent more time fishing for trout than for salmon and had poorer catches than adults.

Salmon fishing was concentrated in the lower half of the river. Trout fishing also was popular there, although it was generally spread more evenly throughout the river. Factors that anglers valued about the lower Waitaki River included road and bankside access, the availability of sufficient stocks of salmon and both trout species, the variety of water types, the abundance of good water, and preservation of the Waitaki's big river character.

If the proposed lower Waitaki power scheme terminates at the State Highway 1 bridge, the proposed residual river upstream of that point will have to support about 55% of the river's salmon fishing, and about 70% of the trout fishing. The upper half of the residual river would primarily be a trout fishery, whereas the lower half would support both salmon and trout fisheries. The maintenance programme for the residual river would need to keep access tracks open, schedule flood flows to coincide with periods of low angler use, and maintain a natural flow regime.

1. INTRODUCTION

Various hydro-electric schemes have been proposed for the lower Waitaki River (Ministry of Works and Development 1979, McColl and Natusch 1982). One option incorporates a separate residual river, where a reduced and controlled flow would be provided to maintain fisheries, wildlife, and recreation values. As this river currently supports fisheries of regional and national importance (Graynoth *et al.* 1981, Teirney, Richardson, and Unwin 1982, Teirney *et al.* 1982), studies have been undertaken to determine how they can be maintained in a residual river.

During 1981 and 1982, whole-season fishing licence holders were sent postal questionnaires. Information was collected on the origin of anglers, their fishing locations, angling effort, and catch of salmon and trout. They were also asked to comment on the quality of the fishery. The results are presented in this report and are compared with those from five other South Island east coast rivers.

The primary aim of this report is to predict the fishing effort and catch which a residual river would have to sustain in the future. Whether or not development proceeds, these data will serve as a baseline for future studies.

2. METHODS

Two postal sample surveys of anglers in the Waitaki region were undertaken. Each survey related to the angling season (1 October-30 April) just completed. In the 1980/81 survey, Waitaki Valley Acclimatisation Society (WVAS) and Otago Acclimatisation Society (OAS) adult fishing licence holders (16 years of age and over) and WVAS juniors were sampled. In 1981/82, South Canterbury Acclimatisation Society (SCAS) adults also were included.

Sample sizes were derived from the results of creel surveys on the Waitaki River and from other Freshwater Fisheries Centre (FFC) postal surveys (Unwin and Davis 1983, West and Goode 1986). Approximately 1000 adult licence holders from OAS, and 500 each from WVAS and SCAS were sampled, together with 250 junior WVAS licence holders.

The samples were drawn at random from the fishing licence receipts at the end of each fishing season. Each angler was sent a letter explaining the survey, together with a questionnaire (Appendices I and II) and a reply-paid envelope. Those who failed to reply within three weeks were sent a reminder letter, and another questionnaire and reply-paid envelope. After a further three weeks, this was repeated for those who had still not replied. When queries arose, respondents were contacted by letter or telephone, and any changes recorded. At the end of the survey, the respondents were sent a summary of the results and a letter of thanks.

In 1980/81, information was collected on:

- a) the number of anglers fishing and their angling effort in days;
- b) their catch of salmon, brown trout, and rainbow trout;
- c) the distribution of angling effort and catch in each of four zones (Fig. 1).

In 1981/82, anglers also were asked to record separately their salmon and trout angling effort and catch in each of the four zones, and to list the features that had attracted them to the lower Waitaki River fishery, and any features that they disliked.

3. RESULTS

3.1 Anglers' Replies

Approximately 90% of the anglers returned their questionnaires (Table 1), a similar response rate to that obtained by other FFC postal surveys (e.g., Unwin and Davis 1983). Therefore, following an assumption made in these earlier surveys, we considered the non-respondents to have the same fishing habits as those who replied.

Of the 442 licence holders who failed to return useful responses, 317 did not reply at all, 108 had moved and left no forwarding address, 11 were dead, four returned invalid questionnaires, one refused to reply, and one junior angler had his questionnaire returned by an adult.

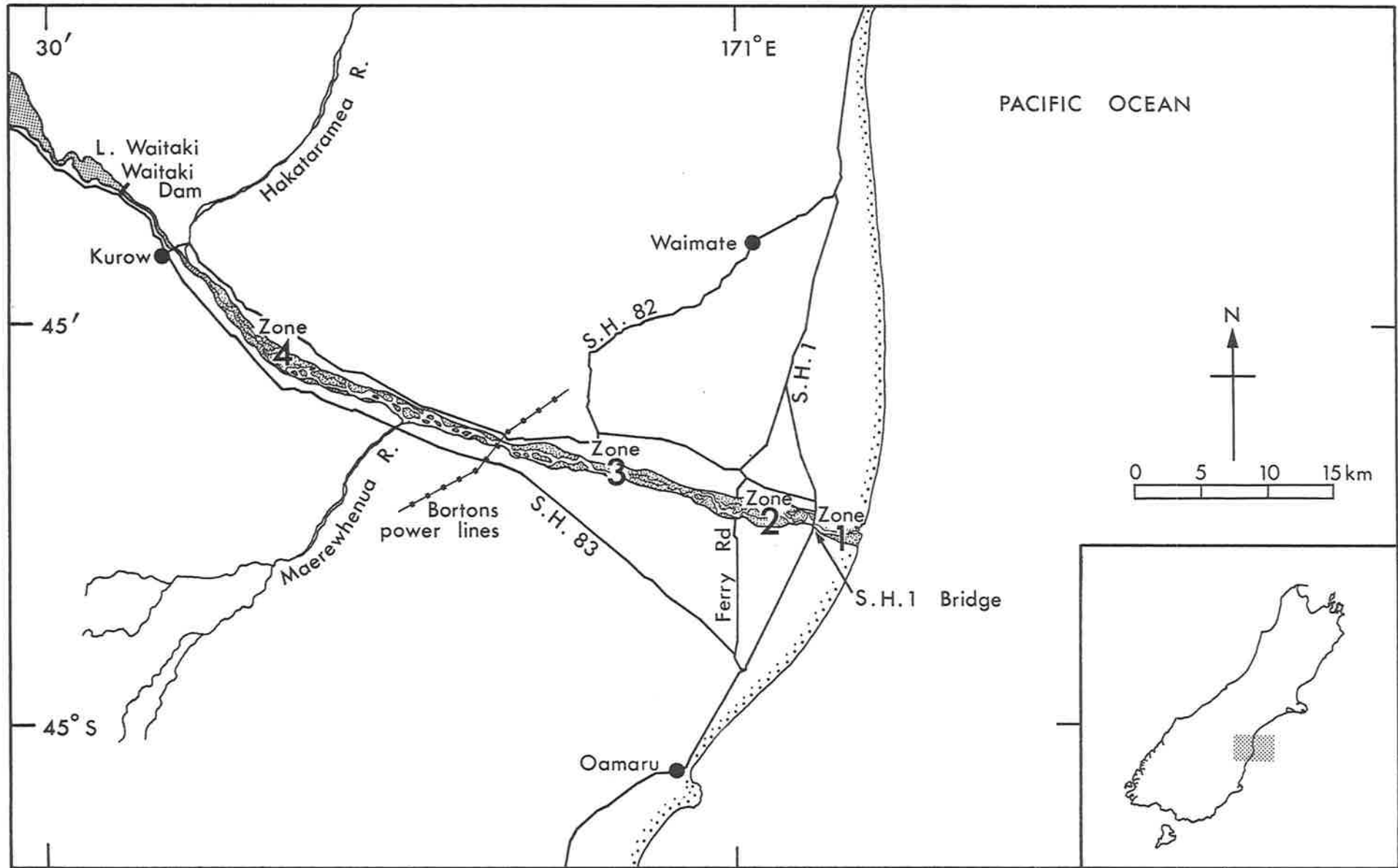


FIGURE 1. Location of the lower Waitaki River, showing zones used in the postal survey. (Zone 1 = River mouth to State Highway (S.H.) 1 bridge; Zone 2 = S.H.1 bridge to Ferry Road; Zone 3 = Ferry Road to Bortons power lines; Zone 4 = Bortons power lines to Waitaki dam.)
New Zealand freshwater fisheries report no. 106 (1989)

TABLE 1. Licence sales, sample sizes, and response rates for two postal surveys of lower Waitaki River anglers conducted for the 1980/81 and 1981/82 fishing seasons.

Licence class	No. of licences sold	1980/81		No. of licences sold	1981/82	
		No. of licences sampled	No. of replies received		No. of licences sampled	No. of replies received
Waitaki Valley adults	3 062	552	499	3 230	539	474
Waitaki Valley juniors	1 676	280	252	1 662	258	229
Otago adults	7 936	1 057	957	8 442	1 006	894
South Canterbury adults	*	-	-	3 091	495	440
Total	12 674	1 889	1 708	16 425	2 298	2 037

* = not sampled.

3.2 Number of Anglers

In 1980/81, an estimated 4110 \pm 260 licence holders from WVAS and OAS fished the lower Waitaki River (Table 2). In 1981/82, the estimated number of anglers increased to 4610 \pm 300, with the inclusion of just over 600 SCAS anglers.

A much higher percentage of WVAS adult anglers (54-55%) fished the lower Waitaki River than did OAS or SCAS anglers (19-21%) (Table 2). However, almost equal numbers of WVAS and OAS anglers fished the river, because licence sales were about 2.6 times higher in the OAS district than in the WVAS district (Table 1).

3.3 Distance Travelled

An estimate of the distance anglers travelled to fish the lower Waitaki River was derived from an analysis of the postal addresses of respondents to the 1981/82 survey. WVAS anglers usually lived less than 20 km from the river, whereas SCAS anglers usually travelled more than 60 km and OAS anglers travelled more than 80 km to fish the river.

The percentage of licence holders fishing the Waitaki River was higher near the river than further away. Obviously, use of the river depended upon where the licence holders lived.

3.4 Target Species

Most of the anglers fished exclusively for trout or for trout and salmon; only 18% fished solely for salmon (Table 3). In total, about 3800 anglers (82%) fished for trout and about 2300 (50%) fished for salmon.

Adult anglers travelled further to fish for salmon than for trout. A higher proportion of OAS anglers fished for salmon (Table 3), and about 30% of these salmon anglers lived more than 180 km from the river (compared to 10% of the OAS trout anglers). The distance that anglers travelled reflects the importance of the salmon fishery.

TABLE 2. Estimated number of Waitaki Valley, Otago, and South Canterbury whole season licence holders fishing the lower Waitaki River in the 1980/81 and 1981/82 fishing seasons.

Licence class	1980/81				1981/82			
	No. of respondents who fished	% of respondents who fished	Estimated number of anglers	95% C.L.*	No. of respondents who fished	% of respondents who fished	Estimated number of anglers	95% C.L.*
Waitaki Valley adults	269	54	1 650	130	259	55	1 760	140
Waitaki Valley juniors	125	50	830	100	88	38	640	100
Otago adults	197	21	1 630	200	167	19	1 580	220
South Canterbury adults	-†	-	-	-	90	20	630	120
Total	591	35	4 110	260	604	30	4 610	300

* = confidence limits.

† = not sampled.

TABLE 3. The proportion of Waitaki Valley, Otago, and South Canterbury whole season licence holders estimated to have fished the lower Waitaki River for salmon only, trout only, or for both salmon and trout in the 1981/82 fishing season.

	Salmon only	% of anglers	
		Trout only	Both salmon and trout
Waitaki Valley adults	15	50	35
Waitaki Valley juniors	14	60	26
Otago adults	27	43	29
South Canterbury adults	14	51	34
Total	18	50	32

3.5 Total Angling Effort

WVAS and OAS licence holders fished for 42 000 days in 1980/81 and, with the addition of SCAS licence holders, for 49 300 days in 1981/82 (Table 4). There was no significant difference in estimated effort between the two fishing seasons. WVAS adults contributed over 50% of the fishing effort, followed by OAS adults (Table 4).

The respondents averaged 10.2 days fishing on the lower Waitaki in 1980/81 and 10.7 days in 1981/82. WVAS adult anglers fished most often, averaging 13.8-16.4 days per season, compared to 6.6-8.5 days for the other licence classes (Table 5).

The frequency distribution of the number of days fished per angler was highly skewed by a few respondents who fished very often (Fig. 2). In 1981/82, 13% of the anglers fished for 20 days or more and accounted for 46% of the total effort.

The fishing effort for salmon and trout was estimated using the replies to the 1981/82 postal questionnaire. About 61% of angling effort was for trout, and 39% for salmon. Junior anglers spent more time (74%) trout fishing than the adults did.

TABLE 4. Estimated angling effort expended on the lower Waitaki River by Waitaki Valley, Otago, and South Canterbury whole season licence holders during the 1980/81 and 1981/82 fishing seasons.

Licence class	1980/81			1981/82			
	Estimated effort (angler-days)	95% C.L.†	% of total estimated effort	Estimated effort (angler-days)	95% C.L.	% of total estimated effort excluding SCAS adults	including SCAS adults
Waitaki Valley adults	22 900	3 800	54	28 900	5 400	65	58
Waitaki Valley juniors	6 700	1 600	16	5 400	1 400	12	11
Otago adults	12 400	2 700	29	10 300	2 100	23	21
South Canterbury adults	-*	-	-	4 700	2 000	-	10
Total	42 000	4 900		49 300	6 300		

† = confidence limits.

* = not sampled.

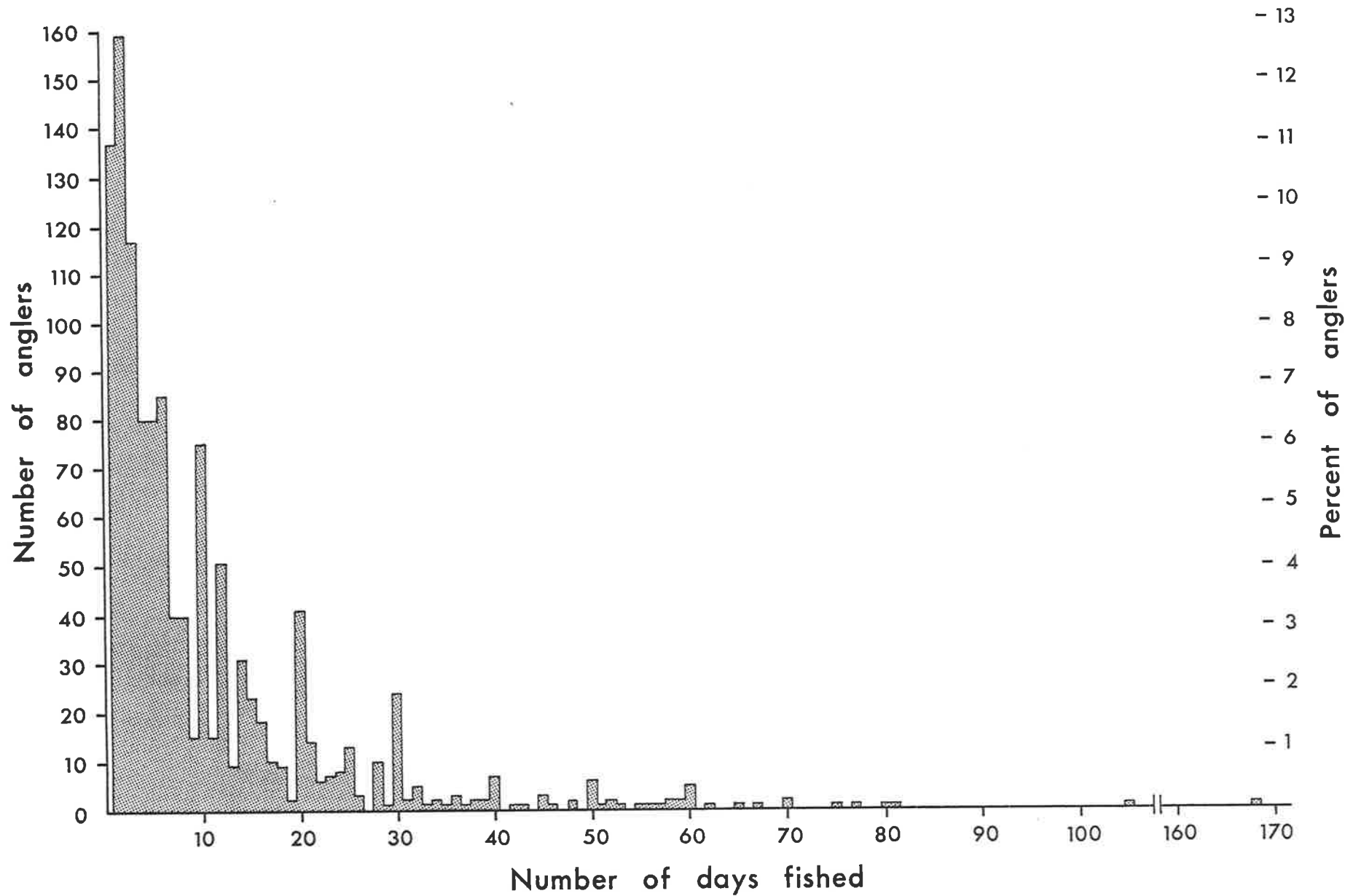


FIGURE 2. Number of days fished by respondents who fished the lower Waitaki River in the 1980/81 or 1981/82 fishing seasons. New Zealand freshwater fisheries report no. 106 (1989)

TABLE 5. Estimated number of days fished per angler on the lower Waitaki River by Waitaki Valley, Otago, and South Canterbury whole season licence holders in the 1980/81 and 1981/82 fishing seasons.

Licence class	1980/81	1981/82
Waitaki Valley adults	13.8	16.4
Waitaki Valley juniors	8.1	8.5
Otago adults	7.6	6.6
South Canterbury adults	-	7.5
Total	10.2	10.7 (11.2 excluding SCAS)

- = not sampled.

3.6 Total Effort by Zone

The salmon fishery was concentrated in the lower reaches of the Waitaki River. Over 80% of the salmon angling, but only 35% of the trout angling, took place in Zones 1 and 2 (Table 6, Fig. 3). Conversely, Zone 4, in the upper half of the river, supported only 9% of the salmon angling effort but 43% of the effort for trout. WVAS junior anglers fished for salmon in the upstream zones more than adult anglers did (Table 6). The intensity of fishing effort (in angler-days per kilometre) was highest in Zones 1 and 2.

3.7 Total Catch

The estimated salmon, brown trout, and rainbow trout catches from the lower Waitaki River for the 1980/81 and 1981/82 fishing seasons are presented in Table 7. Whether or not SCAS adults were included, the catch estimates did not differ statistically between the two seasons.

The distribution of anglers' catches was highly skewed because the majority of anglers caught no or few fish. A very high proportion of salmon anglers (71%) caught no salmon and a further 22% caught only one or two. The remaining 7% of anglers caught more than two salmon, and were responsible for 62% of the total catch. Trout anglers fared better; only 32% caught no trout, and 51% caught more than two. About

TABLE 6. Estimated percentage of salmon and trout angling effort in each zone of the lower Waitaki River by whole season SCAS, WVAS, and OAS adult (A) and WVAS junior (J) licence holders for the 1980/81 and 1981/82 fishing seasons.

Zone	% river length	1980/81			1981/82			1981/82			1981/82		
		Salmon and trout			Salmon and trout			Salmon			Trout		
		Total	A	J	Total	A	J	Total	A	J	Total	A	J
1	6	35	38	20	31	32	23	51	53	30	18	18	20
2	9	18	19	17	23	32	23	31	30	36	17	17	18
3	29	18	18	17	16	16	22	9	9	17	21	21	23
4	56	29	25	46	30	29	33	9	8	16	43	44	39

TABLE 7. Estimated catch of salmon, brown trout, and rainbow trout from the lower Waitaki River in the 1980/81 and 1981/82 fishing seasons.

Licence class	1980/81			1981/82		
	Salmon	Brown trout	Rainbow trout	Salmon	Brown trout	Rainbow trout
Waitaki Valley adults	800	7 600	5 800	990	7 600	5 300
Waitaki Valley juniors	100	1 200	1 400	40	670	780
Otago adults	630	5 700	3 100	720	3 700	2 600
South Canterbury adults	-	-	-	300	1 500	1 500
Total	1 530	14 500	10 300	2 050	13 470	10 180
Confidence limits (95%)	430	2 900	2 100	770	2 400	2 000

- = not sampled.

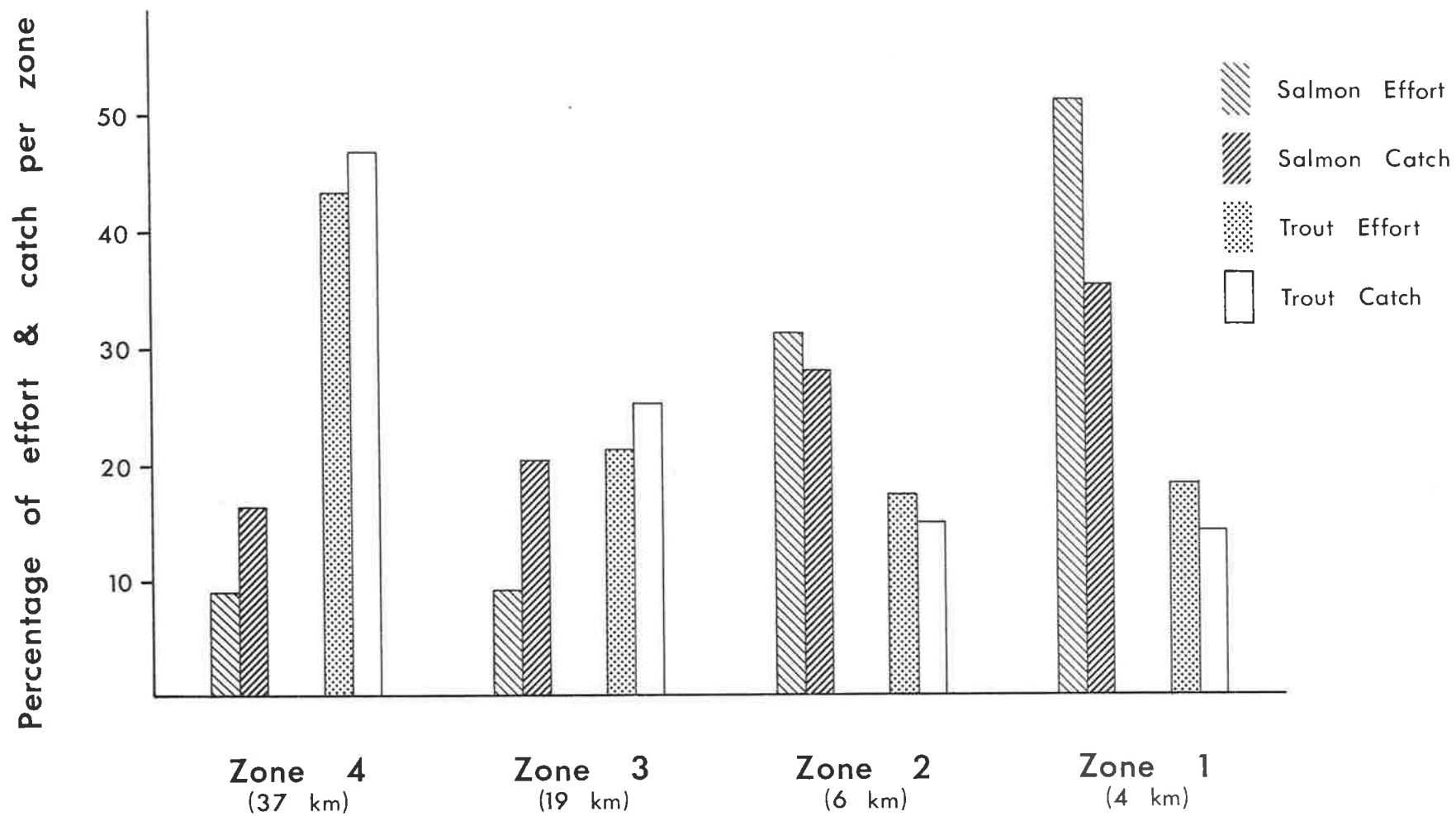


FIGURE 3. Percentage of fishing effort and catch by salmon and trout anglers in four zones of the lower Waitaki River during the 1981/82 fishing season.

9% of the anglers caught more than 20 trout each, and contributed 46% of the total catch.

Adult anglers' catches averaged five or six trout and 0.4 salmon per season (Table 8). Junior anglers were less successful.

TABLE 8. Estimated mean catch for salmon and trout anglers and for all anglers for the 1980/81 and 1981/82 fishing seasons on the lower Waitaki River.

	1980/81 Total	Adult	1981/82 Junior	Total
Salmon				
Catch/salmon angler	-	0.96	0.17	0.89
Catch/angler*	0.37	-	-	0.44
Trout				
Catch/trout angler	-	6.98	2.65	6.29
Catch/angler*	6.03	-	-	5.14

- = not estimated.

* = fished for trout, salmon, or both species.

3.8 Catch by Zone

Most of the salmon were caught in the lower reaches (Zone 1) of the Waitaki River (Table 9). The salmon catch per kilometre was also much higher in Zones 1 and 2 than in the rest of the river. However, between 1980/81 and 1981/82, the proportion of the salmon catch taken in the two lower zones altered; the percentage taken below S.H.1 dropped from 62% to 35% whereas that taken between S.H.1 and Ferry Road increased from 15% to 29%.

Trout catches were distributed between the zones more evenly than salmon (Table 9), with the notable exception of Zone 4, where about 46% of the total trout catch was recorded. More brown trout than rainbow trout were caught (Table 7).

TABLE 9. Estimated crop of salmon and trout by zone in the lower Waitaki River in the 1980/81 and 1981/82 fishing seasons.

Zone	Salmon		Brown trout		Rainbow trout		Salmon Average	Trout Average
	80/81	81/82	80/81	81/82	80/81	81/82		
1	950	730	3 000	2 300	1 600	1 000	840	3 900
2	230	590	1 700	2 200	1 200	1 400	400	3 200
3	210	420	3 400	3 200	2 500	2 700	320	5 900
4	150	330	6 400	5 900	4 900	5 100	240	11 000
Total	1 540	2 070	14 500	13 600	10 200	10 200	1 800	24 200

Trout anglers were more successful than salmon anglers in the 1981/82 season, and caught 0.55-0.86 trout per day, compared to 0.07-0.18 salmon per day (Table 10). The lowest salmon catch rate of 0.07 fish/day was recorded in Zone 1.

TABLE 10. Estimated catch rates (fish/day) for salmon and trout anglers fishing the lower Waitaki River in the 1981/82 fishing season.

Zone	Salmon anglers	Brown trout	Trout anglers	
			Rainbow trout	Total trout
1	0.07	0.38	0.17	0.55
2	0.09	0.39	0.24	0.63
3	0.14	0.47	0.39	0.86
4	0.18	0.42	0.36	0.78

3.9 Anglers' Comments, 1981/82

Approximately equal numbers of favourable and unfavourable comments were made about the lower Waitaki fishery. There were 1985 comments in all, of which 933 were favourable (Table 11) and 1052 were unfavourable (Table 12). The comments were general in nature, but were sufficient to identify features that anglers would require in a residual river.

Anglers were attracted to the Waitaki mostly by good access (16% of comments), proximity to home (10%), abundance of good water (10%), availability of salmon (9%), wild/aesthetic/natural surroundings and

TABLE 11. Number of comments on features that attract anglers to the lower Waitaki River, and percentage of comments by licence class, 1981/82.

	Licence class				No. comments	Total (%)
	WVAS adults (%)	WVAS juniors (%)	OAS adults (%)	SCAS adults (%)		
1. Access	16	17	17	15	172	16
- close to home	16	18	4	5	103	10
2. Water						
- variety of water types	6	2	2	5	42	4
- natural flows	1	1	<	2	7	1
- fishability of backwater	4	2	2	2	27	3
- size of river	1	-	-	-	3	<
- fast water	2	4	5	-	31	3
- size (abundance) of good water	5	7	7	27	102	10
- meandering of river	1	2	1	1	13	1
- good water to fish both trout and salmon	4	4	7	3	49	5
- side streams - variety	3	3	4	1	30	3
- fishability	1	1	<	-	6	1
- number	2	1	2	4	22	2
3. Fish						
- sea-run trout	1	1	<	-	6	1
- size of trout	1	-	<	-	4	<
- size of fish/good fish	5	5	8	11	76	7
- size of salmon	1	-	1	1	6	1
- species variety	4	6	4	2	40	4
- salmon	5	1	16	5	90	9
- catch	4	5	4	3	40	4
- good catch rate	1	2	1	2	10	1
4. Other						
- wild river/aesthetic value/natural surroundings/scenic value	12	12	9	9	108	10
- open spaces/isolation	5	5	4	4	45	4
- sociability	<	2	2	-	11	1
- other sporting activities	1	1	<	1	8	1
- stable side streams for spawning	<	-	-	-	1	<
Number of comments	355	117	391	189	1 052	
Number of anglers with comments on attractive features	231	76	250	129	686	
Total number of anglers who commented	279	89	302	155	825	

- = no comments.
< = less than 1%.

TABLE 12. Number of comments on features of the lower Waitaki River disliked by anglers, and percentage of comments by licence class, 1981/82.

	Licence class				No. comments	Total (%)
	WVAS adults (%)	WVAS juniors (%)	OAS adults (%)	SCAS adults (%)		
1. Access	8	7	11	10	86	9
- too far from home	1	1	1	4	13	1
2. Water						
- quality, dirty, silt, mud	14	10	9	14	110	12
- flows too fast	2	-	1	1	10	1
- high/floods	6	1	3	10	47	5
- fluctuations	17	16	24	25	195	21
- too braided	1	-	1	1	7	1
- unpredictable water course	5	2	3	1	34	4
- lack of side streams	4	2	1	-	18	2
3. Fish						
- poor condition of trout	4	-	2	3	24	3
- decline in number of rainbows	1	-	-	-	2	<
- too few fish/no fish	5	17	9	4	70	8
- small trout	1	2	2	1	14	2
- low catchability	3	5	1	1	18	2
4. Others						
- vegetation	1	-	1	1	7	1
- willows	2	2	3	-	19	2
- gorse	1	2	1	-	9	1
- too much weed	2	5	1	1	14	2
- salmon angling pressure	<	-	2	1	8	1
- snags	1	5	2	1	16	2
- power station operation	5	6	6	5	50	5
- future change	1	-	3	3	17	2
- jet boats	2	2	2	2	18	2
- lack of launching sites	<	1	<	1	5	1
- railway lines, stop banks, willow clearance	1	1	-	-	5	1
- NZE, MWD, WCC	3	5	4	3	33	4
- bulldozers	5	5	3	4	40	4
- trawlers off mouth	<	-	-	-	1	<
- mouth	1	-	3	-	14	2
- spawning grounds gone	1	-	<	1	6	1
- fish food gone	4	-	2	3	23	3
Number of comments	367	82	329	155	933	
Numbers of anglers with adverse comments	225	57	221	110	613	
Total number of anglers who commented	279	89	302	155	825	

- = no comments.

< = less than 1%.

scenic value (10%), and the size and condition of the fish (7%). Less important factors included the variety of species available, catch and catch rate, open spaces and isolation, and the variety of water types (including side channels and backwaters).

The factor most disliked about the lower Waitaki, especially by visiting anglers (from OAS and SCAS), was the fluctuation in flow (21% of adverse comments). The effect of dirt, silt, and mud on water quality was also disliked (12%), as well as difficulty of access (9%), power station operation (5%), high flows and floods (5%), and a paucity or absence of fish (8%). Some respondents disliked the condition of the fish, or, in the case of trout, their size. Manipulation of the river was definitely not favoured, as evidenced by comments about bulldozers, some of the river control measures, activities of the Ministry of Works and Development, N.Z. Electricity Corporation, and the Waitaki Catchment Commission, and the threat of future change.

The mix of favourable and unfavourable comments reflects the variety of angling experiences offered by the existing river, as well as anglers' individual preferences. It also indicates that anglers will have varying and sometimes conflicting expectations of a residual river.

4. DISCUSSION

4.1 Effort Estimates

The estimated annual angling effort of 42 000-49 000 days agrees well with the estimates of 45 000-56 000 days obtained by the FFC's National River Angling Survey (NAS) (Teirney, Richardson, and Unwin 1982, Teirney et al. 1982), given that whole season licence holders from acclimatisation districts other than WVAS, OAS, and SCAS were included in the NAS estimate.

However, a lower estimate of about 28 000 days per season was derived from aerial counts of anglers fishing the lower Waitaki over the years 1974-1983 (Pierce in prep.). Aerial surveys undertaken prior to the start of the salmon fishing season (late December) indicated that about 50 anglers per day fished the river. Given that trout angling

comprised about 60% of the total angling effort and that there are 212 days in the fishing season, the postal survey data provide an average estimate of about 130 trout anglers per day fishing the lower Waitaki River. During the salmon season, however, aerial count estimates of 140 anglers per day agree well with postal questionnaire estimates of about 150 anglers per day.

It seems, therefore, that the postal questionnaires may have over-estimated trout angling effort but not salmon angling effort. Alternatively, because of the short duration of aerial observations, aerial surveys may have under-estimated trout angling effort.

4.2 Catch Estimates

The estimated annual catch of 1500-2100 salmon in 1981/82 is similar to the estimated catch of 2000 salmon in the 1965/66 season (Dougherty et al. n.d.) and the aerial survey estimate of 2300 (Pierce in prep.). However, it is much less than the estimated 10 000 salmon caught in the exceptional 1984/85 fishing season (Ward and James 1985).

The annual crop of 24 000-25 000 trout is much higher than the estimated 10 000 trout caught in 1965/66 (Dougherty et al. n.d.) and the aerial survey estimate of 7900 trout (Pierce in prep.). It also exceeds stock estimates of 20 000 takeable trout and catch estimates of 6200-9500 trout calculated on a proportional basis from surveys in the demonstration channels (Smith and Pierce 1986, Graybill et al. 1988). The estimated trout crop also appears high when compared to the few trout present in the spawning streams. During 1981 and 1982, traps on three of the principal spawning streams caught a total of less than 1300 trout (Webb et al. in prep.). Although this was an incomplete tally, primarily because some trout spawned elsewhere, it is difficult to understand how such low spawning runs could support a crop of 24 000 trout.

It seems, therefore, that the postal questionnaires may also have over-estimated the annual crop of trout, but not salmon.

4.3 Catch Rate Estimates

Data collected from Waitaki anglers' diaries suggest that a salmon angling day averages 4.5 h and a trout angling day averages 3.6 h (FFC unpublished data). Applying these figures to the postal survey data (Table 11) results in an estimated salmon catch rate of between 0.02 and 0.04 fish per hour and a trout catch rate of between 0.15 and 0.22 fish per hour. Both of these estimates agree well with catch rates recorded for anglers in creel surveys on the river (0.03 salmon per hour and 0.21 trout per hour) (FFC unpublished data). They also agree with estimated catch rates for trout in the Waitaki demonstration channels, which ranged from 0.15 to 0.34 trout per hour (Smith and Pierce 1986).

4.4 Reasons for Over-Estimation of Trout Angling Effort and Catch

The reasons why the Waitaki River postal questionnaire schemes apparently led to an over-estimate of trout angling effort and catch are unknown.

It is possible that some anglers may have exaggerated their fishing effort and catch to try and stop future power schemes. Others may have been unable to remember accurate details of their fishing, and perhaps tended to round up their effort and catches to the nearest 10 or 20 (Fig. 2). Trout anglers in particular could have found it difficult to recall their catches from up to 10 months earlier, whereas salmon anglers only had to look back a maximum of seven months. Also, the capture of a salmon is usually a fairly rare and memorable event. Trout, on the other hand, are caught much more frequently, are smaller in size, and often are returned to the water. Finally, there was at least one angler who misinterpreted the questionnaire and recorded details of trout catches from the upper Waitaki, which was outside the survey area.

4.5 Comparison of the lower Waitaki River with Five other South Island East Coast Rivers

FFC has applied the postal questionnaire technique to five other South Island east coast rivers. These were the lower Clutha (Whiting 1986), Hurunui (Davis 1982), Rakaia (Unwin and Davis 1983), Rangitata

(Davis et al. 1987), and Waimakariri (Jellyman et al. 1987) Rivers (Table 13). The NAS rated four of these as angling rivers of national importance (Teirney et al. 1982). The exception was the lower Clutha, which was rated as regionally important because it is fished heavily only by Otago anglers. The lower Waitaki was the only New Zealand river identified by FFC as being nationally important both for trout and salmon angling.

The estimated angling effort recorded on the lower Waitaki was similar to that expended on the Rangitata River, and exceeded that on the lower Clutha and Hurunui Rivers (Table 13), but was less than that recorded on the Rakaia and Waimakariri Rivers, probably because of the proximity of these latter two rivers to the large population centre of Christchurch.

Catch estimates for the lower Waitaki salmon fishery were similar to those recorded for the lower Clutha and Hurunui Rivers. However, preliminary results from more recent postal surveys (Ward and James 1985, James and Ward 1986) indicate that annual Waitaki salmon catches have increased in recent years. This may be because the fisheries were depressed over the 1979/83 period owing to MWD construction work in the upper Waitaki, which increased sediment loads and reduced fishability in the lower Waitaki (G. Hughes pers. comm.).

Consistent with its ranking as a nationally important trout fishery, the lower Waitaki River attracted more trout anglers than any other river listed in Table 13. On the lower Waitaki, 50% of adult anglers fished only for trout (Table 3), compared to only 4% on the Rakaia (Unwin and Davis 1983).

4.6 A Residual River

At least 4000-5000 anglers could be expected to visit a residual lower Waitaki River each season, to fish for about 27 000 days and to catch between 2000 and 10 000 salmon and about 8000 trout. A fishery for salmon and trout must be maintained in the residual river, to retain the diversity of angling experiences now offered by the lower Waitaki River.

TABLE 13. Summary of postal survey results from the lower Waitaki River and five other South Island east coast rivers.

	Lower Waitaki	Lower Clutha(1)	Hurunui(2)	Rakaia(3)	Rangitata(4)	Waimakariri(5)
Sesason surveyed	1980/81, 1981/82	1982/83	1979/80, 1980/81, 1981/82	1978/79, 1979/80, 1980/81	1982/83, 1983/84	1983/84
No. of anglers per season	4 100- 4 600	3 100	2 700- 3 100	6 300- 8 900	4 100- 4 700	7 100
Effort per season (angler-days)	41 900-49 400	35 000	15 900-23 700	53 800-106 700	42 800-48 300	104 200
Salmon catch	1 500- 2 000	2 000	1 100- 2 100	7 300- 14 700	4 300- 6 900	4 600
Trout catch	23 700-24 800	21 000	6 700-12 900	5 000- 13 000	5 800-7 600	12 200
Classification#	nationally important recreational trout and salmon fishery	regionally important fishery	nationally important scenic trout fishery and regionally important salmon fishery	nationally important recreational salmon fisheries and regionally important recreational trout fisheries		

- 1 = Whiting (1986).
 2 = Preliminary results only, Davis (1982) and Bonnett *et al.* (in prep.).
 3 = Unwin and Davis (1983).
 4 = Davis *et al.* (1987).
 5 = Jellyman *et al.* (1987).
 # = Teirney *et al.* (1982).

It is difficult to predict where anglers would fish in a residual river, because this will be influenced by factors such as fish distribution, angling access, fishability of the river, and the availability of accommodation. If present trends continue, anglers would tend to concentrate in the lower reaches of the residual river, although junior salmon anglers may prefer to fish further upstream than adults.

If the power scheme development resulted in a residual river between Kurow and S.H.1, it would have to support about 50-60% of the salmon fishery. Salmon angling would be concentrated in the lower reaches, and would decrease upstream.

Trout anglers would use all of the residual river, including the ponded water above Kurow, and about 80% of their fishing would take place above S.H.1. The trout fishery would be distributed more evenly throughout the residual river than the salmon fishery, and, above Bortons power lines, the residual river would probably be used almost exclusively for trout fishing.

Anglers' comments on the attractive and unattractive features of the existing river suggest that their requirements in a residual river will differ widely. Nevertheless, the provision of good road and bankside access would be important, together with adequate stocks of salmon and trout, a variety of water types, and preservation of the "big river" character of the unmodified river.

5. ACKNOWLEDGMENTS

We would like to thank the Waitaki Valley, Otago, and South Canterbury Acclimatisation Societies for their co-operation in giving us access to their records of fishing licence sales. Thanks are due also to FFC staff who assisted with data collection, analysis, and typing, and to E. Graynoth and S.F. Davis who revised and edited the manuscript. We are sincerely grateful to all of the anglers who returned their questionnaires, thus making this report possible.

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APPENDIX I. Lower Waitaki River angling survey postal questionnaire, 1980/81.



**Ministry of
Agriculture
& Fisheries**

Fisheries Research Division,
P.O. Box 96,
OAMARU.

Telephone: 48-248

Fisheries Research Division,
Private Bag,
CHRISTCHURCH.

Telephone: 488-902

Dear Angler,

We enclose a questionnaire in which we ask details of your fishing effort and catch in the Lower Waitaki River over the last angling season (1 October 1980 – 30 April 1981).

Could you please complete and return the questionnaire in the reply paid envelope **WHETHER OR NOT** you fished in the main Lower Waitaki River during the last season.

As you may know, the New Zealand Electricity Division is considering constructing a series of power stations on the Lower Waitaki River. Water rights to develop the Lower Waitaki could be applied for by N.Z. Electricity in just four years time. With the co-operation of local acclimatisation societies we are carrying out detailed investigations to determine the present value of the fishery and ways in which it may be preserved. To do this we need accurate and up-to-date information on fishing effort and catch for inclusion in our environmental impact reports.

Your name and address were chosen at random from a list of Waitaki Valley and Otago Acclimatisation Societies' licence holders. As we are only sampling about one in six anglers your response is essential for the success of the survey.

Please answer the questions as accurately as possible. If you did not fish the river just enter zero in the first question, and post your reply back to us promptly. Your answers will be strictly confidential, only the overall results being published.

If you have any queries about the survey or need some assistance to fill it in, please contact Fisheries Research Division in Oamaru or Christchurch, or the Secretary of your local acclimatisation society.

Thank you for your co-operation and we wish you all the best for the next fishing season.

Yours sincerely,

E Graynoth

(E. Graynoth)
Scientist-in-Charge

1980-81 LOWER WAITAKI RIVER ANGLING SURVEY

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1. On how many days did you fish the main Lower Waitaki River during the last fishing season (1 October 1980 – 30 April 1981). (If you cannot remember exactly make the best estimate you can.)

2. How many Lower Waitaki trout or salmon did you catch and keep?

Brown Trout

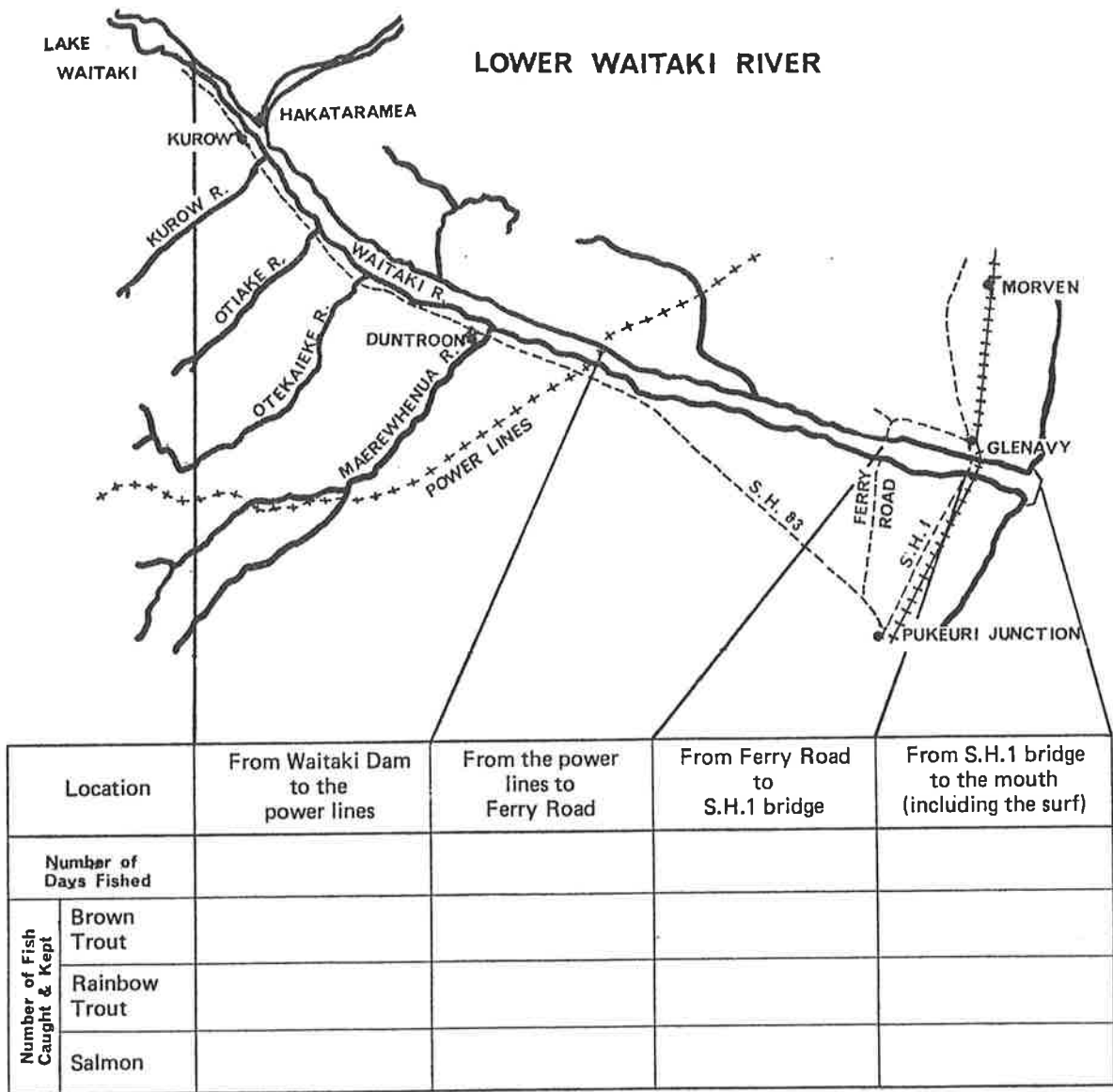
Rainbow Trout

Salmon

Continued Overleaf

3. The following table asks for more detailed information about your angling effort and catch last season. This information is important.

To fill in the table please enter the number of days you fished and the number of trout and salmon you caught and kept in each area. Make the best estimate you can and if none enter zero.



Please enclose this questionnaire in the envelope provided and mail it as soon as possible. Thank you for your co-operation.

APPENDIX II. Lower Waitaki River angling survey postal questionnaire, 1981/82.



**Ministry of
Agriculture
& Fisheries**

Fisheries Research Division
P O Box 96
OAMARU
Telephone: 48-248

Dear Angler

We enclose a questionnaire in which we ask details of your fishing effort and catch in the Lower Waitaki River over the last angling season (1 October 1981 - 30 April 1982). If you have ever fished the Lower Waitaki River we also ask for your comments on the fishery.

Could you please complete and return the questionnaire in the reply paid envelope WHETHER OR NOT you fished in the main Lower Waitaki River during the last season.

As you may know, the New Zealand Electricity Division is considering constructing a series of power stations on the Lower Waitaki River. Water rights to develop the Lower Waitaki could be applied for by N.Z. Electricity in just three years time. With the co-operation of local acclimatisation societies we are carrying out detailed investigations to determine the present value of the fishery and ways in which it may be preserved. To do this we need accurate and up-to-date information on fishing effort and catch for inclusion in our environmental impact reports.

Your name and address were chosen at random from a list of Waitaki Valley, South Canterbury and Otago Acclimatisation Societies' licence holders. As we are only sampling about one in six anglers your response is essential for the success of the survey.

Please answer the questions as accurately as possible. If you did not fish the river enter zero in the first question and if possible answer question four. If you did fish the river please answer all questions and post your reply back to us promptly. Your answers will be strictly confidential, only the overall results being published.

If you have any queries about the survey or need some assistance to fill it in, please contact Fisheries Research Division in Oamaru or the Secretary of the Waitaki Valley, South Canterbury or Otago Acclimatisation Society.

Thank you for your co-operation and we wish you all the best for the next fishing season.

Yours sincerely

L.A. Pierce

(L.A. Pierce)
CONSULTANT SCIENTIST

1981-82 LOWER WAITAKI RIVER ANGLING SURVEY

W V 8 2

1. On how many days did you fish the main Lower Waitaki River during the last fishing season (1 October 1981 - 30 April 1982). (If you cannot remember exactly make the best estimate you can).

2. How many Lower Waitaki trout or salmon did you catch and keep?

Brown Trout

Rainbow Trout

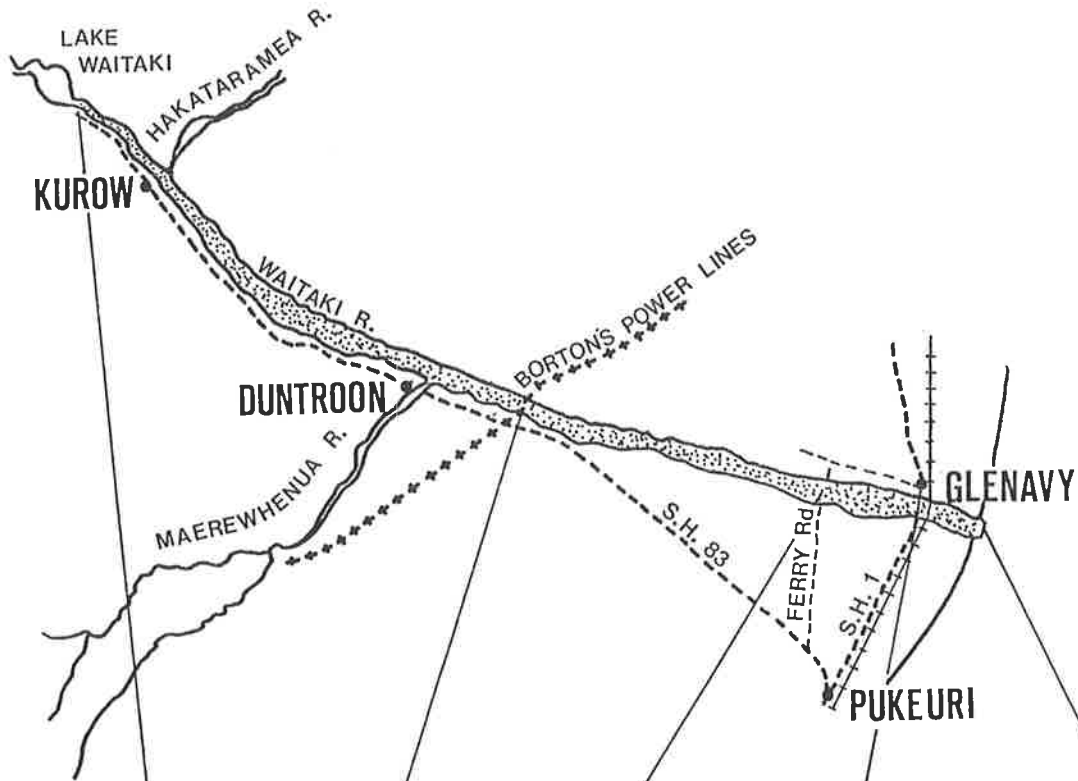
Salmon

CONTINUED OVERLEAF ...

3. The following table asks for more information about your angling effort and catch last season. This information is important.

To fill in the table please enter the number of days you fished for salmon and trout and the number of salmon and trout you caught and kept in each area. Make the best estimate you can and if none enter zero.

LOWER WAITAKI RIVER



Location	From Waitaki Dam to Borton's Power lines	From Borton's power lines to Ferry Road	From Ferry Road to S.H.1 bridge	From S.H.1 bridge to the mouth (including the surf)
<u>SALMON</u> Number of days fished for salmon				
Number of salmon caught & kept				
<u>TROUT</u> Number of days fished for trout				
Number of BROWN TROUT caught & kept.				
Number of RAINBOW TROUT caught & kept				

1981/82 LOWER WAITAKI RIVER ANGLING SURVEY

WV82

4. The following questions ask for your comments about the Lower Waitaki fishery. If you have ever fished the Lower Waitaki please answer them.

(a) What features of the present Lower Waitaki River attract you to fish it?

(b) What features of the present Lower Waitaki River don't you like?

Please enclose this questionnaire in the envelope provided and mail it as soon as possible. Thank you for your co-operation.

New Zealand Freshwater Fisheries Report No. 106

Angling postal questionnaires schemes
on the lower Waitaki River,
1980/81 and 1981/82



MAFFish