

Aerial and ground counts
of sea-run chinook salmon
(*Oncorhynchus tshawytscha*)
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Canterbury, New Zealand,
1973–76

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I. F. West
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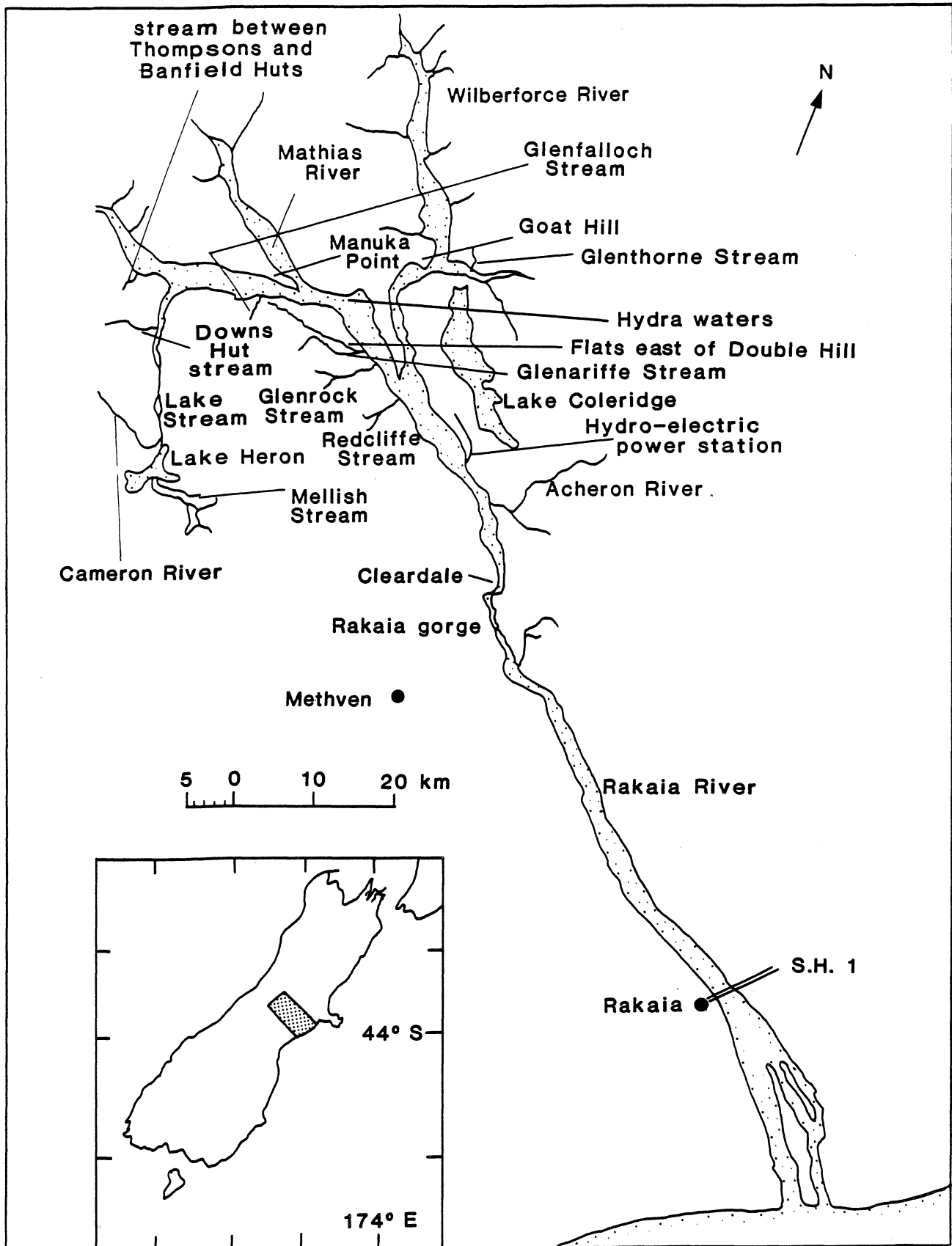


Fig. 1: Location of areas surveyed.

Introduction

The Rakaia River (Fig. 1) supports one of New Zealand's largest recreational fisheries for sea-run chinook salmon (*Oncorhynchus tshawytscha*). In the 1978-79 season an estimated 8861 anglers fished the Rakaia (Unwin and Davis 1983).

The fish counts compiled in this report were collected as part of an attempt to determine the number of salmon that reach the spawning tributaries of the Rakaia. An analysis of these counts was made by West and Goode (unpublished data). The estimated numbers of fish in the major spawning areas (Glenariffe Stream, the flats east of Double Hill, "Hydra waters" and an adjacent stream, the streams at the junction of the Mathias and Rakaia Rivers, and the Manuka Point area) were 4594, 5856, 14 222, and 16 702 fish in the years 1973 to 1976 respectively. For the 1973-74 and 1974-75 angling seasons, concurrent studies were made to determine the number of fish caught by anglers (West and Goode in press). In 1973-74 an estimated 4405 anglers caught 3531 fish, and in 1974-75 an estimated 5332 anglers caught 4875 fish.

The streams surveyed were divided into short sections by features clearly identifiable from the air, such as stream junctions (Figs. 2-4). Each section was identified by a number. The numbers used in the field have been retained for this report, so the numbering in the tables is not necessarily contiguous. Counts were made of clearly identifiable individuals in each section and the results are presented in Tables 1-6. Map references in Table 1 are for the New Zealand Map Series One sheets and are to the downstream point of each section of water. In some sections fish congregate in groups, often too dense to allow the individual fish to be counted. The numbers in such groups had to be estimated. It was sometimes possible to disperse groups and obtain a count of the individuals, and this was useful for checking the accuracy of estimation. We thought it desirable to distinguish between counts of individual fish and those in groups. Consequently, two identifying numbers are sometimes associated with the same stretch of water. Against the lower number, the counts of individual fish are recorded, and against the higher number, the numbers of fish in groups are recorded. In Tables 1-6 the letter g is appended to all figures that include estimates of the number of fish in groups rather than being obtained by direct counts.

The counts were divided into those of fish over spawning gravel and those in other areas. Fish not fully ripe often congregate in "holding" areas below stretches of spawning gravel. Some areas of stream are not suitable for spawning; fish seen in these "throughway" areas were presumably en route to a suitable spawning area. In excluding holding areas and throughways, we excluded almost all the estimates of groups and thus the uncertainty these figures introduced.

The ground counts (Table 6) were made by observers walking beside or in the stream. Generally, ground counts are more accurate for narrow streams than wide streams and for streams with gently shelving banks than those with banks that are undercut or overhung with vegetation.

Figures 2, 3, and 4 were drawn from aerial photographs S73/2/A and S73/3/C of the Department of Lands and Survey. The photographs were taken on 1 March 1973. The aerial counts were made by R. H. Goode, I. F. West, J. R. Galloway, and G. A. Eldon. The ground counts were made by J. R. Galloway, R. A. Dougherty, S. F. Hawke, S. J. Wing, and G. A. Eldon.

References

- Unwin, M. J., and Davis, S. F. 1983: Recreational Fisheries of the Rakaia River. *Fisheries Environmental Report, N.Z. Ministry of Agriculture and Fisheries, No. 35.* 110 p.
- West, I. F., and Goode, R. H. (in press): Postal sample surveys of anglers fishing for sea-run chinook salmon (*Oncorhynchus tshawytscha*) on the Rakaia River, Canterbury, New Zealand for the seasons 1973/74 and 1974/75.

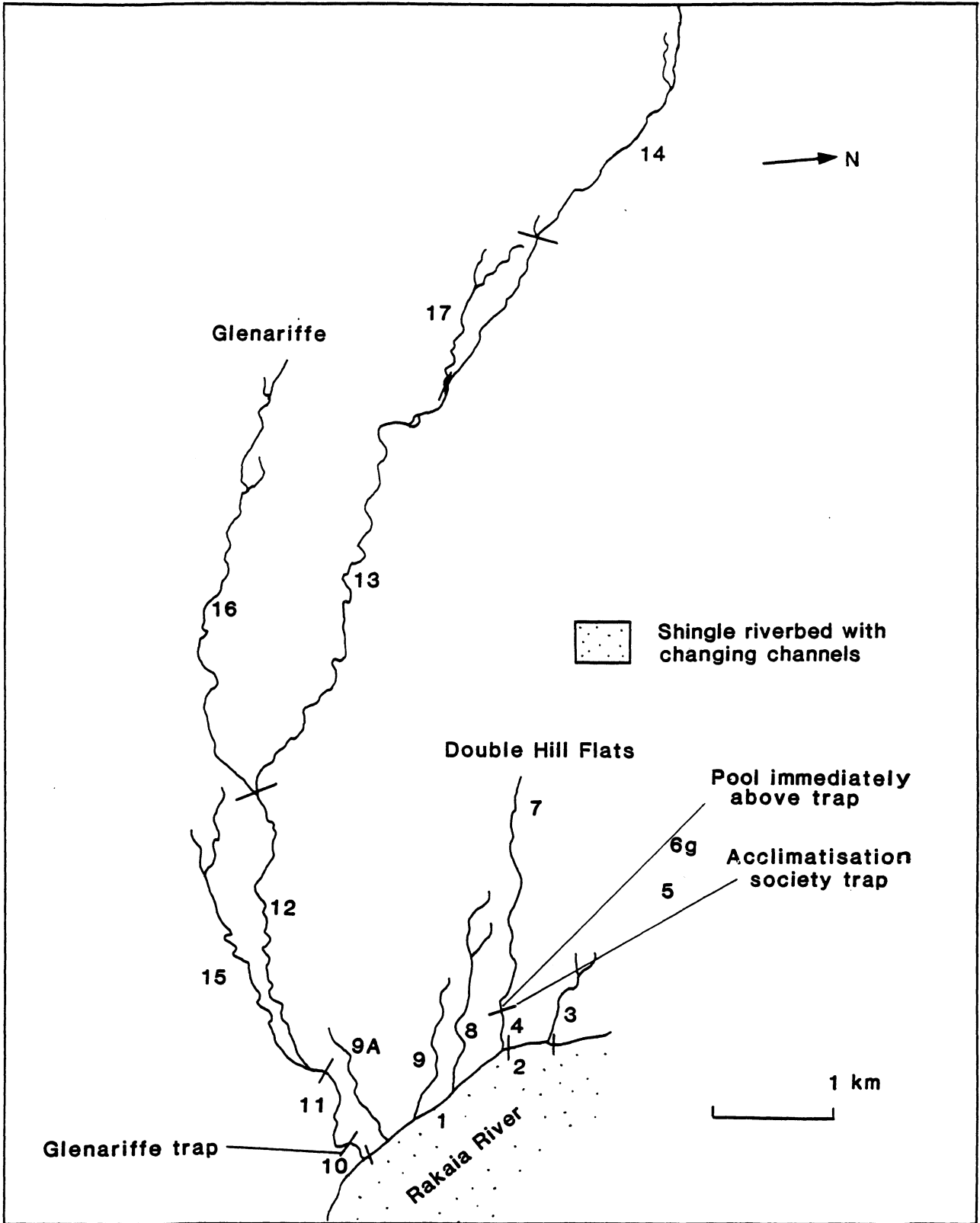


Fig. 2: Glenariffe Stream and streams on flats east of Double Hill (g indicates a count of groups).

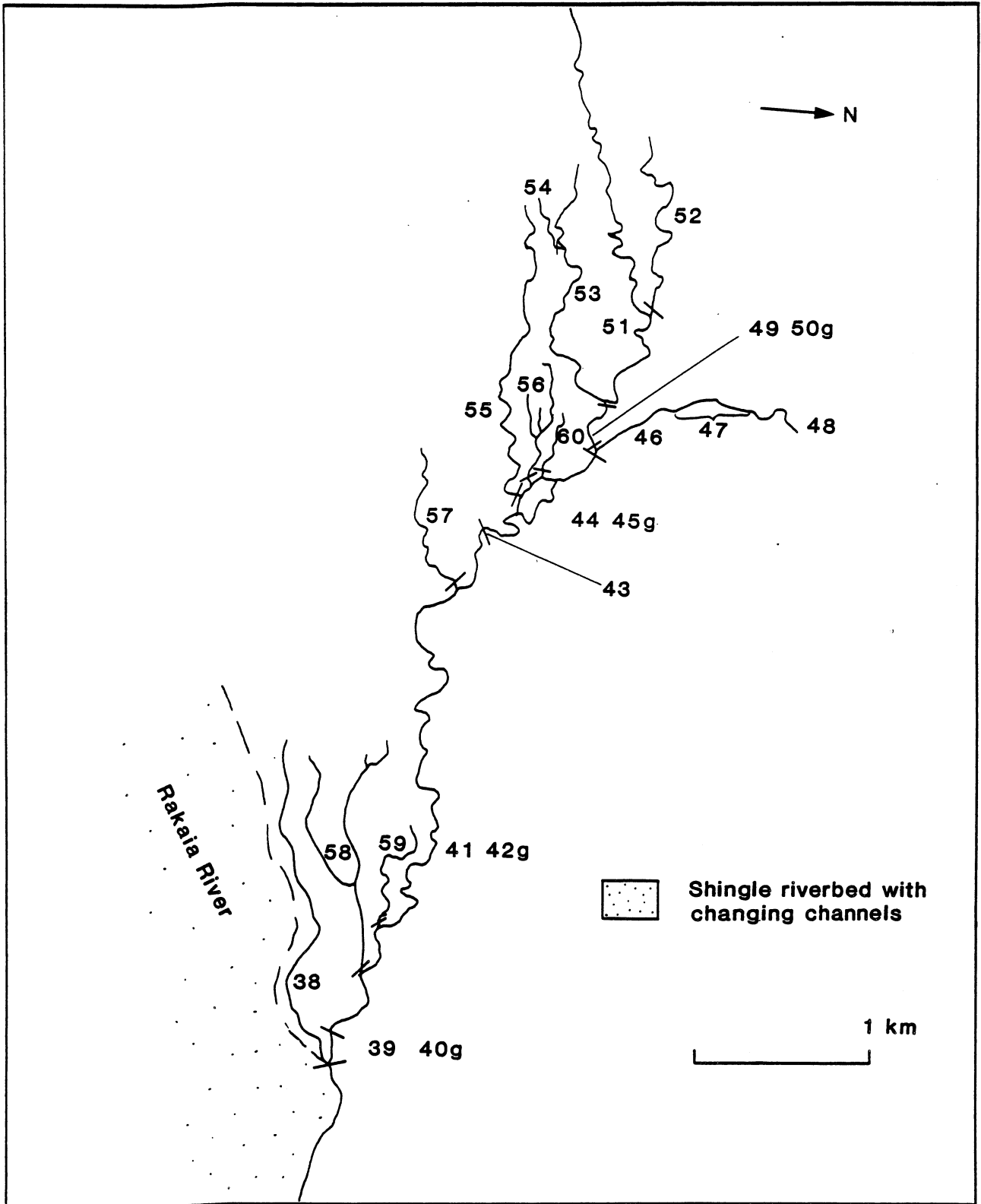


Fig. 3: Map of the Hydra waters (Titan Stream) system (g indicates a count of groups).

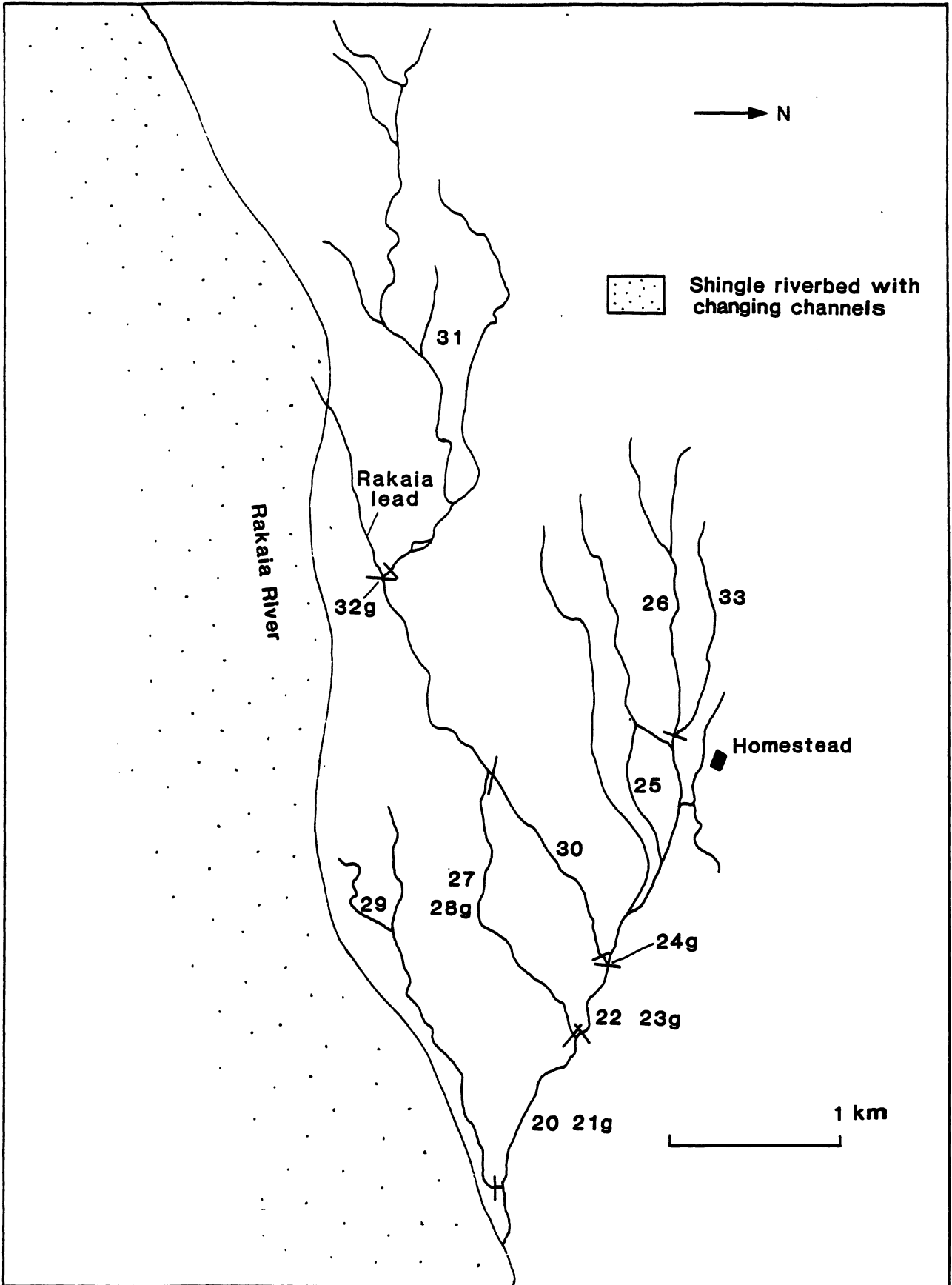


Fig. 4: Map of the Manuka Point system (g indicates a count of groups).

TABLE 1: Waters of the Rakaia River and tributaries in which salmon were counted from the air, 1973-76

Area	Number	Description of water	Use by fish
Acheron River and flats (S74, 063730)			
Coleridge: lead to hydro-electricity station (S74, 025766)			
Cleardale Flats (S74, 095630)			
Redcliffe Stream and flats (S73, 990750)			
Glenrock flats (S73, 902830)			
Wilberforce River and tributaries			
Below Goat Hill (S73, 935840)			
Above Goat Hill (S65, 920940)			
Goat Hill flats (S65, 895940)			
Glenthorne Stream (S65, 935955)			
Glenariffe Stream (S73, 890935)	10	Open riverbed with boulders; mostly placid water with large pools, though turbulent near the trap barrier; some algal growth	Principally holding pools, but there is some spawning, particularly near the junction with Glenariffe Stream
Downstream of the Glenariffe salmon trap			
Main stream of the Glenariffe system from the salmon trap to the junction of the east branch (stream 15)	11	Up to 12 m wide and generally placid; several pools; riffles where the gradient is steep	Spawning, particularly on the insides of bends
Main stream from its junction with the east branch to its junction with the south branch (stream 16)	12	About 6 m wide; meanders through deep pools; banks often undercut, bottom often weedy, and there is some algal growth; some riffles	Spawning

Table 1-continued

Area	Number	Description of water	Use by fish
Main stream from south branch junction to the barrier at the hydro lake	13	Shingle bottomed; generally overhung with matagouri (<i>Discaria toumatou</i>) and kowhai (<i>Sophora microphylla</i>); undercut banks; two open areas of major spawning water	Spawning
Main stream upstream of the barrier at the lake	14	The lower reaches are about 3 m wide, with a weed covered clay-silt bottom; short sections of shingle; most is about 1 m deep and overhung with tussock and trees; in 1973 and 1974 fish had to negotiate a weir and reach this area by passing through the lake; in 1975 and 1976 the lake was closed off to fish and access to the stream above the lake was by a new channel created beside the lake	Spawning
East branch	15	The water is usually clear, but colours in heavy rain; there are areas of open spawning gravel in the lower and upper reaches, these two areas are separated by a boulder-strewn stretch; above the upper spawning area the stream becomes muddy and there is watercress; extensive areas of weed were stripped by cattle in 1976	Spawning
South branch	16	Often channelled between steep undercut banks; areas of gravel used for spawning are scattered along the stream; colours during heavy rain	Spawning
	17	Small shingle bottomed stream	Spawning

Table 1 -continued

Area	Number	Description of water	Use by fish
Streams on flats east of Double Hill (S73, 890835)			
Streams on shingle riverbed east of Double Hill from the entrance to the Glenariffe Stream to the entrance of stream 4	1	In 1973 this water was only a lead to the streams on the flats east of Double Hill; in 1974 the main Rakaia channel broke through here, but extensive mud flats and stable shingle still existed; in 1976 the Rakaia came close to the entrances to streams 3, 4, 8, and 9, and most spawning areas were washed away	Some spawning until 1975, but mainly a throughway
Shingle riverbed between streams 3 and 4	2	As above	As above
Most northerly stream	3	Shallow open shingle; in 1973 it contained very little water	Spawning
Upper stream: downstream of society trap	4	Shallow (up to 0.5 m) open shingle stream up to 5 m wide	Spawning
Upper stream: society trap	5	A trap for adult fish operated by the local acclimatisation societies; adult fish captured for ova and milt removal; only operated for a few weeks each year	Fish ready for spawning are trapped
Upper stream: pool upstream of society trap	6g		Fish sometimes congregate here, especially when the society trap is in operation; a mixture of spent and fresh fish
Upper stream: upstream of middle stream	7	Shallow open shingle stream	Spawning
Lower stream	8	Shallow open shingle stream south of stream 4	Spawning
	9	Shallow open shingle stream	Spawning
	9A	Small stream close to Glenariffe; overhung with matagouri; no salmon have been reported in this stream, so it was never counted from the air	

Table 1-continued

Area	Number	Description of water	Use by fish
Main Rakaia channel below the Hydra waters entrance (S73, 880870)	34, 35	Large pools in the Rakaia	Holding area
Main river pools	36, 37g	Braided shingle streams which are unstable and subject to flooding	Some spawning, but generally this is a throughway and a holding area
From main river pools to junction of Hydra waters and Rakaia			
The Hydra waters (also known as Titan Stream) system (S73, 855892)		The Hydra waters system is in a dense tussock (<i>Chionochloa rubra</i>) area; the streams are stable and clear, though there was some discoloration after heavy rain in 1976 - this was caused by run-off from the large shingle fan on the north edge; there is very little algal growth in the system	
Junction to white post	39, 40g	About 8 m wide, up to 2 m deep, and turbulent; there are several pools, generally at the bends in the stream; the banks are undercut and the water is shadowed; little algal growth; the white post marks the upstream limit of legal fishing	Holding area and throughway
White post to the whirlpool	41, 42g	As for area 39	Mainly a holding area and a throughway, though there is some spawning, mainly in the 200 m below the whirlpool
Whirlpool	43	A turbulent pool about 2 m in depth and 15 m in diameter	Holding area
Whirlpool to corner junction	44, 45g	This section is similar to 39 except that the banks are not as high or as undercut	Holding area and throughway
Corner to potholes	46	Shallow shingle stream	Spawning

Table 1-continued

Area	Number	Description of water	Use by fish
Potholes	47	A series of deep limpid pools in an area of swampy tussock	Holding area
Streams connecting and above the potholes	48	Silt and shingle bottomed streams	Spawning
Corner to "T" junction	49,50g	An open shingle bottomed stream with minor spawning	Throughway
Small spawning streams	51-60	Shallow shingle bottom streams tapering from 2 m in width and overhung with tussock	Principal spawning area
Stream south of Hydra waters (S73, 855892)	38	This stream runs on the southern edge of the Hydra waters system toward the junction of Rakaia and Mathias Rivers; major spawning area for the upper two-thirds of its length; runs through shingle and silt banks and is spring and seepage water; the water is clear except for the lowest 200 m, which in 1975 and 1976 was discoloured during floods	Spawning
Streams at the junction of the Rakaia and Mathias Rivers (S73, 800890)		Spring and seepage water streams; the lower reaches are in sandy shingle and the upper reaches in open tussock; these streams are stable, and the banks are never undercut	Spawning
Main Rakaia River between the streams at the Mathias junction and the Manuka Point lead (S73, 880890)		Open shingle riverbed subject to flooding and change	Throughway with minor spawning
Manuka Point (S73, 760878)	20,21g	This stream leads from the Rakaia River to the bluff east of the Manuka Point homestead; stable; occasionally carries dirty water from streams 27 and 30	Throughway and spawning

Table 1-continued

Area	Number	Description of water	Use by fish
Along bluff	22, 23g	Deep turbulent pools with undercut banks and overhung with trees	Holding area
Bluff pool	24	Large pool at the western (upstream) end of the bluff	Holding area
Homestead streams (bluff to fork below airstrip)	25	A network of shallow shingle streams up to 6 m in width; one small pool just below the fork; these streams are always stable and clear and are heavy spawning areas	Spawning
Stream south of airstrip	26	Shallow shingle stream	Spawning
Centre stream	27, 28g	An open braided shingle stream which carries water from the main Rakaia channel and discolours when the Rakaia is in flood; in 1976 it cut a second channel to join stream 25 above the pools at the bluff; the old channel joins stream 20 below the bluff, this second channel is stream 30; one pool is separately counted as area 32	Throughway with minor spawning
New channel of centre stream	29	Lower reaches are open, shingle bottomed, and shallow, with a width of 2-3 m; upper reaches are in sparse tussock and are about the same width, but water is deeper and there is a sandy bottom	Spawning
Top streams	30	New channel of the main river; joins the homestead streams above the bluff	Throughway
Group in 27 just below mouth of 31	31	Open stable shingle streams up to 6 m wide in sparse tussock; one large silt bottomed pool about 30 m in diameter	Spawning
Airfield stream	32	A narrow, 0.5 m deep, ditchlike stream with a weedy bottom	Holding area
	33		Occasional spawning

Table 1-continued

Area	Number	Description of water	Use by fish
Glenfalloch Stream (S73, 755850)			
Lake Heron tributaries and outlet			
Lake Stream (S73, 680830)			
Downs Hut stream (S73, 670810)			
Cameron River (S73, 680665)			
Mellish Stream (S73, 750640)			
Flats between Thompson and Banfield huts (S73, 632842)			

TABLE 2: Counts of salmon made from a Cessna 150 monoplane (pilot J. Reid) in 1973 (d indicates that the stream was too discoloured to count; p indicates that only a partial count was made; g indicates that the count contains estimates of fish in groups)

Stream	Apr			May			Jun	
	18	19	10	14	15	17	25	13
Acheron River and flats		3						
Coleridge lead	15p	30p				3		0
Cleardale flats							2	0
Redcliffe Stream and flats						28	4	d 6
Glenrock flats						1	0	1
Wilberforce and tributaries:								
Below Goat Hill						5		
Above Goat Hill	8							
Goat Hill flats	11			17				7
Glenariffe								
10								15
11,12,13,14	24	29	21	28		36	19	24
15	2	0	3	5			2	0
16	1	0	4	9		5	4	3
Flats east of Double Hill								
1,2		9	13	6		3	17	d 7
4,6,7	36	63	42	42		48	32	27 19
8	0	0	0	0		0	0	0 2
9	14	22	6	6		9	6	6 5

Table 2-continued

Stream	Apr		May					Jun	
	18	19	10	14	15	17	25	5	13
Rakaia, downstream of Hydra waters									
34	55g	40g	d	0	0		0	d	3
35	200g	300g	d	2	30g		0	d	9
36	71	76	d	35	31		29	d	5
Hydra waters									
39,41	67	88	111	93	82		37	5	10
43	400g	250g	400g	150g	200g		150g	5'x	19
44,46,47,48	20	6	10	53	37		35	20	26
49,50	100g	140g	120g	120g	120g		60g	5'x	0
51,52,53,54,55,56,58,59,60	94	141	167	191	103		88	56	31
Stream south of Hydra waters									
38	29	30	17	48			14	d	5
*Streams at the junction of Mathias and Rakaia Rivers and Manuka Point									
20,21,22,23,24,25,26,27,28,29	1	4		23			5	4	
31	5p			39			34	2	
	40			12p			30	3	
Glenfalloch	0								
Lake Heron tributaries and outlet									
Lake Stream		52					2	13p	
Mellish Stream		2						0	
Flats between Banfield and Thompson huts									
									3

TABLE 3: Counts of salmon made from a Cessna 150 monoplane (pilot J. Reid, except for 15 May when the pilot was J. Leet and 31 May when the pilot was J. Feehly) in 1974 (d indicates that the stream was too discoloured to count; p indicates that a partial count was made; q indicates that the count contains estimates of fish in groups)

	Apr							May							Jun				
	13	19	23	28	28	29	29	5	6	10	15	19	20	21	26	27	31	15	19
Stream																			
Cleardale flats								30	16										
Redcliffe Stream and flats						17	17	13	5				3		10				
Glenrock flats						5	5	2					0						
Wilberforce and tributaries																			
Wilberforce (below and above Goat Hill)						15	15						84					5	
Goat Hill flats						49	49						17					0	
Glenariff																			
10			40											137				11	
11,12,13,14		45	63	45	45	52	52	47	39	20	27	23	15	17	22	6		15	0
15		4	6	4	4	14	14	8	7	4	5	6	2	0	0	1		1	0
16		4	7	8	8	10	10	6	10	8	9	6	4	3	0	0		3	1
Flats east of Double Hill																			
1,2		d	15	16	16	26	26	24		59									
4		)	)	79	84	84	84))))))))))))
5		)	156	10	8	8	8	157	156	140	123	12	10	14	17	17	14	14	17
6,7,8		)	77	)	4	4	4))))))))))))
9		)	11	16	16	14	14	6	5	6	6	4	5	5	5	2	0	0	0
Rakala, downstream of Hydra waters																			
34	d	d	d	d	d	d	d	5	5	7	0	0	0	0	0	0	0	0	1
35	d	d	d	d	d	d	d	100q	100q	100q	40q	30q	30q	20q	20q	20q	0	0	1
36	11	d	26	37	41	41	41	46	36	39	23	34	33	55	46	24	13	9	9
37	150q	d	100q	100q	100q	100q	100q	100q	75q	100q	30q	50q	40q	40q	20q	15q	15q	0	2

Table 3-continued

Stream	Apr							May							Jun		
	13	19	23	28	29	5	6	10	15	19	20	21	26	27	31	15	19
Hydra waters																	
39,40,41,42,43,44,45,47,																	
49,50	335q	420q	460q	475q	442q	466q	452q	340q	230q	260q	275q	255q	240q	220q	130q	70q	84q
46,48,51,52,53,54,55,56,																	
57,58,59,60	71	221	233	293	266	288	224	240	264	359	311	263	232	176	67	77	38
Streams south of Hydra waters																	
38				41	45	33		44			21p	59	24				6
Streams at the junction of Mathias and Rakala Rivers and Manuka Point																	
20,21,22				4		13		7			6	4	2			0	0
23				d		13		18			13	0	d			2	2
24				75q		50q		30q			30q	20q	d			0	0
25,26						80q					30q		30q			20	0
27,28						50		61			48	39	22			0	2
29						7					13	20	d			4	0
31								20			7	6	3			1	1
				79		73		51			49	44	44	19		6	3
Lake Heron tributaries and outlets																	
Lake Stream					51											35	
Downs Hut stream					15											4	
Cameron River					16											2	
Flats between Thompson and Banfield huts					1												

TABLE 4: Counts of salmon made from a Bell 47G4 helicopter (pilot K. Kingsbury) in 1975 (d indicates that the stream was too discoloured to count; p indicates that only a partial count was made; g indicates that the count contains estimates of fish in groups)

Stream	Apr				May				Jun	
	11	19	27	5	6	13	22	29	30	7
Wilberforce and tributaries										
Below Goat Hill					31				2	
Above Goat Hill					20				0	
Goat Hill flats					143				64	
Glenthorne Stream					58				18	
Glenariffe										
10			210					102		9
11	32	104	91	45		28		36		10
12	27	85	72	66		57		40		8
13	52	62	59	78		108		93		30
14	3	27	28	5		8		17		5
15	30	20	33	27		67	69	32		8
16	27	24	54	70		77	94	40		24
17		0	3	7		7		3		0
Flats east of Double Hill										
1	d	19	18p	65		24	d	44		d
2	d	20	35p	28		13	d	17		d
3	0	1	0	7		1	2	1		1
4	)	0	18	3		4	d))
5	)	44	15	0		0	d	)	152g)
6	)	132g	50g	27g		70g	d	)	)	85g
7	)	122g	112	146		93	d)))
8	2	3	5	6		2	11	15		10
9	48	63	68	40		45	28	12		2

Table 4-continued

Stream	Apr			May					Jun	
	11	19	27	5	6	13	22	29	30	7
Rakaia, downstream of Hydra waters										
34	d	0	d	2		0	d	0		d
35	d	200q	d	4		15g	d	0		d
36	d	87	84p	218		73	d	30		d
37	d	260g	d	70q		30q	d	0		d
Hydra waters										
39	44	27	23	75		47	30	24		11
40	0	0	100g	0		0	0	0		0
41	128	135	134	144		122	95	73		26
42	70g	95g	75g	30q		0	0	0		0
43	300g	300q	400pg	300q		250q	100q	100q		30q
44	12	1	10	32		26	29	6		0
45	90g	100q	200pg	200q		95q	100q	100q		31
46	1	6	7	10		21	37	16		7
47	15g	20q	115g	53		50	18p	5		0
48	12	27	36	31		58	37	52		20
49	17	5	30	58		11	64	25		6
50	40g	0	0	0		0	10q	0		0
51	146	140	158	241		244	192	133		73
52	52	50	60	96		99	58	67		40
53	69	70	88	130		183	92	98		44
54	1	4	2	9		11	14	11		5
55	34	45	80	99		174	91	51		37
56	7	2	14	20		29	11	16		8
57										5
58		9	23	28		29	24	13		7
59		2	4	5		4	2	1		1
60	1	0	0	0		2	8	2		0
Stream south of Hydra waters										
38	d	87	102	150		135	133	98		25

Table 4-continued

Stream	Apr				May					Jun
	11	19	27	5	6	13	22	29	30	7
Streams at the junction of Mathias and Rakaia Rivers and Manuka Point										
20	23	30	55		30	18	37	22		6
21	)	41	) 85g		23	44	d	24		5
22	) 127g	100q	)		30q	60g	d	0		0
23	)	56	45		34	49	19	12		18
24	)	0	0		15	0	0	0		0
25	80g	150q	200pg		150q	80g	25q	30q		10q
33	44	114	100		130	90	111	54		25
26	2				31			3		5
27	0		23		4	9	10	3		4
28	56	104	34p		48	89	d	23		4
29	0	15	d		36	0	d	0		0
32	20g	4	7		10	3	5	17		6
31	36	161	294		0	0	41	25		0
					262	207	105	98		37
Lake Heron tributaries and outlet										
Lake Stream									22	
Downs Hut stream									17	
Cameron River									8	
Mellish Stream									5	
Flats between Thompson and Banfield huts										
									5	

TABLE 5: Counts of salmon made from a Bell 47G4 helicopter (pilot K. Kingsbury) in 1976
(d indicates that the stream was too discoloured to count; p indicates that only a partial count was made; g indicates that the count contains estimates of fish in groups)

Stream	Apr				May			Jun
	1	11	21	30	11	21	31	10
Glenariffe								
10							31	
11	38	59	91	167	145	100	39	10
12	33	56	72	125	170	86	45	11
13	12	33	30	67	114	80	43	27
14	1	8	3	10	33	19	4p	5
15	0	27	44	102	130	79	27	20
16	7	40	33	54	198	112	69	17
17	0	0	0	0				
Flats east of Double Hill								
1	20				89	69	30	d
2	0		17	61	38	20	4	d
3	0	0	0	1	3	2	0	0
4	0	0	1	6	0	0	0	0
6	0	17	)	103	)	0	0	0
7	64	220	) 255	276	) 177	64	43	49
8	0	1	5	16	23	9	3	1
9	1	12	29	50	65	50	30	6
Rakaia, downstream of Hydra waters								
34	d	500g	650g	d		d	d	d
35	d	0	0	d		d	d	d
36	222	224	341	d		d	d	d
37	220pg	204g	263g	d		d	d	d
Hydra waters								
39	27	49	27	47	43	43	15	d
40	0	0	0	0	0	0	0	d
41	120	195	222	d	212	121	66	d
42	200g	50g	50g	d	0	0	0	d
43	350g	300g	300g	d	300g	250g	150g	d
44	10	12	15	d	22	18	8	d
45	250g	300g	300g	200g	500g	330g	44	d
46	5	0	21	52	32	27	16	15
47	15	0	0	45	51	10	0	0
48	5	38	57	156	84	86	61	18
49	5	28	0	23	)	)	14	47
50	0	0	100g	280g	) 15g	) 25g	30	0
51	81	261	244	254	392	306	222	130
52	20	87	75	88	103	76	83	25
53	38	92	173	206	175	140	138	77
54	0	3	0	9	15	14	10	6
55	18	86	109	190	222	121	94	29
56	1	7	24	40	49	36	18	11
57	0	5	13	27	41	19	10	2
58	2	4	34	51	54	34	18	4
59	0	0	2	3		7	4	1
60				5		2	2	2

Table 5-continued

Stream	Apr				May			Jun
	1	11	21	30	11	21	31	10
Stream south of Hydra waters 38	37b	124	171	204b	258	132	72	41
Streams at the junction of Mathias and Rakaia Rivers and Manuka Point	6	42	46	d	59	51	12	16
20	d			d	d	d	d	d
21	d			d	d	d	d	d
22	d	37	24	d	39	d	17	10
23	d	45g	130g	d	30g	d	0	0
24	d	50g	150g	d	84	d	d	0
25	10	106	109	219	170	104	43	25
33			19	28		15		
26	0	16	20	34	20	18	6	0
27	d			d		d	d	d
28	d			d		d	d	d
29	5	19	44	76	43	29	12	2
30	d	4	11	d	5	d	d	d
32	0	13	67	97	129	67	27	0
31	17	115	119	253	272	255	121	57

TABLE 6: Ground counts in Glenarliffe Stream, Double Hill flats, Hydra waters, the streams at the junction of the Mathias and Rakaiā Rivers, and the Manuka Point area for 1973-76 (q indicates that the count contains estimates of fish in groups)

Streams	1973					1974					1975					1976	
	10 May	6 Jun	6 May	20 May	4 Jun	17 Apr	12 May	28 May	21 Apr	11 May	9-10 Jun	18 Apr	22 May	28 May	21 Apr	11 May	10 Jun
Glenarliffe																	
11	)	)	)	)	)	94	48	21	24	52	11						
12	)	)	)	)	)	59	45	15	67	119	8						
13	)	)	)	)	)	60	50	52	17	92	6						
14	)	)	)	)	)		7	26	4	29	1						
15	9	1	17	9	5	31	34	51	51	116	14						
16	9	5	33	12	5	47	93	62	24	122	9						
Flats east of Double Hill																	
4,5,6,7	76	41	)	)	)	125	152	88									
8	)	)	)	)	)	1	2	15									
9	)	)	)	)	)	75	45	10									
Hydra waters																	
41	)	)	)	)	)	67	55	66									
42	)	)	)	)	)	80	0	0									
43	)	)	)	)	)	260q	100q	100q									
44	)	)	)	)	)	7	5	8									
45	)	)	)	)	)	85q	95q	100q									
46	)	)	)	)	)	14	20	25									
48	)	)	)	)	)			57									
49,50	)	)	)	)	)	219	64	26									
51	236	82	165	108	49	218	251	218	320	403	103						
52	31	11	76	44	14	90	120	90	125	149	51						
53	181	97	127	124	77	136	207	172	285	263	77						
54	14	12	8	23	5	23	33	21	14	26	16						
55	105	55	106	178	75	98	188	130	203	250	54						
56																	

Table 6-continued

Streams	1973		1974		1975		1976	
	13 May	6 Jun	8 May	21 May	4 Jun	18 Apr	13 May	29 May
Streams at the Junction of Mathias and Rakai Rivers	13 May	6 Jun	8 May	21 May	4 Jun	18 Apr	13 May	29 May
Manuka Point								
20,21,22,23	)	)	)	)	)	113	115	105
24	)	)	)	)	)	100q	70q	
25	) 83	) 13	) 340q	) 154q	) 57q			
26	)	)	)	)	)	7	11	
33	)	)	)	) 16	)	7	25	1