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FISHERIES TECHNICAL REPORT
No. 93

THE SOUTH CANTERBURY TROUT AND SALMON FISHERY

E. GRAYNOTH AND W. SKRZYNSKI

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THE SOUTH CANTERBURY TROUT AND SALMON FISHERY

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FISHERIES MANAGEMENT DIVISION
MINISTRY OF AGRICULTURE AND FISHERIES
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SUMMARY

This report describes the trout and salmon fisheries of South Canterbury Acclimatisation District. It is based on angling results collected since 1947 by eight angling diary schemes.

Over the past twenty years the popularity of angling has doubled. The average Men's Whole Season Licence holder fishes for about 20 days per season to catch 17 fish. The total district effort is about 100,000 days and the total catch 60,000 fish per season.

There has been little historical change in the brown and rainbow trouts' and quinnat salmon's geographical distribution, size caught by anglers and probably numbers. The anglers' crop of fish is estimated to be a small proportion of the natural stock. A comparison of anglers' catches and fish sampled from the rivers shows that anglers' catch is a fairly representative proportion of the population above 25cm.

The seven principal waters and anglers' catches are described. The size limits imposed are too stringent but the bag limits have little effect. Comments are made on future fisheries management.

INTRODUCTION

The South Canterbury Acclimatisation Society district in the South Island of New Zealand is bounded by the Rangitata River in the north and the Hunters Hills in the south. The district also extends inland over the Two Thumbs Range to the Mackenzie Plains and Lakes Tekapo, Pukaki and Benmore to the Alps (Fig. 1).

The freshwater sports fishery has been locally controlled and managed by the South Canterbury Acclimatisation Society for nearly 100 years, the Society receiving technical advice and assistance from the Fisheries Division of the Ministry of Agriculture and Fisheries (formerly the Marine Department). The Marine Department initiated an angling diary scheme in 1947, which continued for five years. The results of this scheme were analysed by Allen and Cunningham (1957). Angling diary schemes were then run at five year intervals in 1957, 1962 and 1967. As a check on their accuracy, postal questionnaire schemes were run in Otago and North Canterbury in 1958 and 1963 and also in other acclimatisation districts.

This report summarises the information contained in these diary schemes in the South Canterbury District and has the following aims:

Firstly, it is a preliminary description of the waters of the district, the size, species and density of fish present and the methods used by anglers to catch the fish. These descriptions are intended to be a primary aid to enable the Acclimatisation Society to develop a management plan for the district and each water. By systematic biological data collection on each specific water, the Society can build up a large store of knowledge. With this accumulated knowledge, any fisheries management problem which arises can be more easily dealt with and more accurate scientific assessments made than at present.

Secondly, the report is aimed to assist the average angler in using the best methods, and also where he can catch the largest fish.

Although the angling diary scheme was run for eight years in South Canterbury district, the response by anglers has been very poor and apathetic. In total 262 diaries were received, recording 6,364 days and 21,240 hours angling to catch 11,890 takeable fish. All licence holders were given a diary with their licence in these 8 years but in no case did the percentage return of diaries from these licence holders exceed 3%. This low return makes certain derived statistics such as anglers' catch rate and crop from specific waters subject to large possible errors and of little value. Because of these errors, firm decisions cannot be taken from some of these data and management will be still somewhat speculative instead of scientific and accurate.

We have only analysed the diary scheme and related it to the other data known to us, such as Technical Field Service reports and other published information in Society annual reports. There is a tremendous amount of unpublished information held by the Society and by local anglers as well as by Catchment Boards and other organisations. We feel it is the local management's responsibility to analyse and bring this all together with this report, to produce management plans for the future. Without this coordination no progress will be made.

The angling diary data were coded and computer tabulated. This basic information is stored by the Marine Department and should be used in planning future creel census or postal questionnaire schemes.

A statistical analysis of angling results derived from angling diary schemes was made by Allen and Cunningham (1957) and Graynoth (1973), to which reference should be made.

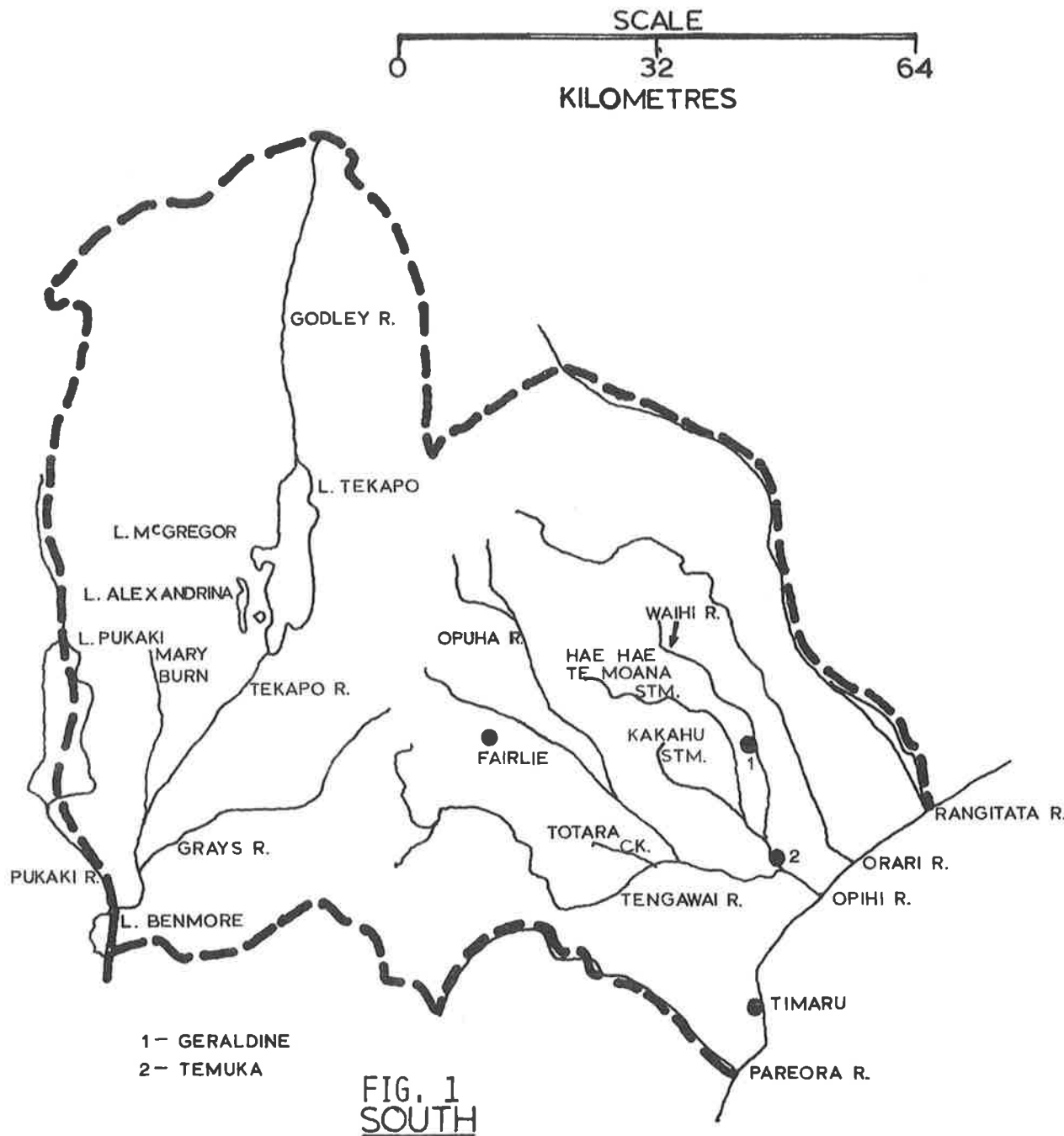


FIG. 1
SOUTH CANTERBURY ACCLIMATISATION DISTRICT

THE ANGLERS

The Number of Anglers

In 1951 South Canterbury held the second place after Ashburton in the popularity of angling amongst the population. Since then the number of Men's Whole Season Licences has more than doubled (Fig. 2), surpassing the increase in licence sales in Ashburton. Therefore now the district probably holds the first place in New Zealand in the popularity of its angling, which would have increased from 9.9% of men holding Men's Whole Season Licences in 1951 to about 15% nowadays. In several larger districts (e.g. Wellington) the popularity of angling has been much lower and has actually decreased in recent years. It is interesting that the number of Men's Whole Season Licences in South Canterbury remained about the same from 1955 until 1964 when it increased very rapidly from 2,100 to about 2,700 in 1967, since when it has remained stable. The Society has always been active but there appears to be no obvious explanation for such a rapid increase of interest in angling during those three years.

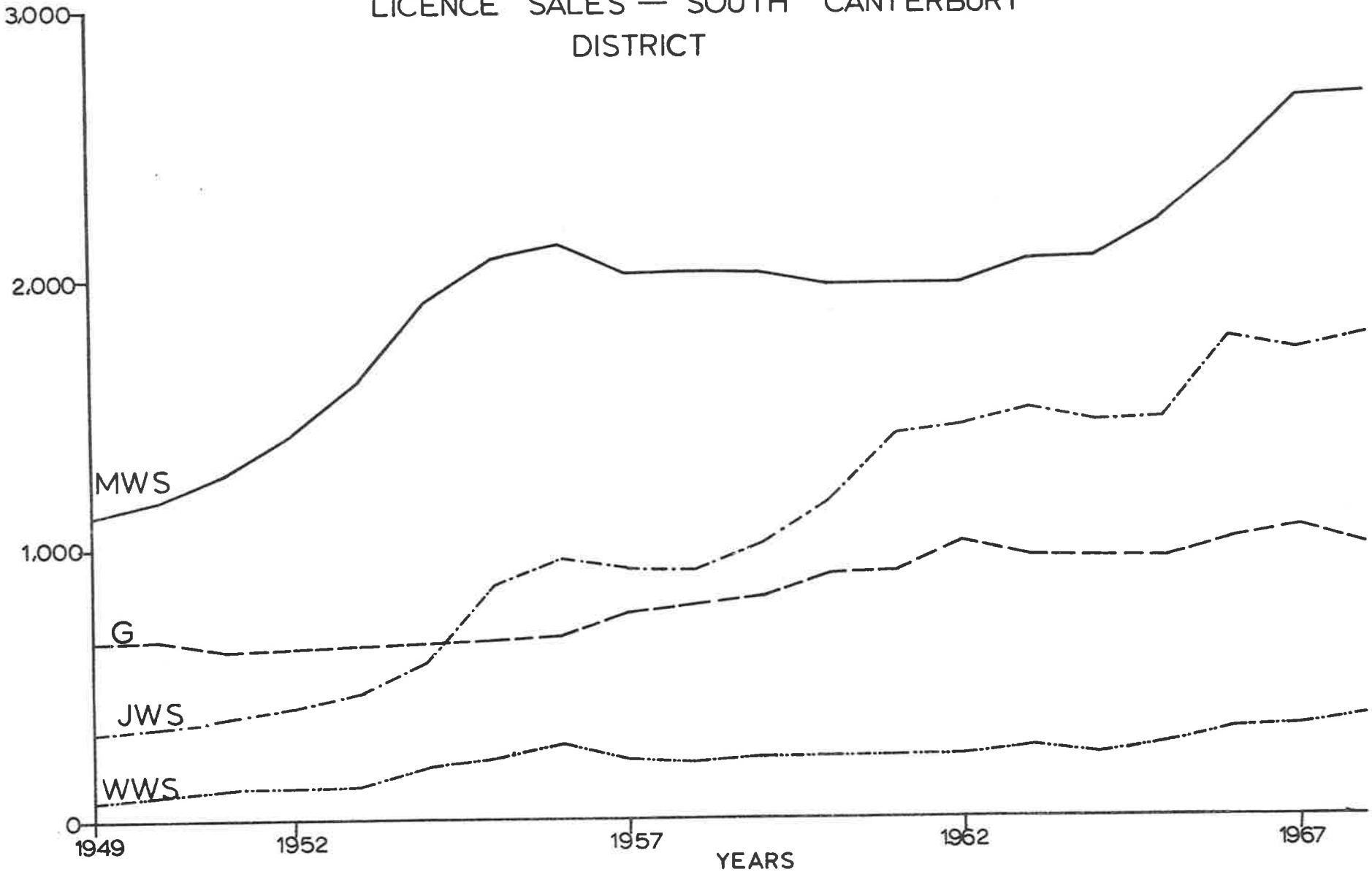
The Average Angler's Fishing Effort, Catch and Catch Rate

The average Men's Whole Season Licence holder fishes for about 20 days per season to catch about 17 fish (Table 1). This is a similar average effort to Ashburton and North Canterbury anglers but for a considerably larger number of fish (17 cf. 10). It appears from the diaries that these figures would have not changed much since 1957. Graynoth (1973) has confirmed that the diarists are generally more skilled and successful than the average angler. The average diarist catches about 35 fish per season with a range from 0 to 300 fish per season.

Few diaries were returned from women or children anglers but using North Canterbury results it seems that they would catch about 5 fish per season on average in the South Canterbury district.

FIG. 2.

LICENCE SALES — SOUTH CANTERBURY DISTRICT



MWS - Men's Whole Season

JWS - Junior Whole Season

WWS - Womens Whole Season

G - Game Shooting Licence Sales

TABLE 1

Average Annual Fishing Effort and Catch of Men's Whole Season Diarists from 1947 to 1967

Year	1947-52	1957-58	1962-63	1967-68
Men's Whole Season Licence Sales per Annum	1,131	2,011	1,969	2,665
Total Diaries Returned	58	43	53	21
Percentage Return	1.03†	2.14	2.69	0.79
Mean Days/Season Own District	23.9	21.26	22.96 * (19.83)	22.19
Hours/Day	3.51	3.61	3.25	2.56
Mean Fish Kept/ Season	69	33.77	35.32 * (16.80)	35.29
Fish/Day	2.89	1.59	1.54 * (0.85)	1.59
Fish/Hour	0.82	0.44	0.47	0.62

† 5 year scheme

* Figures for an average Men's Whole Season angler derived from the 1963 North Canterbury questionnaire according to statistical considerations in Graynoth (1973).

The South Canterbury diarists spent over 10% of their fishing time outside the home district, mainly in the Waitaki Valley.

The District Crop of Fish

The present district crop of fish has been estimated at about 60,000 fish a year, about 10% of which (6,000 fish) would have been taken by visitors. About 45,000 of these fish would have been taken by resident Men's Whole Season Licence holders, whose rate of catch and time spent fishing per season are much greater than these of other licence holders. Since it appears that the catch of the average angler has not changed from 1957, the district crop would have been only affected by the increase in the number of anglers, i.e. it would have increased rapidly between 1964 and 1967. Assuming a direct proportion to the increase of Men's Whole Season Licence sales, the district crop would have increased from about 47,000 in 1964 to 60,000 fish in 1967, caught in about 100,000 days fishing.

The average catch of the 1947-52 diarists was twice as large as that in the following years, although the number of days fishing remained about the same. The main reason for this appears to be that in 1947-52 the diarists fished much less in Lake Alexandrina, where the rate of catch is much lower than in the main rivers. Therefore, in these early years the catch consisted mainly of river fish. The increased popularity of Lake Alexandrina is probably connected with better transport.

THE FISH STOCKS

The Distribution of Species

Brown trout are found in all angling waters and comprise the great majority of the anglers' catch (80%). All the rivers contain large stocks of brown trout and they are also found in lesser numbers in Lakes Pukaki, Tekapo and Alexandrina.

Rainbow trout are mainly found in Lakes McGregor, Alexandrina and Benmore and a few in Lakes Pukaki and Tekapo. A few rainbow were reported caught by diarists in the Opihi and Orari Rivers.

Sea run quinnat salmon are very important in terms of licence sales and angling effort, but not catch. These fish run mainly up the Opihi and its tributaries and also the Orari River. A few land-locked quinnat are present in Lake Alexandrina and probably some land-locked sockeye salmon in Lake Benmore.

The Size of Trout

The average size of brown trout caught in all rivers is fairly small from about 30 to 36 cm (Table 2a). Large fish of over 61 cm are rare and have been recorded by the diarists only from the Opihi and Tengawai Rivers.

The size of fish caught in the principal waters of the district has been very stable for many years and all length results have been summed in Table 2a.

Lake Alexandrina has yielded the largest fish in the district for many years. Although the proportion of brown trout is small, most of the largest fish are brown. The average weight is about 1.8 kg with the largest brown trout caught up to 6 kg and the largest rainbow up to 4kg.

There is a record of 25 large brown and 5 rainbow trout caught in Grays River in 1967, the average size of which was 50 cm and 11 of these were over 1.8 kg. The rate of catch was 0.45 fish/hour. This suggests that Grays River contains a good stock of large fish. It is probable that other streams below Lake Tekapo also contain large fish.

The Hae Hae Te Moana, Waihi, Te Ngawai, Totara Valley Creek, Main Drain, Orari, Pareora and Upper Kakahu Rivers are subject to water loss due to summer droughts. In 1969, with the aid of an electric fishing machine and nets, Rangers of the South Canterbury Society salvaged over 4,000 salmon and trout from these rivers. The salvaged fish were measured and transferred to permanent water or other rivers and lakes. Lengths of brown trout are given in Table 2b and comparisons with the size of angler caught fish in Fig. 3 a, b, and c.

TABLE 2 a

LENGTH OF ANGLER CAUGHT TROUT 1962-1967

Length (in.)	cm	*RIVERS* Orari	Waihi	Te Moana	Kakahu	Temuka	Opihi	Tengawai	Pareora	*LAKE* Alexandrina
Below 10		75	543	137	72	355	996	484	887	
10	25.4	8	159	19	8	77	115	43	167	
11		17	263	22	35	136	172	124	345	
12		35	238	43	54	184	331	194	452	1
13		11	108	32	35	91	319	76	262	2
14		39	63	33	31	72	376	102	251	23
15	38.1	20	19	27	12	19	285	44	186	42
16		9	6	7	13	15	237	59	129	70
17		6	1	1	4	2	120	26	71	66
18		13	1			3	176	29	52	112
19		1	1		1		54	17	20	74
20	50.8	6			1	1	42	12	15	170
21						1	20	11	20	103
22		1				1	15	12	11	139
23							5	5	4	105
24							5	5		130
25	63.5						5			91
26							5			50
27							2	1		46
28							4	1		8
29							1			3
30	76.2						2			
31							4			
Fish more than 25.4 cm TOTAL		166	859	184	194	602	2295	761	1985	1235
Av.Wt. kg		0.54	0.32	0.41	0.41	0.36	0.54	0.54	0.45	1.8
Av.Lth. cm		35.6	29.7	32.5	32.8	31.0	36.8	34.8	33.5	53.3

TABLE 2 b
LENGTHS OF TROUT SAMPLED

Length (in.)	cm	Electric Fishing Salvage Records 1968 - 1969					Netting Feb.1959	Spawning Run Traps 1962
		Orari	Waihi	Te Moana	Upper Kakahu	Pareora	Opihi	L.Alexandrina
0								
1								
2		?	?	?	?	?	?	
3		?	?	?	?	?	?	
4		34	11	?	?	?	?	
5	12.7	45	39	5	?	1	?	
6		5	170	8	2	1	?	
7		160	368	22	7	1	2	
8		394	235	23	22	9	32	
9		452	260	17	12	20	54	
10	25.4	63	134	7	6	10	64	1
11		45	79	4	10	13	25	1
12		21	22	13	6	21	26	0
13		26	10	28	4	55	65	4
14		11	5	17	1	49	24	3
15	38.1	15	1	6	4	40	5	13
16		4	1	4	1	37	2	90
17		4		2		43	1	230
18						11		240
19				1		2		280
20	50.8					2		510
21						1		650
22						1		620
23								410
24								180
25	63.5							55
26								12
27								0
28								1
29								0
30	76.2							
31								
Fish more than 25.4 cm								
TOTAL		189	252	82	32	285	212	3300
Av.Wt.(kg)		0.32	0.23	0.45	0.32	0.59	0.32	1.71
Av.Lth.(cm)		30.0	27.2	33.5	30.5	36.8	30.2	52.3

FIG. 3a Length Frequency for Angler Caught Brown Trout 1947-67 and Brown Trout Caught by Electric Fishing 1968-69

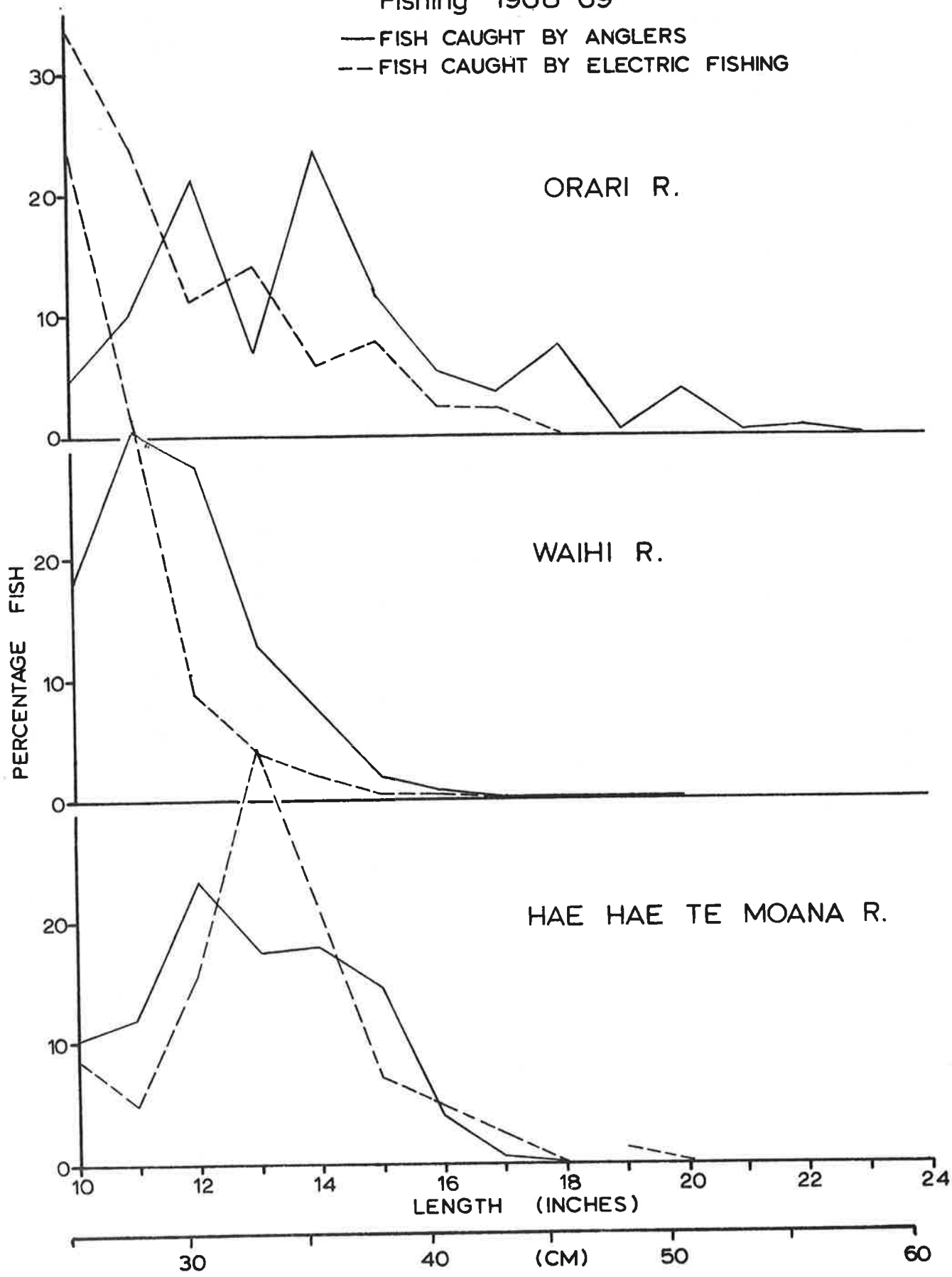


FIG. 3b

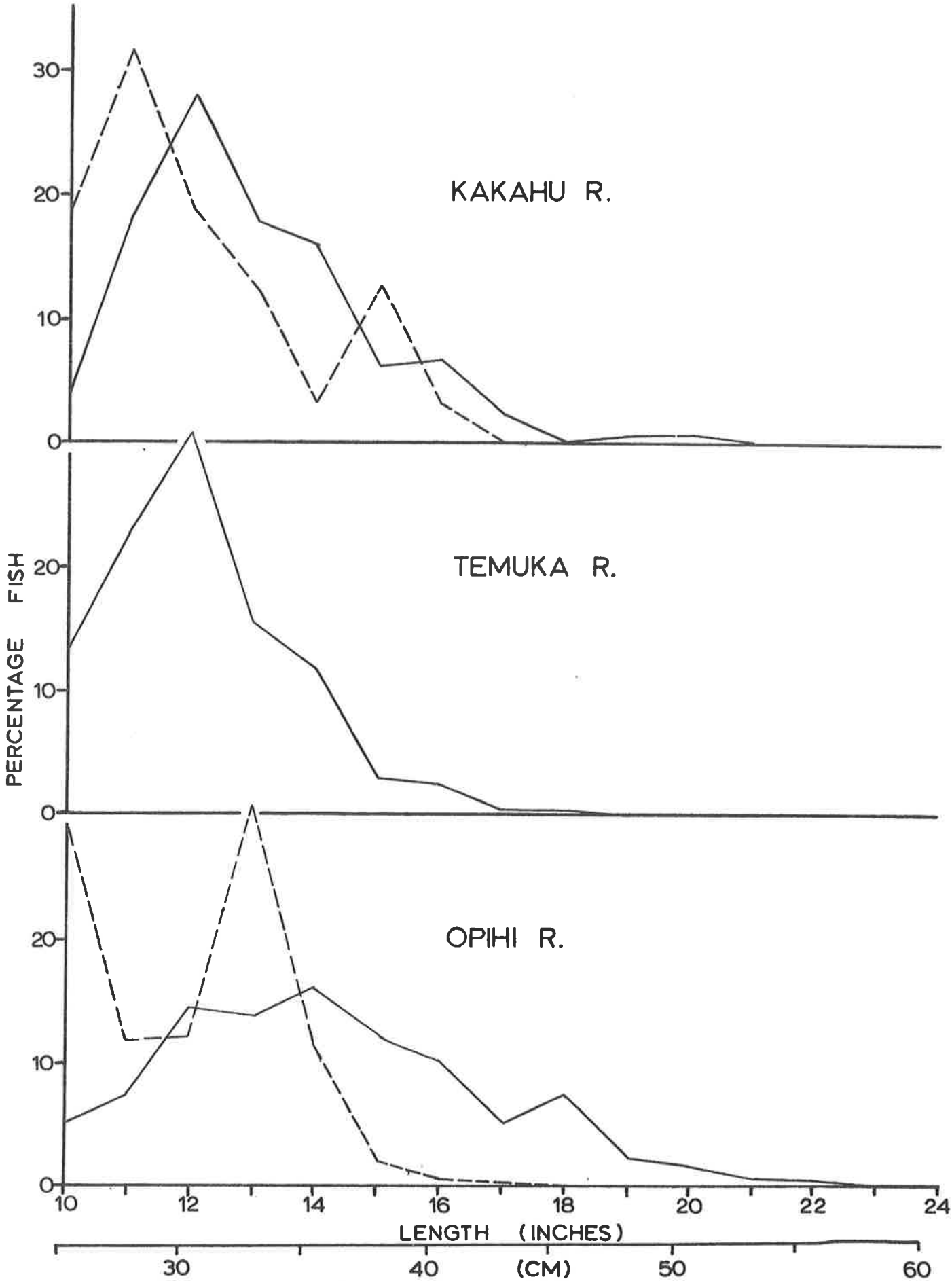
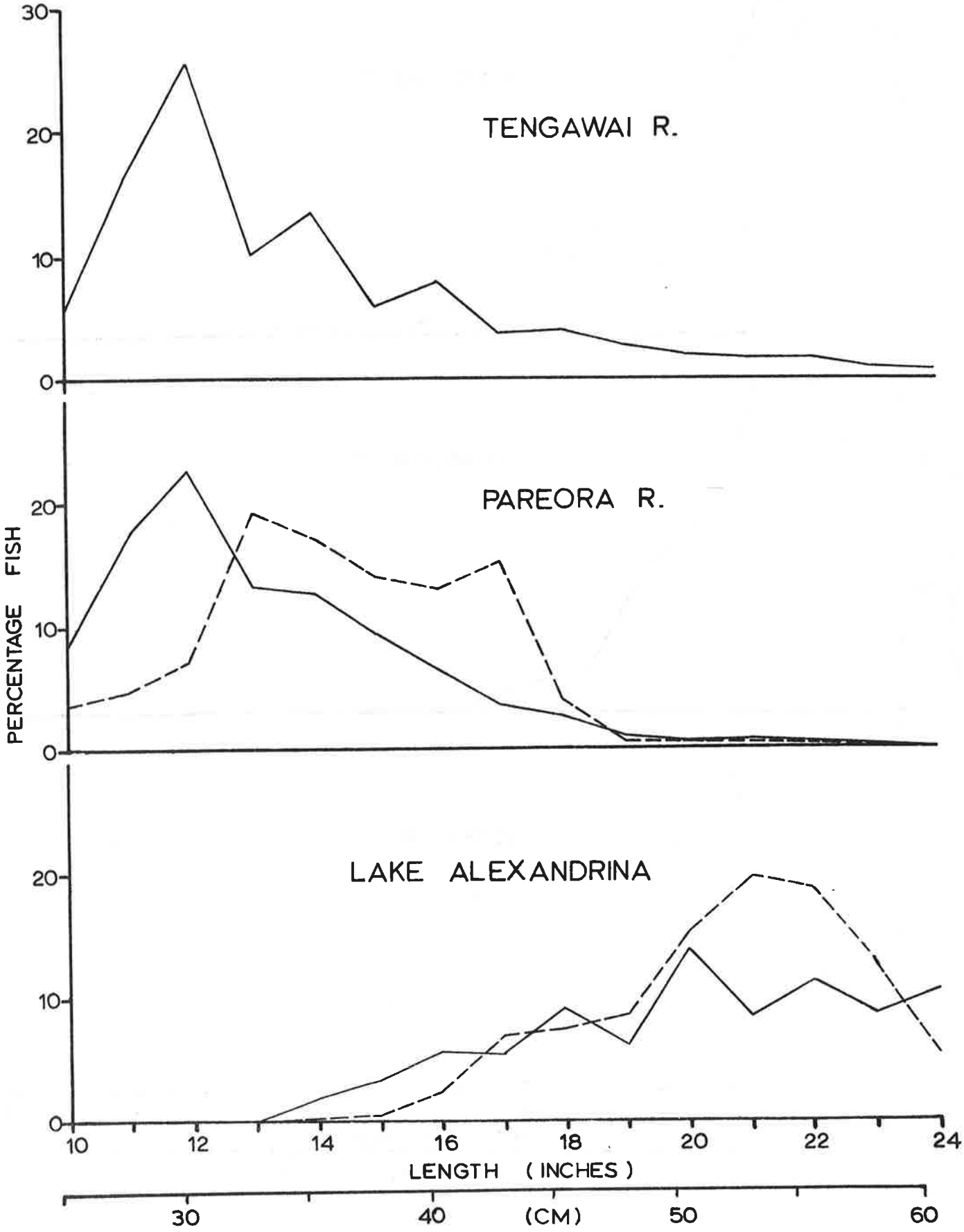

KAKAHU R.
TEMUKA R.
OPIHI R.
PERCENTAGE FISH
0
10
20
30
10
12
14
16
18
20
22
24
LENGTH (INCHES)
30
40
(CM)
50
60

FIG. 3c


TENGAWAI R.
PAREORA R.
LAKE ALEXANDRINA
PERCENTAGE FISH
30
20
10
0
10
12
14
16
18
20
22
24
LENGTH (INCHES)
30
40
(CM)
50
60

Anglers appear to select the larger fish (in the population over 25.4 cm) but the selection factor is not very great and may be largely explained by anglers returning 25.4 and 27.9 cm fish as undersized. Angler selection of larger fish probably only becomes noticeable where the average size is larger, such as in Lake Alexandrina. With more accurate anglers' and electric fishing results from this district, the Society could clarify this important relationship.

The Growth Rates of Trout

The brown trout were salvaged from the rivers mainly from November to April, when the 0+ year old fish would be fry or fingerlings. These trout were not usually measured. The main catch would be 1+ year old trout which averaged about 20.8 cm in length (17-25cm). Although these records are subject to certain unknown errors, such as electric fishing size selection and locality, differences in the growth rate agree with those shown in other South Island brown trout rivers such as the South Branch, sections 5 and 6 (Burnet 1968) and the Hinds River (Lane 1964). The growth rate is probably fitted by the von Bertalanffy growth curve. With a maximum size of 48.3 cm the length at 1, 2, 3, 4 and 5 years of age would be 15, 25.6, 32.9, 37.6 and 41.1 cm respectively.

This growth rate is considerably slower than that found by Allen (1951) and Graynoth (1973) in North Island brown trout waters and may be related to the greater density of trout found in South Canterbury rivers.

It is unfortunate that more use cannot be made of these salvage records, but various measurements were not made, such as the electric fishing capture efficiency, the length of fingerlings, area salvaged, area dry, etc.

The Stock and Anglers' Crop of Trout

The brown trout populations of the rivers have not been accurately surveyed. The only records available are those of the 1969 salvage operations. Only rough measurements of distances surveyed were given and the fish caught were from an unknown area of river, some of which was dry. These records have been examined and the stocks of catchable trout (25.4 cm +) in the Hae Hae Te Moana, Waihi, Pareora and Orari Rivers were roughly 105, 310, 527 and 310 per kilometre respectively. These stocks are high but not exceptional. The Wainuiomata and Hutt Rivers in the North Island have around 125 catchables per kilometre (Graynoth 1973), the Doyleston and Hamner Road Drains just over 60 and South Branch (section 3) 93 (Burnet 1959 and 1968). The Hinds River in its middle reaches had about 250 per kilometre and 125 per kilometre near the sea (Lane 1964).

The present total crop in the district has been estimated at 60,000 fish per season of which 800 to 1,700 are salmon caught in the Opihi.

The total crop was subdivided according to the proportion of fish caught in various waters by the diarists in 1957, 1962 and 1967. This proportion varied from year to year as Table 3 shows. The fluctuations are very high and they would reflect partly the fishing conditions but mainly the individual preferences of the diarists whose number was small.

When the estimated stock figures are compared to anglers' estimated crop figures, it can be seen that the anglers' crop is generally low and probably averages about 20-30% of the catchable stock in most rivers.

A very large proportion of the fish present in the rivers are 1+ year old and are just under the 25.4 cm size limit. It is therefore very unlikely now or in near future that anglers' catches will cause a significant reduction in stock numbers or cause the fisheries to deteriorate.

The stock in Lake Alexandrina has been estimated on the basis of the proportion of fish, marked during the 1962 spawning survey, captured by anglers during the opening weekend of the angling season. This estimate was about 18,000 fish plus an unknown number of catchable fish which did not participate in the spawning runs. This gives a medium cropping rate which may approach about 40%.

TABLE 3

Angling Statistics for the Major Waters

Water	Trout Average Length cm	1962-1967 Fish/Hour (MWS Anglers)	Estimated Crop 1957	1962	1967	Approx. crop per kilo-metre	Estimated Catchable Stock per Kilometre
Rangitata*	40.6	-	200	1,200	500		
Orari	35.6	0.60	450	1,000	1,000	10	300
Opihi	36.8	0.68	5,100	8,400	15,600		
Waihi	29.7	0.80	2,400	3,200	6,800	100	300
Te Moana	32.5	0.90	150	1,900	500	20	100
Kakahu	32.8	1.30	200	600	2,600		
Temuka	31.0	1.20	1,200	3,700	2,200		
Tengawai	34.8	0.3	3,300	600	2,200		
Opuha	34.3	-	100	50	1,900		
South Opuha	30.5	-	50	200	-		
Pareora	33.5	1.0	12,500	8,200	7,900	235	530
Lake Alexandrina	53.3	0.22	9,100	5,500	2,900	8.6 (per hectare)	26.9 (per hectare)
Lake McGregor	53.3	-	300	900	50		
Lake Tekapo	40.6	-	100	600	500		
DISTRICT TOTALS			43,000	44,000	58,000		

* South Canterbury District records only

Fisheries Regulations

The limit bags of 12 trout from rivers and four trout from Lakes Alexandrina and McGregor are seldom reached and therefore they have little restrictive effect on the catch. In Lake Alexandrina the bag limit would have to be lowered to 2 fish to become really effective. In 1962 out of 436 bags recorded only 18 were of three fish and 17 of four fish (8% of total). There is no justification for a different bag limit (8) in lakes and rivers west of Burke's Pass and this should be changed to 12 for uniformity.

It is not known what effect the limit of four salmon has, but because of the low rate of catch of salmon it is probably negligible.

It would be most beneficial to lower the size limit in all waters east of Burke's Pass to 20 or at least 23 cm and also to allow juvenile anglers at least in some waters to take 15 cm fish. The Society's Ranger has measured 3,474 fish salvaged from these rivers and of these only 850 (less than a quarter) would have been available to the anglers under the present limit. With the periodic droughts most of these fish die before they can reach takeable size. The size limit of 20 cm would make 71% of the above sample of fish available to the anglers, a much more satisfactory situation and less wasteful. At present up to 50% of the fish caught are undersized. For a more complete discussion on the use of size limits, especially where the trout are small, see Allen (1951 and 1954).

The Society (pers. comm.) has considered the lowering of size limits on a number of occasions but because of an adverse reaction from anglers has not been able to proceed with this.

As a general guideline, the method restrictions should be imposed only where and when absolutely necessary. It has been proved that no legal method is consistently more efficient than the others e.g. Allen and Cunningham (1957). Winter fishing could be tried in the Pareora River which is obviously very productive and not used to its full extent.

THE WATERS

The Rangitata River is described in the Ashburton District report.

The Orari River rises in the foothills of the Southern Alps. It is about 77 kilometres long and has a catchment area of 767 square kilometres. The catchment area has been almost entirely changed by man.

The Orari carries large amounts of shingle from the foothills and there is a wide shingle flood bed in the lower reaches. The river is seriously affected by periodic flooding, drying up of the middle reaches in summer and extensive Catchment Board activities aimed at flood control. The whole catchment is generally unstable.

The Orari is one of the smallest rivers supporting a quinnat salmon run. The diarists recorded catching 72 brown trout and 2 quinnat in 1962 and 27 brown trout, 1 rainbow and 1 quinnat in 1967.

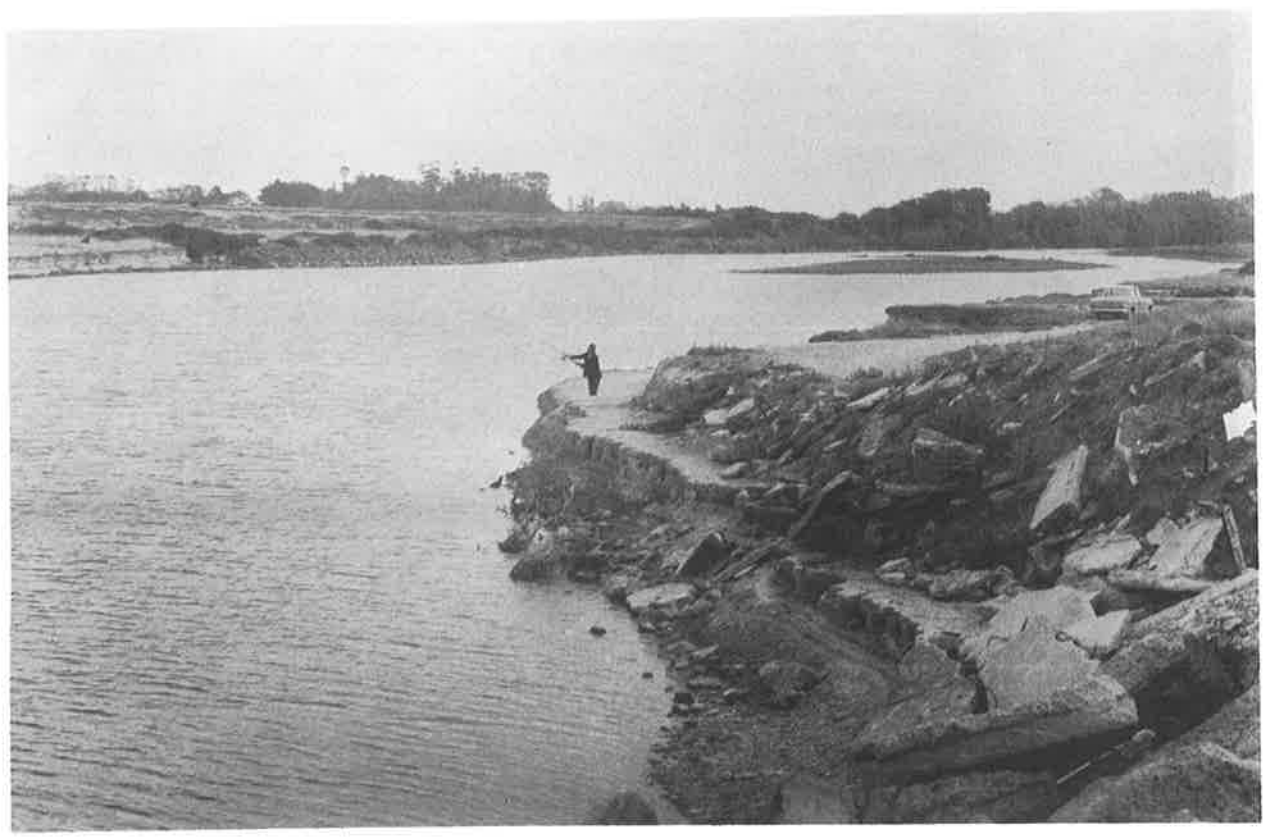
The data are not sufficient, but the average size of brown trout caught has been stable for 20 years at 35.3 cm, 0.5 kg in weight. The percentage of undersized fish caught is usually high. It was 27% in 1962 and 17.9% in 1967.

The rate of catch fluctuates due to low diary returns and was 0.55 in 1957, 0.37 in 1962 and 0.98 fish/hour in 1967. Most angling methods are used in this river. In 1962 wet fly was the most popular and gave a catch of 0.39 fish/hour. Two other popular methods were worm (0.38) and spoon(0.14 fish/hour). In 1967 minnow was the most popular method and caught 0.37 fish/hour.

No scientific surveys of Orari River have been undertaken. It would be interesting to investigate this salmon run and the angling potential.

Mouth of Orari River (C.J. Hardy)

Orari River at mouth (C.J. Hardy)



Lower Orari River (C.J. Hardy)

Lower Orari from Glandeboye Bridge down (C.J. Hardy)

Opihi River System

Tributaries: Temuka, Waihi, Hae Hae Te Moana, Kakahu, Tengawai and Opuha Rivers

This is the most important river system for angling in South Canterbury. It has been surveyed and described (Investigation Report 24).

The report describes the physical features of the rivers and gives a brief description of the fish stocks. It states that the Opuha tributary is too unstable to support a good trout population but that spawning facilities are adequate. A series of bottom samples showed a typical *Deleatidium/Hydropsyche/Elmid* invertebrate fauna except where pollution occured from wool scours.

Brown trout are the main species present although occasional rainbows are also recorded by the anglers. The Opihi is the smallest river system where regular quinnat salmon catches are recorded constituting about 10% of the total catch.

Most fishing is done in the main river and the following catches were recorded: 606 brown trout, 3 rainbow and 40 quinnat salmon (1962) and 442 brown trout, 3 rainbow and 46 quinnat salmon (1967). Practically all the fish recorded in 1962 were caught in the lowest 16 km between the mouth and Pleasant Point, indicating that most of the main river is very little fished. The average size of brown trout has been quite stable over the years, from 1947 to 1957 it was between 35.8 cm (1949) and 39.1 cm (1948). In 1962 it was 39.1 cm and in 1967, 34.5 cm Hobbs (1948, p. 30) gives average weights of fish taken in the Opihi since 1890 and these correspond very closely with the lengths shown above. The percentage of undersized fish was usually high, up to 60% (1950). It was 45% in 1957, 24% in 1962 and 14% in 1967 (the lowest recorded).

The rate of catch was 0.31 in 1957, 0.40 in 1962 and 0.64 in 1967. This increase is not statistically significant. Most legal methods were used in the river. In 1962 and 1967 4 methods accounted for most of the fishing, although their order of popularity varied from year to year. In 1962 wet fly (0.53 fish/hour) and spoon (0.14) were the most popular, but dry fly (0.62 fish/hour) was the most successful. In 1967 spoon (0.15) and dry fly (0.93) were the two most popular methods and worm (1.55) was the most successful. Most salmon were caught on a spoon and its popularity, despite a low catch rate, indicates that many fishermen were attempting to catch salmon in preference to trout.

There is sufficient information to compare the size of fish caught by three methods: dry and wet fly and worm in 1962 and 1967.

		Order of Popularity	Avge. Size cm	% under-sized	Catch rate fish/hour	Salmon caught
Dry fly	1962	4	36.6	11	0.62	None
	1967	2	34.3	16	0.93	
Wet fly	1962	1	40.1	21	0.53	None
	1967	3	34.3	18	0.97	4
Worm	1962	3	38.9	28	0.50	None
	1967	4	33.5	15	1.55	
All methods used	1962	-	39.1	24	0.40	40
	1967	-	34.5	14	0.64	46

There are no clear differences evident in the above results which indicates that different methods catch similar sized fish at similar rates of catch.

The Temuka River and its tributaries Waihi and Hae Hae Te Moana are popular for angling. The Kakahu is less popular probably because of its less attractive nature (see Investigation Report 24). The only species recorded are brown trout with an occasional rainbow and in the Temuka an occasional quinnat. The average size of trout taken is smaller than in the Opihi and has been stable over many years (see Hobbs 1948, p. 30). In the Temuka it was 30.5 cm in 1962 and 32.5 cm in 1967, in the Waihi 31.2 cm in 1962 and 29.7 cm in 1967, in the Kakahu 34.3 cm in 1962 and 34.5 cm in 1967. Similarly to the Opihi, the percentage of undersized fish usually remained high at about 20% to 40%. The rates of catch were very high, possibly reflecting high fish densities. In 1967 they were: Waihi 1.78 fish/hour, Kakahu 2.45 and Temuka 0.91. Artificial fly methods were much more important than in the main river and spoon and worm were used less.

Of the two remaining tributaries, Tengawai was very popular, although the rate of catch was usually lower than in the other streams at 0.61 fish/hour in 1957, 0.19 in 1962 and 0.44 in 1967. The average size was similar. Artificial flies were almost exclusively used in the Tengawai and of these the dry fly was much more popular than the wet fly, although it was much less successful (dry fly 0.10 fish/hour in 1962, 0.38 in 1967 and wet fly 0.33 in 1962 and 0.86 in 1967).

The Opuha was little fished and from the few results available appears to be similar to the other Opihi streams. In 1967 the average size was 34.0 cm with 3% undersized and the rate of catch 1.38 fish/hour. Most fishing in the Opuha was on a dry fly.

It is interesting to note that the rate of catch in all Opihi streams, except Tengawai and Opuha, has increased from 1957 to 1962 and again in 1967. All 1967 catch rates were very high, except a moderate one in the Tengawai.

South Canterbury Society Photos

Tidal Reaches Opihi

Opihi 5 km from mouth

Opihi between irrigation intake and Temuka river junction

The Opihi system is very valuable for angling and possibly unique in New Zealand in that all the tributaries are fairly evenly utilised by anglers with a high and steady rate of success. It also offers a variety for methods of fishing which anglers use, except in the Tengawai and Opuha rivers where artificial fly fishing predominates.

The system offers good spawning for trout, except the Opuha which is unstable, however good catches were reported in the Opuha in the past (see Percival 1932, p. 29) and the 1967 results quoted above are also very good.

Although the average size of fish is small, large fish are sometimes caught and they may be sea run (Investigation Report 24).

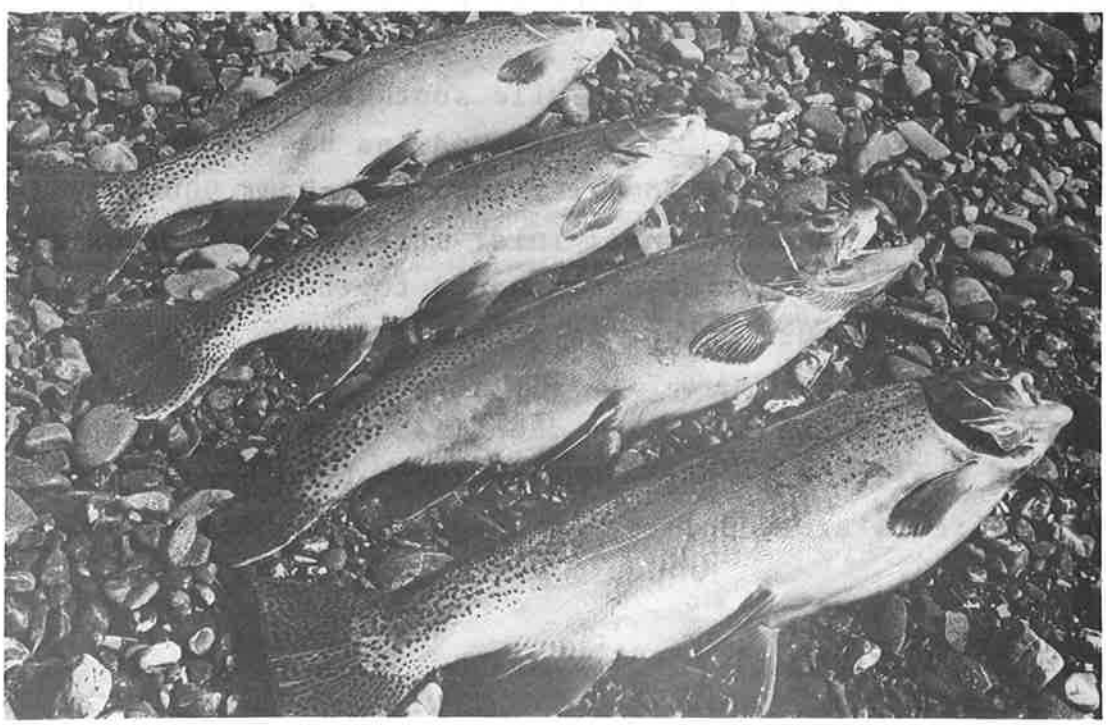
The Opihi warrants care in management. The 1960 survey showed that the pollution has already caused unfavourable changes and affected bottom fauna in some places. The present situation should be investigated. Water abstraction for irrigation also affects the main river (Hardy 1972). It would be worthwhile to investigate the salmon run, which is a great attraction.

Lake Alexandrina - is located a mile southwest of Lake Tekapo in the Mackenzie Plains. Lake Alexandrina has an area of 658 hectares and is 7.2 kilometres long and about 900 metres wide. This lake has two small inlet streams Muddy Creek and Scotts Creek and the outlet stream runs to the small Lake McGregor which in turn drains into Lake Tekapo.

Lake Alexandrina is fairly deep (13.4 metres average) and clear, the shallow lake edges having large weed beds. The spawning streams are described in Investigation Report 40.

Lake Alexandrina
National Publicity Studios

Lake Alexandrina - Rainbow trout
National Publicity Studios



Rainbow trout predominate in the lake, there being a small stock of brown trout and very few land-locked quinnat salmon. Despite some anglers' fears that brown trout are becoming more scarce in the lake, this is not bourne out by the diary results which showed 8, 3.4, 8.8 and 16% of brown trout in anglers' trout catches in 1947-52, 1957-58, 1962-63 and 1967-68. Gill nets in 1959 and 1960 gave 14.3% of the stock to be brown trout and spawning run traps in 1962(Investigation Report 40) gave 5.9%. No individual percentage is very accurate, the average percentage of brown trout probably being about 9 and ranging from 4 to 15 in different years.

The two main spawning areas are Muddy Creek and Scotts Creek. Brown trout spawn probably only in Scotts Creek and about twice as many rainbow use this stream than Muddy Creek (Investigation Report 40). The spawning gravels are of small extent and of poor quality and much superimposition occurs. From the 1962 spawning surveys there were approximately 900 to 1500 redds in the whole lake area from an estimated population of 3,000 plus adult female trout. Therefore, although there is wastage of ova in the streams, a considerable number of redds are made and ova deposited.

The survival of these ova is probably poor because of siltation and lack of oxygen. Vibert boxes placed in the spawning streams had high losses. No studies have been made of lake edge spawned ova survival. Fry mortality is likely to be high in the spawning streams because of intraspecific spatial competition and predation by eels (Hobbs 1948). Mortality of the fry and fingerlings in the lake is not known. From present knowledge the effect of natural production cannot be gauged. We are not aware of any period since the 1940s when the lake was not stocked with fry or fingerlings and the natural stock cannot be estimated by these means.

Hatchery liberations have been extremely variable, in the 1950s about 300,000 rainbow fry were liberated annually. Recently around 10,000 rainbow fingerlings or yearlings were released annually. Spasmodic liberations of brown trout fry and salvaged brown trout were, and are being made. Present policy is to determine the best size at release and time of release of these salvaged brown trout and rainbow trout by determining the number of tagged fish recaptured and reported by anglers. The size and release time are inter-related and survival cannot be attributed to one or the other from the recapture results. We suspect size if of major importance and the following analysis was made.

On the basis of returns from three groups of 100 salvaged brown trout released in Lake Alexandrina in February 1959, it appears that brown trout in this lake give a higher return to anglers. The returns were consistently high at 26, 28 and 30%. The size range of these fish was from 17.5 cm to 42.5 cm and the average size was around 28 cm. It was found that the fish 30 cm and over gave a considerably better return to anglers than the smaller ones (37, 45 and 48% respectively for each group compared to 17, 18 and 19%). The tag returns were the highest in the first and second season after release and then they declined sharply with 1 fish caught after 7 years and 1 after 10 years. The hatchery rainbows also gave a better return when released at a larger size, returns from 10-15 cm, 20-25 cm and 25-30 cm fish being 1%, 10.9% and 12.8% respectively. Hatchery costs need to be also considered in future rainbow fingerling releases, Burnet in the South Canterbury Society annual report 1970 suggesting 17.5 cm to 22.5 cm as the optimum size.

Growth rates of tagged fingerling and yearling rainbows and salvaged 27.5 cm brown trout are excellent. Tagged fish growth rates depend upon their size and 30 cm yearlings after 1 year in the lake (i.e. 2 year olds) measure 43 cm, 3 year olds reaching 48 cm.

The adult fish tend to remain at this size and grow slowly in length. From gill net captures and Fish (1968), the naturally produced rainbow trout would be slightly larger at one year but be of the same size at 2 years of age and older.

The condition of the trout caught by anglers is generally good, brown trout tending to be in far better condition in the spawning runs. This indicates that the trout (especially brown) population is not at a maximum and could be increased.

The trout's food has been examined in gill net captures and bullies and daphnia were found to be important.

The size,sex, natural mortality and age composition of the trout population is not well known. These parameters can be measured using accurate unbiased sampling techniques. No such surveys have been made, and in seine nets, gill nets, anglers' catches and spawning run traps the one year and two year old fish are generally rarely caught. Diving observations and gill nets of different sizes could be used in future to obtain better samples. At present allowing for the selectiveness of each method this seems to be the state of affairs.

The numbers in the trout population have been estimated in various different ways.

Firstly, anglers' catch rates are low around 0.2 fish per hour. No direct studies have been made of the relation between fish density and anglers' catch rates in lakes containing this size of rainbow trout. This catch rate is lower than that found in Rotorua lakes, but similar to that from Lake Tutira in Hawke's Bay. No accurate total stock estimate can be made.

Gill net records gave around 50 fish per night. This is lower than Smith (1959) recorded for various Rotorua lakes. No total stock estimate can be accurately made from these records.

Growth rates are good but can occur at high and low densities depending upon the environment (see Fish 1968). This environment is thought good and would indicate high densities.

Spawning run traps recorded 3,560 adult trout in 1962.

The best estimate comes from tagged spawning run fish recaptured by anglers in the first few days of the angling season. "Of 263 mature rainbow trout tagged in July and September 1958, 11 were taken on the opening day for a total of 299 fish. This indicates that the lake contained about 7,000 takeable fish in 1958, and this appears to be quite a good stock, considering the size of the fish and the size of the lake" (Burnet in 1960 Annual Report of the South Canterbury Acclimatisation Society). This estimate is subject to a large possible error, minimum and maximum stock being from 3,000 to 11,000 fish, because of the few fish tagged and recaptured in relation to the numbers present in the lake (Robson and Regier in Ricker 1968).

In Investigation Report 40 a similar tagging and angler capture programme estimate gave 18,000 rainbow trout. This included 2 year plus fish which may have been left out of the former estimate due to selective tagging. This estimate is more accurate to about $\pm$ 20% for the larger fish and far less accurate for the smaller two plus age group which makes the total estimate only accurate to about $\pm$ 8,500 fish. This angler capture of tagged fish is not typical of the population because it seems that the small female rainbow trout are probably not caught by the angling methods employed.

There is no way of estimating the stock using the tagged fingerlings and anglers' captures, since the natural mortality of these fingerlings is unknown. Also accurate crop statistics are not available and crop rates cannot be estimated.

The progressively reduced catch of tagged trout in the years after release cannot be used to estimate the trout mortality. A study of the tag returns gave the following general figures.

An average return of 10% from 3,000 yearlings would give this return of tagged fish from the first to seventh year: 10, 100, 80, 60, 40, 20, nil. The mortality of adult rainbow trout was estimated by Smith (1959) at about 0.66 of the age class per year, i.e. if the trout were equally catchable at all ages, catches should have been approximately 201, 66, 22, 7, 2, 1, 0. The discrepancy could be caused by very high survival or more probably by increased catchability with size and age.

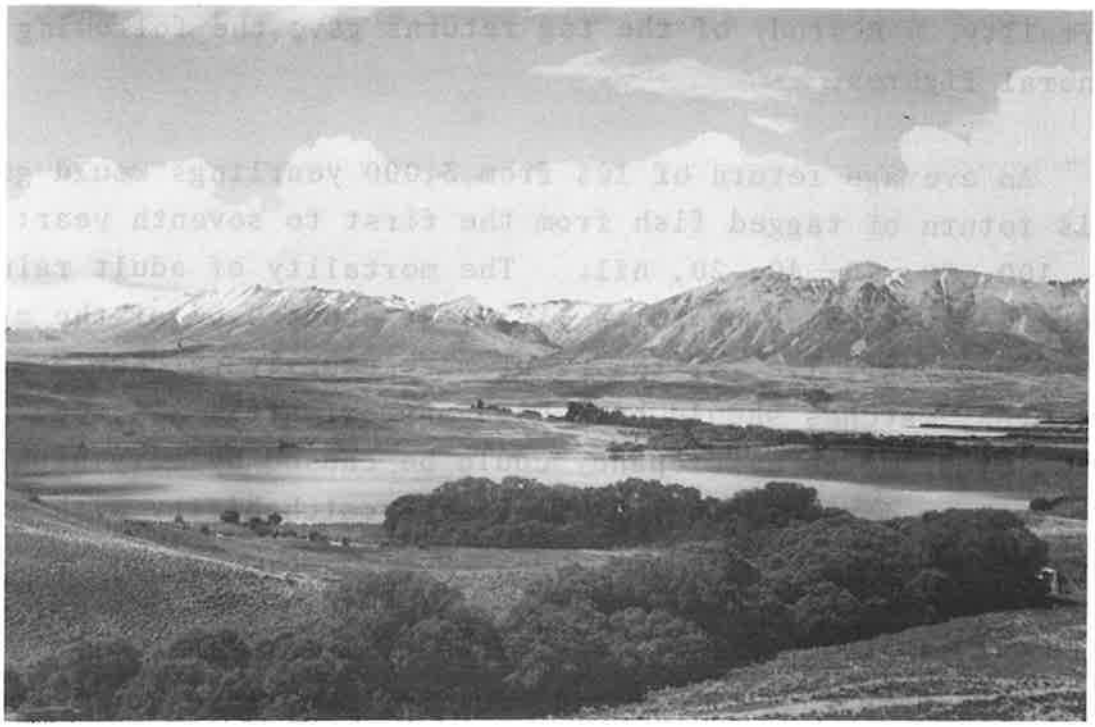
The stock can best be estimated by the Society, if required, by a tagging and gill netting programme for 3 to 4 years, as was carried out in the Rotorua lakes by Fish (1968). We estimate that about 3,000 yearling rainbow need tagging each year for 3 to 4 years and that about 500 fish need catching each year by a series of different sized gill nets. This should give a stock estimate accurate to about $\pm$ 30% for any given year. This gill netting should give data on the other parameters such as sex and population size structure.

Alternatively, if the lake is clear, manta board surveys should give an accurate estimate with a week or two of diving effort.

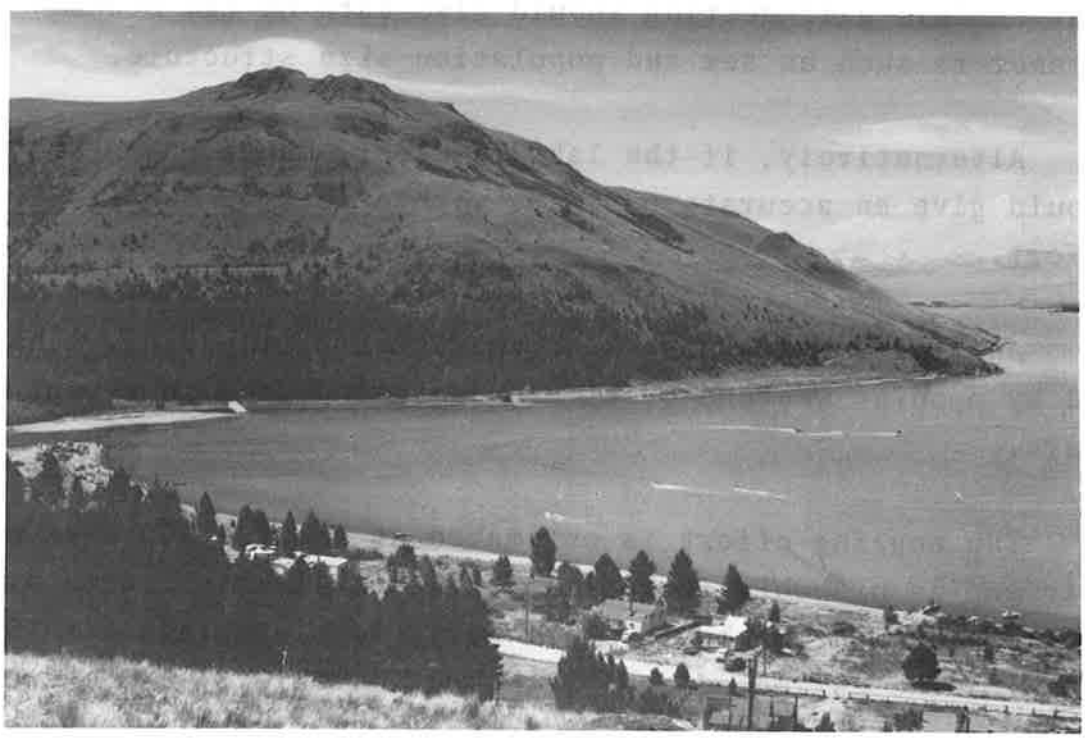
Angling results have been collected by the diary scheme and by opening weekend creel censuses conducted in recent years.

The angling effort is estimated at about 5,500 days per year and is probably increasing. Anglers' catch rates average around 0.2 fish per hour, there being little change for 15 years. The estimated crop is shown in Table 3. The drop in catch shown through the years is not significant.

Lake McGregor



Lake Tekapo



These statistics derived from diary schemes are subject to a large possible error (Graynoth 1973). More accurate statistics could be obtained by a well planned creel census. This should be organised if the stock is estimated by gill netting and tagging.

Wet fly has always been the most popular and generally effective method. The bag limit of 4 fish was reached in 17 out of 436 days recorded in 1962-63 and in two out of 190 days recorded in 1967-68 and has little restrictive effect on the catch. Few undersized fish are caught.

The size of trout caught has fluctuated over the past forty years but is generally fairly stable at 53 cm and certainly shows no sign of deterioration.

Lakes Tekapo and Pukaki, Waitaki System - Lakes Tekapo and Pukaki are large glacial lakes in the upper reaches of the Waitaki River. They have both been incorporated in the Waitaki River Power Development Scheme and will be used as storage basins with consequent variations in water level detrimental to aquatic life. It is proposed to build a new dam and increase the level of Lake Pukaki by more than 30 metres.

The lakes are very little fished probably because of the desolate nature of the surroundings, turbid water and low fish populations.

There is only one record of two fish caught in 1957 from Lake Pukaki and no subsequent information.

Records from Lake Tekapo indicate that there may be a quite good population of rather small fish, mainly brown trout. In 1962, 36 brown and 5 rainbow trout were caught with 29% of fish undersized. The average size was 40.5 cm and the rate of catch 0.77 fish/hour. In 1967, 16 fish were recorded of which 3 were brown and 4 rainbow. The rate of catch was 0.4 fish/hour. Wet fly, minnow and spoon were mostly used.

Lake Pukaki

From associated waters there are a few isolated records. One from Godley River flowing into Lake Tekapo and a few from Mary Burn, a tributary of Tekapo River. Ten trout were taken from Mary Burn in 1967, five of which were brown and one rainbow.

Tekapo has been studied by the Technical Field Service but the results have not been published. Fish populations should be sufficient to provide reasonable sport for anglers who wish to fish these lakes as the results from Lake Tekapo indicate. Depending on the terrain contours, the raising of Lake Pukaki could be either beneficial or detrimental to fish and angling.

Pareora River - originates in the Hunters Hills and is about 40 km long. It has not been surveyed and nothing is known about its nature.

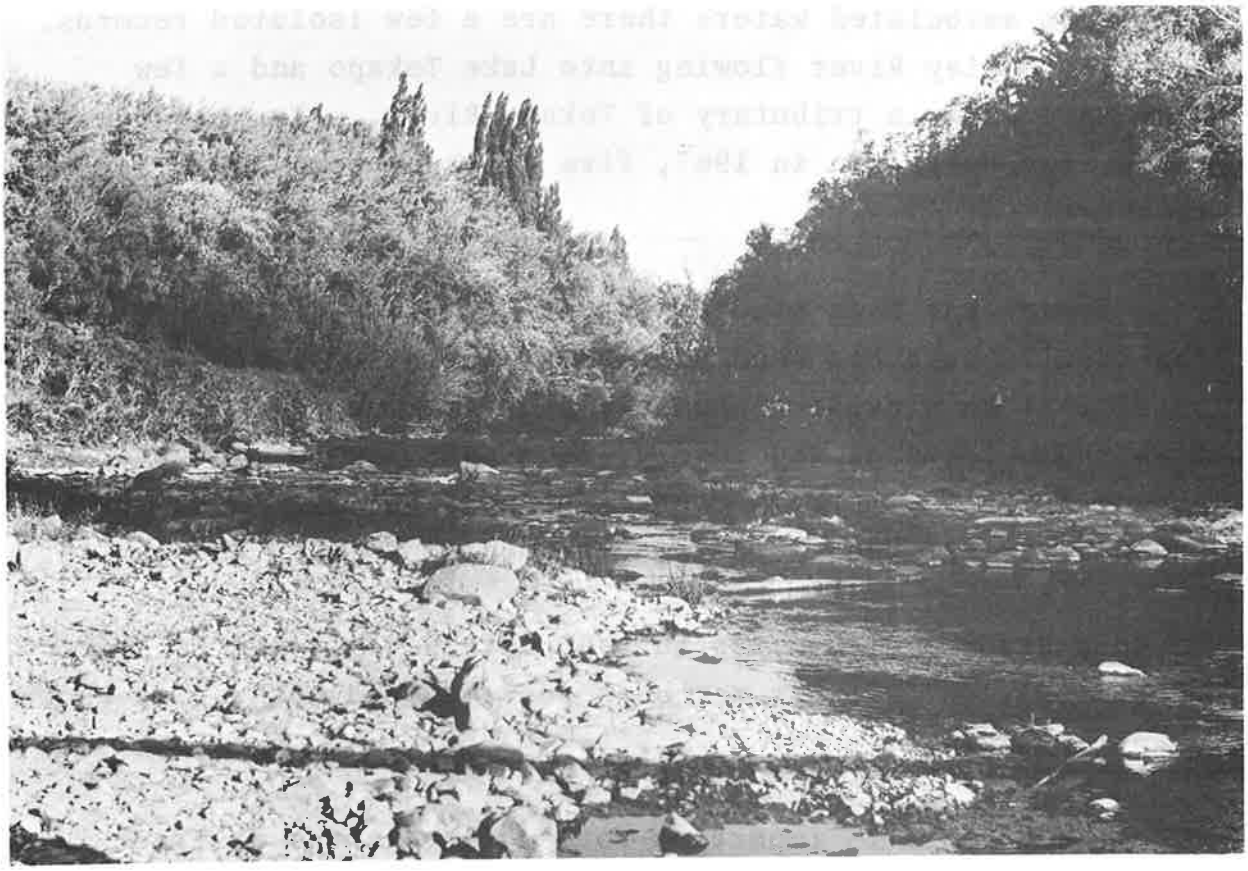
The Pareora is important for angling in the district and it yields high crops of small fish. It contains brown trout and an occasional rainbow was recorded by diarists.

The average size of fish caught is stable and was 31.7 cm in 1957, 34.0 cm in 1962 and 30.2 cm in 1967 with the percentage of undersized fish 40, 23 and 25% respectively. The rate of catch was high: 0.85 in 1957, 0.73 in 1962 and 1.26 fish/hour in 1967. Wet and dry flies are the most popular in this river, but other methods are also frequently used.

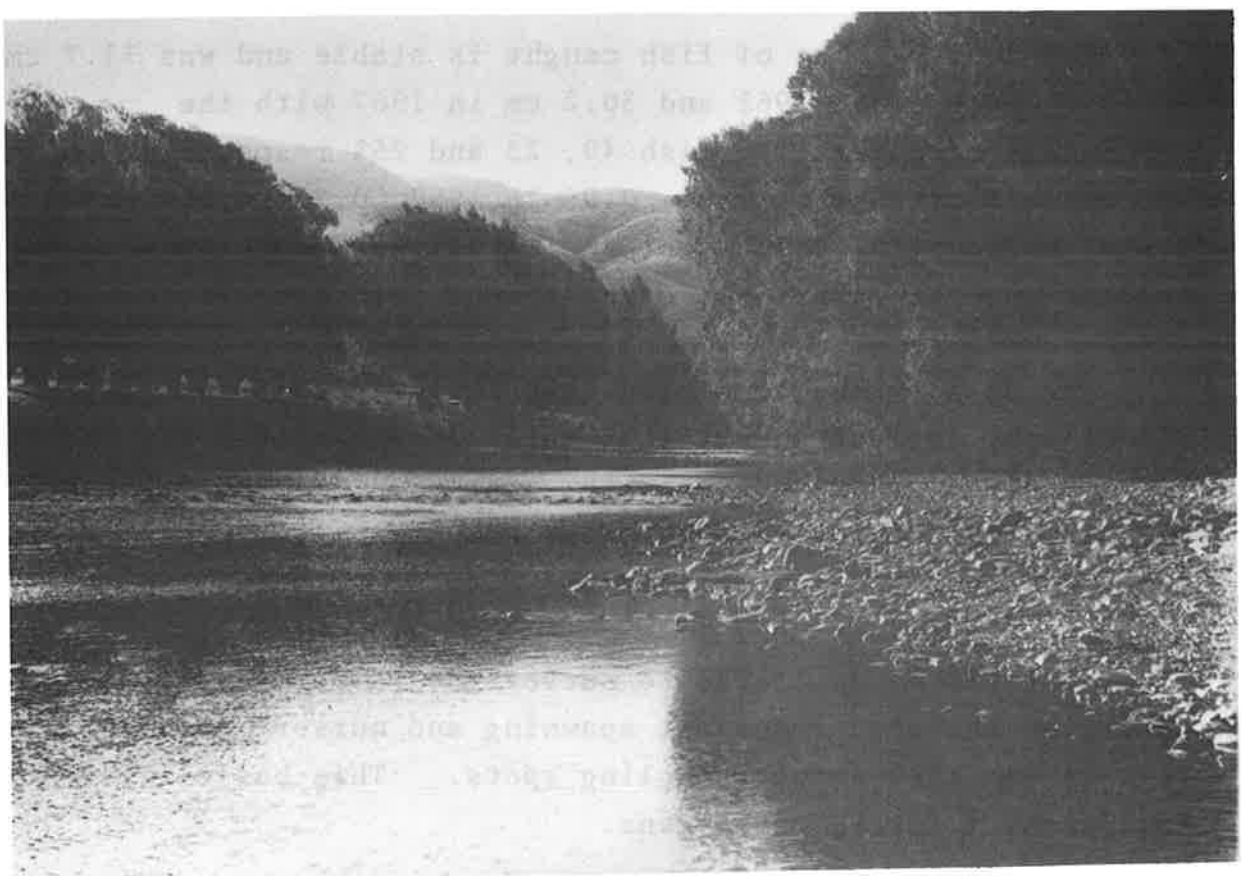
The Society has commented that this river is not greatly affected by irrigation but that water is abstracted for the Timaru town supply. The stock density, approximately 530 fish per kilometre in 1969,would be smaller nowadays , for due to recent droughts there are now large areas with no fish in them.

It would be desirable to survey the Pareora and to determine the most important spawning and nursery areas as well as the most popular angling spots. This basic information would assist future management.

Pareora River (C.J. Hardy)



Pareora River (C.J. Hardy)



FISHERIES MANAGEMENT

This Society is very fortunate in having an exceptionally large proportion of the community actively interested in angling. This is very important in the continuing struggle to protect the fisheries against the unfavourable changes in the environment.

The Society has recognised the need for collection of information on the fish stocks and angling many years ago and has collected a considerable amount of material. With the increasing changes in the environment and the angling pressure it is important to establish permanent records for each water separately. Only written records kept over a number of years enable a judgement related to whether a particular fishery is stable, deteriorating or improving. The information collected should include environmental conditions (water flow, clarity, pollution, flood damage, spawning material), the state of fish stocks and the angling.

It is considered that the evaluation of the condition of the major district fisheries and their relative importance coupled with the enforcement of regulations, fish salvage, publicity and improvement to angling (such as erection of notices, building of extra huts etc.) should be given priority over hatchery work. This last activity should continue only if it can be meaningfully fitted into the overall management plan.

It has been proven that most of the rivers in New Zealand do not require stocking after the initial establishment of trout in them. It is likewise true that many of them hold sparse populations of trout and do not offer angling up to the expectations based on that in the more productive rivers like the Selwyn or the Mataura. The unsatisfactory state of the fish stocks is usually caused by conditions which no fish authority can hope to control, such as instability, flooding, lack of food or holding pools and many other more complex factors.

Usually it is assumed that inadequate stocks are caused by deficiency in natural spawning and steps are taken to remedy this by liberations which generally fail. Similar attempts are made to alter the composition of species which is also governed by complex factors. These factors affecting the distribution of species in New Zealand are so far not fully understood. However, it is a well documented fact that at least three species have been extensively propagated throughout the South Island and that only the brown trout have been generally successful. There is no proof that rainbow trout would give a better return to anglers in most of these waters.

For instance, the Society's releases of tagged rainbow yearlings in the Rangitata showed a return to the angler of below 1% of released fish, and therefore are not a worthwhile practice. In comparison, the same hatchery fish released in Lake Alexandrina gave returns of up to 12.8% (about 15% allowing for loss of tags and non-return).

Water abstraction appears to be the major problem in the region and the Society is rightly concerned about it. This is one of the reasons why the systematic gathering of information is advocated. It is fairly obvious that the anglers will have to loose out in some cases and the Society should be in the position to produce valid facts on the importance of each water to the production of fish and to angling. Waters of little importance could be sacrificed in exchange for improvements to others.

We have made little comment on the salmon fishery because diary results contain little useful information on this. The fishery is very important, however, and its management problems such as instability of spawning grounds are common to the whole Canterbury district. Management should be related to the whole fishery and generally co-ordinated by the salmon committee of the South Island Acclimatisation Societies.

Lake Alexandrina

On the available evidence, we consider that the Society's efforts at present in improving the spawning conditions in the streams are the most important. Eels should be removed from the spawning streams by electric fishing machine, Vibert boxes planted in the lake side gravel, and electric fishing here will give some idea of fry production from this area. The hatchery liberations probably do aid the fishery but to an uncertain extent. A simple way of testing this would be to run an accurate creel census for a few years then stop liberations and continue the census. Changes in anglers' catch rate and effort should show the effects liberations have. Alternatively, if stopping liberations is objected to by anglers, their effectiveness could be tested by a 3-4 year experimental gill netting, tagging, spawning traps and creel census investigation.

Present liberations of tagged fish should cease as growth rates and the best size to liberate have been determined. More liberations of salvaged brown trout which seem to be easily caught will be worthwhile.

ACKNOWLEDGMENTS

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MINISTRY OF AGRICULTURE AND FISHERIES

FISHERIES TECHNICAL REPORT
No. 93

THE SOUTH CANTERBURY TROUT AND SALMON FISHERY

E. GRAYNOTH AND W. SKRZYNSKI

WELLINGTON, NEW ZEALAND
1973