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THE AUCKLAND TROUT FISHERY

E. GRAYNOTH

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MINISTRY OF AGRICULTURE & FISHERIES
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SUMMARY

This report describes the trout fisheries of the Auckland Acclimatisation District. It is based on angling results collected since 1948 by seven angling diary schemes.

In this district angling licence sales have remained stable for many years in comparison to shooting licence sales which have steadily increased. The average men's whole season licence holder fishes for about thirteen days per season to catch 11 fish. The total district catch of fish is between 35 and 40,000 fish and the total angling effort between 55,000 and 60,000 days per annum. Every year anglers spend over $200,000 on fishing.

Rainbow trout are the principal species caught. Brown trout are caught in small numbers in the northern part of the district, but constitute about 50% of the catch in the southern Waipa and Wanganui Rivers. There has been no definite historical change in species distribution or fish size over the past twenty years. No direct surveys of the fish stocks have been carried out but anglers' catch rates are fairly low and it is thought that the stocks also are low. It is suspected that the anglers' catch is a fair proportion of the stocks. Suitable spawning gravels are limited in area but may be adequate for the stocks present. There is a need for a quantitative assessment of the extent of spawning gravels and its relation to the stocks of trout.

The thirteen principal waters and anglers' catches are described. The fisheries regulations are fairly lenient and have little restrictive action on the catch. More scientific studies need to be made if the management of the angling waters is to be improved.

INTRODUCTION

The Auckland Acclimatisation District has a very large area of 25,750 square kilometres and has approximately 1,300 km of fishing water. As shown in Fig. 1 the major angling waters are situated in the southern part of the district. The climate is milder and cooler than in the north and only these rivers have good spawning gravels suitable for trout.

The freshwater fishery has been controlled and managed for over 100 years by the Auckland Acclimatisation Society. The Society is governed by a Council elected by a postal ballot of fishing and shooting licence holders. The Council directs the activities of two full time field officers engaged in both game and fisheries work. The Ministry of Agriculture and Fisheries (formerly the Marine Department) provides an advisory service to the Society. It undertakes research projects when requested and has statutory powers in relation to the fishing regulations and the introduction of fish.

The Marine Department in 1936 initiated an angling diary scheme, in which diaries were sent to selected anglers, and this continued until 1939. Another diary scheme was run from 1948 to 1952 and was described by Allen and Cunningham (1957). Diary schemes were then run in 1957, 1962 and 1967. Postal questionnaire schemes were run in 1958 and 1963. In all these schemes approximately 500 diaries were returned, recording 7,000 fishing days or 26,000 fishing hours to catch over 12,000 fish. In the questionnaire schemes an additional 700 annual angling results were recorded. In any one year only a small percentage of diaries were returned from licence holders who, at the beginning of the season, received a diary with their licence. Had the projected 50% return been achieved, far more information would have been available and more definite conclusions made. This report summarises the data, describes the fisheries and gives some fisheries management advice. Analysis methods with the statistical accuracy of information derived from angling diary schemes are given in Graynoth (1973).

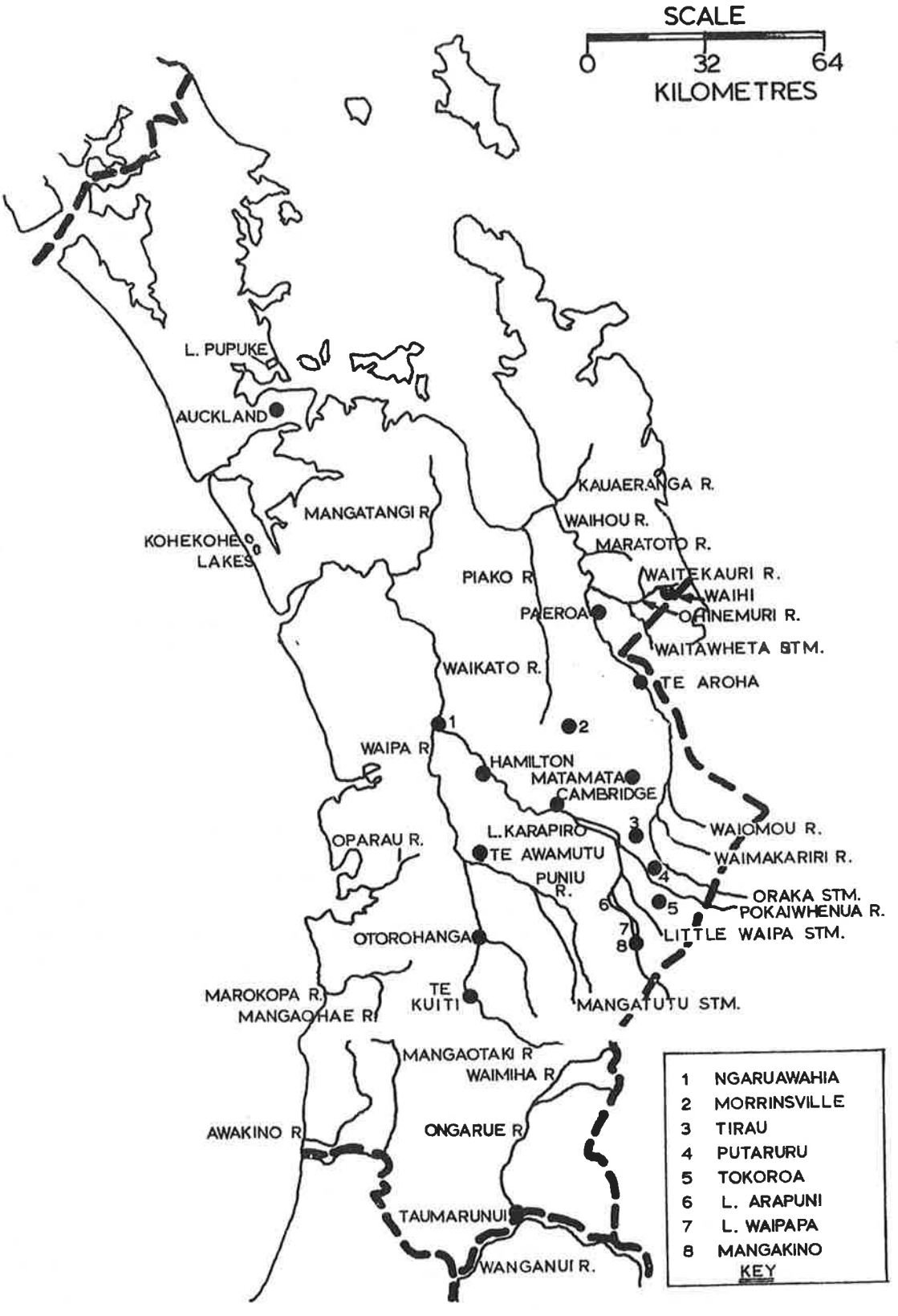
THE ANGLERS

The Number of Anglers

Freshwater angling is really popular only in the southern half of the Auckland district. There has been relatively little change in angling licence sales over the past 15 years (Fig. 2), men's whole season licences averaging between 1,500 and 1,700 per annum. Youths'

FIG. 1

AUCKLAND ACCLIMATISATION DISTRICT



whole season licences rose to a peak of 1,750 in 1961 then dropped to 1,400 in 1964 and since then have started increasing again. Women's whole season licences have shown a slight decrease over the years down to just over 100 per annum. Many more shooting licences are sold in this district than angling licences, sales having increased steadily from 6,250 in 1957 to the present figure of over 10,000 shooting licences per annum. The reasons for the relative unpopularity of angling are not known. When it is taken into account that this region has had the highest population growth in the whole country in the last 10 years, it becomes obvious that the popularity of angling has decreased considerably.

Where the Anglers Live

Table 1 shows the geographical distribution of licence sales and the geographical distribution of the homes of the diarists. In 1962 there was quite a good agreement between the distribution of licence sales and the diaries returned. In 1967 there was a surplus of diaries returned from the Matamata, Morrinsville, Waihi area and very few were returned from the middle Waikato and Waipa River areas. The percentage of licence holders in the population of Auckland city area is considerably smaller than that of the rural areas, especially the rural area around Matamata. The greater proportion of rural dwellers being anglers is also found in Wellington and Hawkes Bay districts (Graynoth 1973).

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

The average licence holder's annual fishing effort and catch can be estimated from the diarists' annual fishing effort and catch. In Table 2 and Table 3 are shown the summarised results of the diarists' fishing effort and catch from 1948 to 1967, and the effort and catch results recorded from the 1958 and 1963 postal questionnaire schemes.

The annual effort of the men's whole season licence holder diarists seems to have dropped from 22 days per season to 12 days per season in the 20 years of the scheme. This is a false trend. Allen and Cunningham (1957) by a regression analysis showed that the estimated average effort of men's whole season licence holders in Auckland district in 1948-52 was only about 9.7 days per season. The diarists are enthusiastic and more skilful anglers than average licence holders and consequently go fishing more often. In 1958 and 1963 the questionnaire results were similar to those of the diarists, from 14 to 17 days per season.

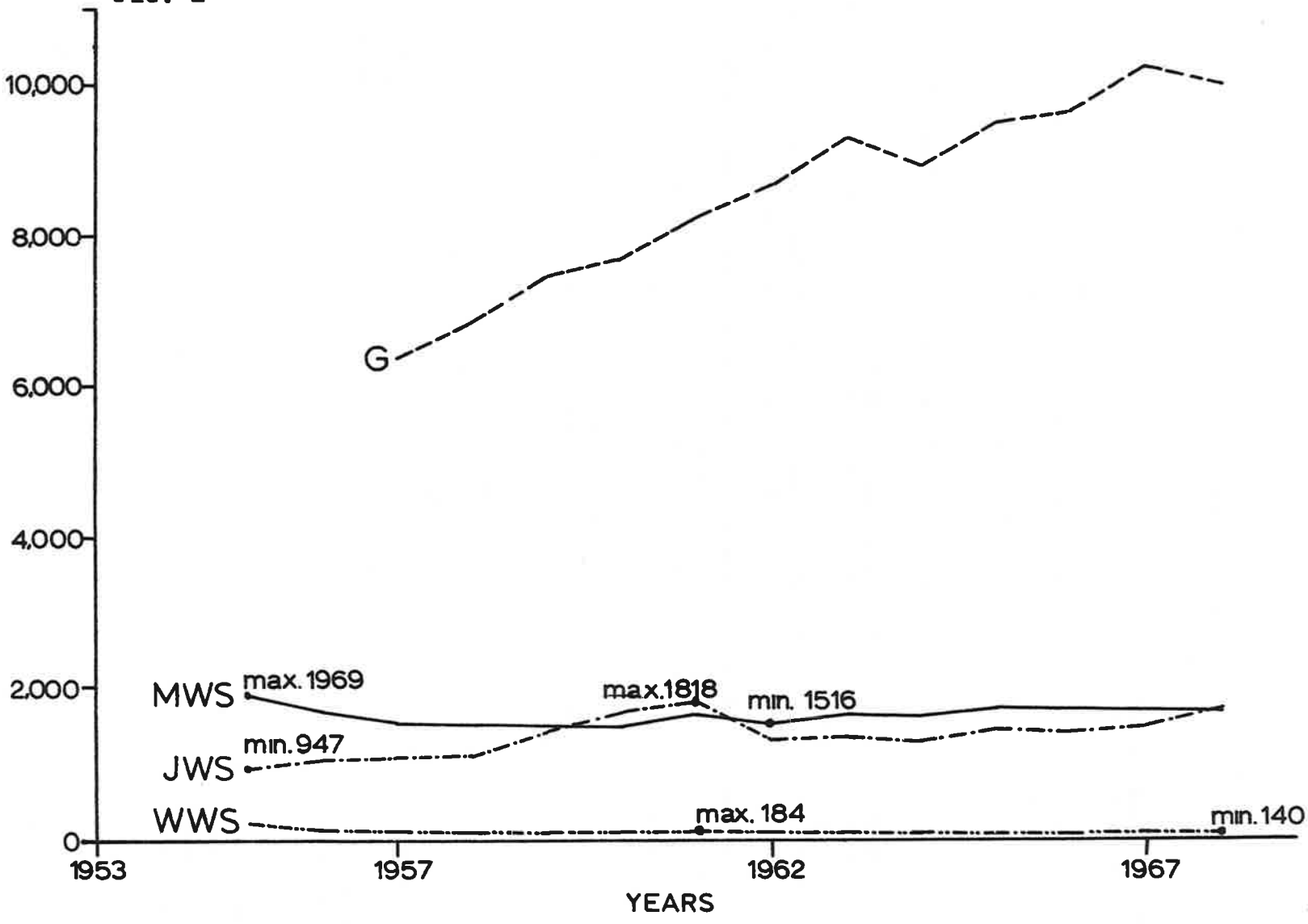
TABLE 1

Geographical Distribution of Diarists and Licence Sales

Towns and Districts	% Licence Sales 1962-63	% Diaries returned 1962-63	% Diaries returned 1967-68
Auckland	15.7	10.1	15.4
Auckland area	0.7	0.5	7.7
Ngaruawahia	1.4	1.1	
Hamilton	10.5	11.1	10.3
Cambridge	4.6	3.7	2.6
Te Awamutu	5.0	5.8	
Hamilton area	2.4	2.6	
Otorohanga	3.6	3.2	
Te Kuiti	4.9	2.1	2.6
Taumarunui	8.6	7.9	2.6
Te Kuiti area	0.3	0.5	2.6
Mangakino	2.4	0.0	
Tokoroa	6.0	3.2	
Putaruru	7.2	7.4	

LICENCE SALES – AUCKLAND DISTRICT

FIG. 2



MWS - Men's Whole Season licence, JWS - Junior Whole Season

WWS - Women's Whole Season, G - Game shooting licences

TABLE 1 - Continued

Towns and Districts	% Licence Sales 1962-63	% Diaries returned 1962-63	% Diaries returned 1967-68
Tirau	2.1	1.6	
Matamata	5.3	7.4	17.9
Morrinsville	1.7	1.6	7.7
Te Aroha	1.5	4.8	10.3
Paeroa	2.5	2.6	7.7
Waihi	5.0	5.3	7.7
Others	4.6	9.5	
Other districts	2.2	1.1	5.1
Total No. examined	713	189	39

TABLE 2

Annual Fishing Effort and Catch of Men's Whole Season Diarists from 1948 to 1967 in Auckland District

Year	1948-52	1957-58	1962-63	1967-68
MWS licence sales per annum	1,716	1,593	1,516	1,745
Diaries returned	98	44	115	30
Percentage return	1.43*	2.76	7.58	1.72
Mean days own district	22.5	17.86	14.39	12.67
Fish own district (kept)	48.3	28	18.90	12.93
Fish per day (kept)	2.15	1.57	1.31	1.02
Av. hours per day	4.19	3.92	3.65	2.79
Fish per hour (kept)	0.51	0.40	0.36	0.50
Hours per fish (kept)	1.95	2.50	2.78	2.00

*4 year scheme

TABLE 3

Results of the 1958 and 1963 Postal Questionnaires

Licence Type	MWS		CWS			WWS		
Year	1958	1963	1958	1963	Diarists 1962-63	1958	1963	Diarists 1962-63
Questionnaires distributed	282	451	168	127	1,502 (Licence Sales)	55	39	142 (Licence Sales)
Questionnaires returned	79	226	69	55	41	20	17	11
% return	28	50.1	41	43	2.7	36	44	7.7
Days Auckland district	16.21	16.60	26.6	19.2	12.78	9.2	12.1	16.82
Days elsewhere	0.80	6.42	0.3	1.11	0.24	4.0	4.47	0.0
Fish Auckland district	19.22	13.27	14.1	7.23	17.2	10.2	7.27	16.0
Fish elsewhere	1.60	14.98	0.0	0.55	0.22	5	8.67	
Fish/Day Auckland	1.19	0.80	0.53	0.38	1.35	1.11	0.60	0.95
Fish/Day elsewhere	2.00	2.33	0.0	0.49	0.92	1.25	1.94	0
Total expenses £	58.3	79.1	10.5	15.4		69	56.6	

In neither the questionnaire or diary scheme was a 100% return achieved and it is likely that the anglers who did not return their results were not as interested in angling and did not fish as often. Suitable correcting factors have been taken from a Wellington district questionnaire run in 1963 (Graynoth 1973), from which I have calculated that the average Auckland men's whole season licence holder fished for just over 13 days in 1957 and just over 14 days in 1962. In 1967 only a few diaries were returned, the estimated average effort of men's whole season licence holders being 10 days per season. There seems to have been little change in fishing effort of the men's whole season licence holders and a weighted average from 1948 to 1962 gives the figure of 12.8 days per season. This is comparable to many other acclimatisation districts in New Zealand and should be quite accurate.

From the 1958 and 1963 postal questionnaire schemes (Table 3), children seem to fish for more days per season than men and women fewer days per season than men. The estimated average child's whole season licence holder therefore fishes for about 19.4 days per season, the women's whole season licence holder fishes for about 9 days per season. The annual district angling effort is estimated at between 55,000 and 60,000 days.

The catch of the diarists has dropped from 48 to 13 fish per season (Table 2). It is likely that this trend is also incorrect and does not reflect the true trend in average catch of the average men's whole season licence holder. Using the results of the 1958 and 1963 postal questionnaire schemes it seems that the average catch of the men's whole season licence holder in 1951, 1957, 1962 and 1967 was 12.7, 13.5, 10.5 and 6.2 fish respectively. In 1967, results were only from a few diarists and probably are very unrepresentative. The average catch of this licence type from 1951 to 1967 was therefore calculated to be 11.2 fish per season (Table 4). Children and women catch fewer fish per season. Table 4 shows the estimated mean catch of 8.1 fish for children and 6.6 fish for women. There are, of course, great variations between licence holders in their annual effort and catch, it being quite likely that three or four anglers can catch up to 250 fish per season. However, many anglers even though they take out a licence, do not go fishing or go fishing for only one day, often with no success, and it is these anglers who reduce the average licence holder's catch to the quite low figures shown in Table 4.

TABLE 4

Estimated average licence holder's fishing effort and catch in Auckland Acclimatisation District from 1951 to 1967

Licence Type	Mean days per season	Mean catch per season	Mean catch per day
Men's whole season	12.81	11.25	0.88
Child's whole season	19.42	8.10	0.42
Women's whole season	8.98	6.56	0.73
Weekly	2.9	2.18	0.75
Daily	0.9	0.68	0.75

It is interesting that when anglers leave the Auckland Acclimatisation Society district to go fishing probably in Taupo and Rotorua, they have considerably more success and catch more fish per day. Table 3 shows men's whole season licence holder questionnaire respondents' catch rate increasing from 1 to 2 fish per day.

The total district crop of fish can be calculated from these results. The catch of visiting whole season licence holders is probably low and is estimated at about 5% of the local anglers' catch. In 1951-52 the total crop was estimated at 29,400 fish, in 1957-58 it had risen slightly to 31,700 and in 1962-63 to 36,000. In 1967-68 it increased slightly again to 36,700 fish per annum. This district crop of fish is higher than that in the Wellington or Hawkes Bay district but it is a small fraction of what is caught in Rotorua and Taupo.

The Anglers' Expenditure on Fishing

After corrections had been made for questionnaire non-respondent anglers' lower expenditure, the average men's whole season licence holder's annual expenditure on angling in 1957 was calculated at £49 per season and in 1962 at £70 per season. For children it was calculated at £7 and £11 per season respectively and for women at £55 and £47 per season. The total expenditure in 1957-58 was calculated to be £106,000 and in 1962-63 £155,000. This expenditure was mainly on travel and accommodation but some large sums were spent on boats and caravans to be used solely when angling. In dollars, it appears that men's whole season licence holders spend between $7 and $10 per day on angling, children from 80 cents to $1.15 per day and women from $10 to $12 per day. This expenditure is slightly higher than that recorded in the South Island, where the average men's whole season licence holder spent about $6.50 per day on angling.

The Most Popular Angling Methods

Table 5 shows the angling method preferences of the 1963 questionnaire respondents. From this table it is apparent that these respondents prefer to fish using fly techniques. I have found, however, (Graynoth 1973) that the non-respondents to postal questionnaires are generally not so skilled and prefer to use minnow and baitcaster and spoon techniques, like the children shown in Table 5. It is noticeable in this district that wet fly is more popular than dry fly. In the Wellington district dry fly is more popular; this reflects a difference between the two species of trout. In Wellington district brown trout are easily caught using dry fly. Wet fly, however, is probably the most effective technique for rainbow trout and is used extensively in this district.

TABLE 5

Angling Method Preferences of 1963 Questionnaire Respondents

	Number in each Licence Type		
Method	MWS	WWS	CWS
Dry fly	14		2
Wet fly	61	5	11
Lure	4		2
Unsp. Fly	25	1	5
Minnow and Baitcaster	4	2	2
Spoon	23	1	16
Worm			1

THE FISH STOCKS

The Distribution of Species

Rainbow trout are predominant in the Auckland district, brown trout are not dominant in any water. In the Waihou system brown trout comprise under 1% of the anglers' catch. In the Waikato River and hydro lakes about 2% of trout caught are brown trout. In the Waipa tributary of the Waikato River, anglers catch about 50% rainbow, 50% brown trout. The diarists' records are rather few but there appears to have been an increase in the number of brown trout in the Waipa. From 1948 to 1952 brown trout comprised 45% of the catch, in 1962 59%, and in 1967 66% of the catch were brown trout. An interesting study could be made of the relationships between the two species in the rivers of this district. Apart from this possible increase in the numbers of brown trout in the Waipa system, there has been no major change in the distribution of the fish stocks for the past twenty years.

Sea-run rainbow may run up the Awakino, Oparau and Waihou Rivers. However, there has been no scientific confirmation of this as yet. Other species of fish present are mullet in the Waihou, catfish, crucian carp and goldfish in the Waikato River and possibly some perch, although they have not been recorded by the diarists. Eels are generally abundant except in one or two localities, where impassable falls or rapids prevent the upstream dispersal, such as in the Okoroire system of the Waihou.

The Size of Trout

The diary records provide good evidence that there has been no change in the size of fish caught for many years. The summarised results for all the diary schemes from 1948 to 1967 are shown in Table 6. The rainbow trout in the main Waikato River system are on average the largest caught. The average size ranges from 46.7 cm in Lake Arapuni to 50.3 cm in Lake Karapiro. In the Waihou tributaries and the Waipa River system the trout caught seem to be of similar sizes around 38 to 41 cm average length. Slightly larger fish are caught in the Waiomou and lower Waihou. Larger fish are also caught in the Awakino.

There seems to have been a depreciation in size and numbers of fish in the Awakino. From 1932 to 1951 there was an increase in fish size in the Awakino from 40.6 to 50.8 cm average length; since 1951 there has been a deterioration in size to 40.6 cm in 1962. There are no records for 1967 and it is thought that the rainbow trout in the Awakino are now scarce. This may be associated with changes in land use in the vicinity.

There are differences in size of fish caught by different angling methods, by anglers fishing in different localities and at different seasons. In the Waihou, artificial minnow and spoon caught the larger fish, artificial fly catching only the smaller fish. In the Waiomou wet fly caught larger fish than spoon; in Lake Arapuni there was no difference between wet fly, spoon and trolling, but in Lake Karapiro dry fly caught larger fish than minnow or trolling. In the Waitawheta and Ohinemuri there was no difference between the methods. In the Waihou there are very small fish in the upper reaches, but in the lower reaches below the Okoroire Falls the fish are considerably larger. Seasonal changes are few. In Lake Arapuni the average size dropped from 51.1 cm in October to 45.2 cm in April 1963. However, most of the really large fish were caught in March. In April larger fish are also caught in the Waihou and this could be a spawning run from the lower reaches.

The Stock and Anglers' Crop of Trout

In no water has the stock been directly assessed. The stock of rainbow trout in some Hawkes Bay rivers was assessed in 1971 (Graynoth 1973) and was found to be low, the number of catchable trout ranging from 1.4 to 31 per kilometre. The rainbow trout waters of Auckland are different, being relatively more stable and less liable to flooding than the Hawkes Bay rivers and it is quite possible that the stock of catchables is considerably higher than in Hawkes Bay. There is a need for direct surveys using electric fishing or other techniques to assess the stocks in these rivers. The catch rates of anglers are generally low and indicate fairly low stocks. For instance catch rates recorded in the Waitawheta are from 0.3 to 0.4 fish per hour, in the Kauaeranga around 0.4 fish per hour; in the Oraka, where stocks may be slightly higher, around 0.7 fish per hour. There is a lack of knowledge of actual fish density and abundance despite sixty years of fisheries management.

The anglers' crop of fish from individual waters can be calculated approximately from the results of the angling diary scheme. Table 7 shows the percentage of the diarists' catch from the various waters in the Auckland district. There is considerable variation between the individual diary schemes in the percentage of the catch from the various waters, which in part can be explained by an uneven geographical return of diaries from the district. For instance in 1967 most diarists lived near the Waihou River and its tributaries, consequently these rivers in 1967 recorded an extraordinarily high percentage of the district crop. I have shown earlier than in the 1962 scheme the diaries were evenly returned from the whole of the district and the percentage of the district crop from the various waters in this year should be quite accurate. However, Lake Arapuni seemed to be fishing extremely well in this year and almost 40% of diarists' crop came from this lake. This seems disproportionally large and inaccurate. In 1963 in the angling questionnaire anglers were asked which was their most popular water, i.e., which water they fished most often. In this questionnaire Lake Arapuni was relatively unpopular and the percentage of the district catch from it is probably nearer 14% rather than 40%. The estimated crop of fish in 1962-63 is shown in Table 7. From the Little

TABLE 6

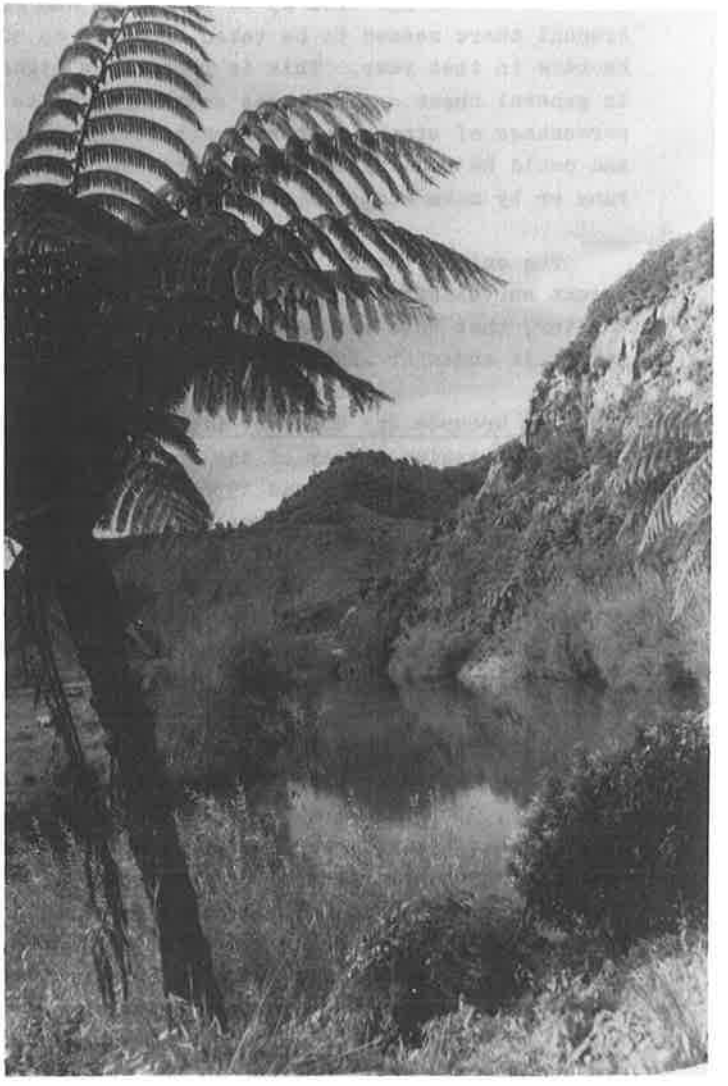
LENGTH FREQUENCY OF RAINBOW TROUT CAUGHT IN 1948-1967 WATERS

Length cm	Mangatangi	Waikato	Karapiro	Arapuni	Waipa	Lower Waihou	Upper Waihou	Kauaeranga	Waitawheta	Waitekauri	Waiomou	Oraka	Awakino
						1962 only							
25							10	1				1	
27.5							5	2		1	1		
30	16	1	1	7	4	6	16	38	4	10	26	33	33
32.5	12	3	4	40	20	11	13	52	23	38	38	35	39
35	4	8	5	89	22	18	13	59	55	54	26	56	61
37.5	9	13	12	93	20	26	4	49	63	41	31	34	72
40	3	13	15	149	18	30		63	44	32	39	40	116
42.5		13	15	129	12	15		34	34	24	37	43	106
45		20	20	212	7	17		14	46	26	74	35	83
47.5		7	29	107	6	13		11	19	14	57	18	65
50	1	11	29	116	1	19		3	9	12	43	10	67
52.5		14	30	66	3	12			3	3	15	3	30
55		14	23	84	1	6		3	3		12	1	17
57.5		9	27	50		6	1				6		10
60		6	9	39		2					4		6
62.5		3	3	23							1		1
65		3	4	14							1		
67.5			2	2									
70				3							1		2
72.5				3									
75				4									9
77.5				1									
80				1									
82.5				1									
Average Length cm	34.3	48.0	50.3	46.7	39.1	43.4	32.0	37.8	40.6	39.4	43.7	39.4	43.4
Total Fish	45	138	228	1,233	114	181	62	329	303	255	412	309	717

TABLE 7

ANGLERS' CROP FROM VARIOUS WATERS

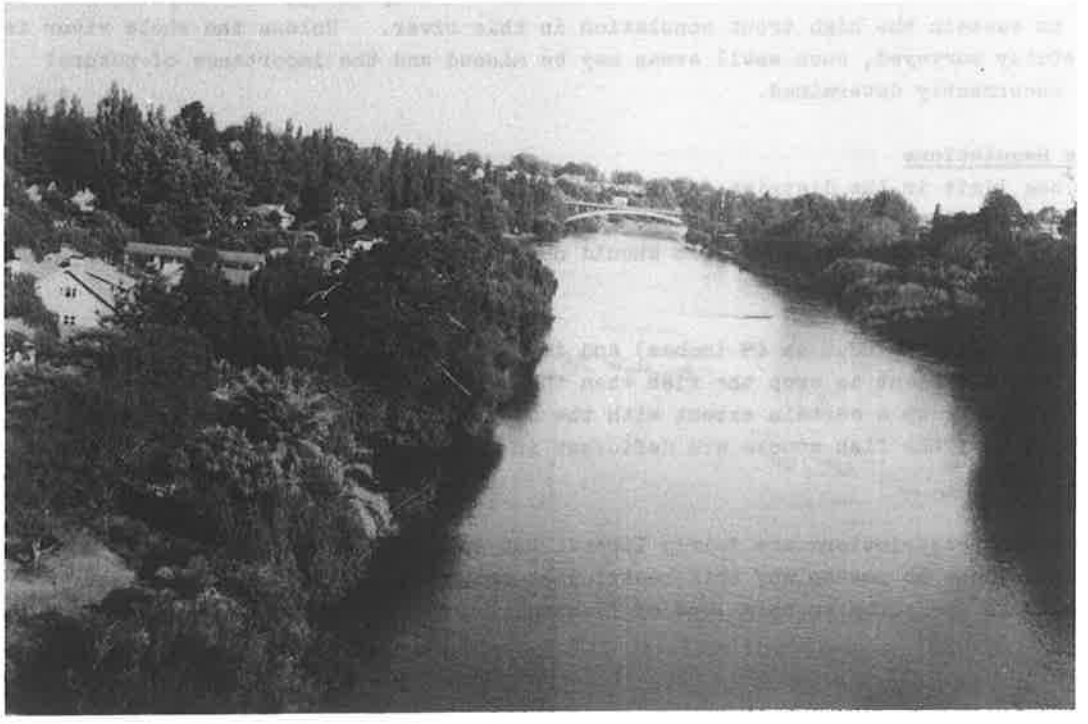
Water	% District Crop Recorded in Diary and Questionnaire Schemes				Estimated Crop 1962-1963
	1948-52 Diaries	1962-1963 Diaries	1963 Questionnaire % Popularity	1967-68 Diaries	
Waikato River		0.8	6	0.9	
Kohekohe Lakes		1.5			
Lake Pupuke			5		
Mangatangi River		0.4	1		
L. Karapiro	4.5	1.4	2		
Pokaiwhenua Stream		0.9	4.5		
Little Waipa Stream		1.4	1.5		500- 550
L. Arapuni	5.8	37.5	14	0.6	5,000-13,500
L. Waipapa		1.0	2	3.1	
Waipa River	7.4	2.4	4.5	3.3	850- 1,600
Mangaohae	1.5	0.3			
Puniu		1.8	2	0.2	
Mangatutu	1.6	0.4		0.9	
Marokopa		0.7		3.0	
Awakino	11.8	0.4		0.9	
Mangaotaki	4.6	0.1			
Wanganui		13.5	12.5	0.2	(Waimarino = 5,600
Waimiha		0.6		4.3	(Auckland = 4,700
Ongarue		0.4		1.1	
Waihou	10.1	8.3	10.5	22.0	2,300-3,800
Kauaeranga	1.8	2.2	3	7.8	800-1,100
Maratoto	1.0	0.5		5.2	
Ohinemuri		4.9	6	8.3	1,800-2,200
Waitekauri	4.2	1.3		5.4	
Waitawheta	3.1	2.5	3	3.5	900-1,100
Waiomou	5.7	1.3	1	9.4	
Waimakariri		0.5	1	0.2	
Oraka		4.9	4	4.3	1,400-1,800
Total Fish Recorded	5,057	3,423	200 Anglers	540	
Estimated District Crop	29,400	36,000		36,700	



AWAKINO RIVER

(NATIONAL PUBLICITY STUDIOS)

WAIKATO RIVER (N.P.S.)



Waipa the crop seems to be about 30 catchables per km, from the Waipa from 20 to 40 per km, from the Kauaeranga from 25 to 35 per km and from the Oraka from 30 to 40 per km. From Lake Arapuni there seemed to be taken from 3.5 to 10 fish per hectare or from 4.5 to 12 kg per hectare in that year. This is probably a higher crop per hectare than that in Lake Taupo. In general these crop figures seem to be quite high and it is possible that quite a high percentage of stocks is taken each year by anglers. Confirmation of this point is important and could be made by various methods such as by tagging adult rainbow trout in their spawning runs or by more accurate estimates of the stock and crop.

The only evidence of depreciation in stock numbers is from the Awakino River where a recent survey by the Technical Field Service found very few fish. It is thought, as mentioned earlier, that this is due to changes in land use with the heavier siltation of the river making it somewhat unsuitable for trout.

Spawning Grounds and Hatchery Liberations

An extensive survey of the spawning grounds in Auckland district was carried out by the late D.F. Hobbs in 1935 and 1936. His observations were published in Fisheries Bulletin No. 8 (Hobbs 1940). In general, he found that all the streams he surveyed except for the Piako had some areas of spawning gravel. In many cases there was extensive super-imposition of redds and consequent loss of ova. In general, spawning grounds were considered adequate in the Waipa system but not in parts of the Waihou and Waikato hydro lakes area. Where the ova were deposited there was good survival. Hobbs found in certain spawning tributaries quite large numbers of ova deposited. In the Tauroroa, a Waipa tributary, 61 redds were counted in 3.6 kilometres of water and it seemed that there would be about 89,000 ova deposited. In the Omahine, a Waiomou tributary, 56 redds were counted in 1.6 km of water and it was estimated that 109,000 ova were deposited. In the Raparapa, another Waiomou tributary, 13 redds were seen and it was calculated that about 40,000 ova were deposited there. This natural reproduction seems to be quite high and significant in comparison to the few fish which are released by the Society. I would suggest from the limited data available, that natural spawning and reproduction could be of greater significance than previously thought,and that a considerable amount of money could be wasted on the liberations which take place. I would also suggest from consideration of Hobbs' studies of the spawning grounds that a more satisfactory solution may be to increase the area of spawning grounds rather than increase the amount of hatchery liberations. If suitable quantities of shingle can be obtained and deposited in the correct areas of the rivers, the natural spawning may be increased considerably. There is a need for more quantitative surveys and assessments of the amount of natural spawning in the rivers. In these surveys all of the river should be covered, since it must be remembered that Hobbs found in the Kakanui River in the South Island that only 0.15% of the river bed area was used for spawning, but this was perfectly adequate to sustain the high trout population in this river. Unless the whole river is very carefully surveyed, such small areas may be missed and the importance of natural spawning incorrectly determined.

Fisheries Regulations

The bag limit in the district is 15 trout per day. As described for the specific waters, this bag limit is very rarely achieved and has no effective restrictive action on the angler's catch. This bag limit should not be changed until it is proved that the stocks are being over-fished.

The size limit is 22.9 cm (9 inches) and it is pleasing that this low limit is enforced, as it is more efficient to crop the fish when they are small and young. This low limit, however, conflicts to a certain extent with the Society's hatchery policy from which one would assume that the fish stocks are deficient in natural spawning and that they are being heavily fished.

The method restrictions are fairly liberal but earthworms are allowed to be used only in some lakes. I see no reason why this restriction should be enforced and believe that more waters could be opened up to this type of fishing.

There is a winter fishing season in the lower reaches of many rivers.

THE WATERS

The Auckland Acclimatisation District has many trout waters. Diarists' results have only been adequate for a few of these major waters which are discussed and described in the following section. Some waters, such as the coastal dune lakes and Lake Pupuke, have not been described since there is inadequate information even though they are quite important for angling.

Lake Karapiro

This large hydro lake in the lower reaches of the Waikato River was formed after 1947. It has an area of about 8.5 square kilometres with about 25 kilometres of shore line. Biological surveys have been carried out in relation to eutrophication and the weed problem, also of spawning areas, the major spawning areas being in the Pokaiwhenua, the Waititi and Little Waipa Streams.

There are adequate diary records only for 1962. Out of 50 fish reported caught 49 were rainbow and one was a brown trout. The trout caught in that year were very large averaging 47.0 cm and very few were undersized. The numbers of trout in the lake have not been assessed but the anglers' catch rates are quite low at 0.23 fish per hour. It is difficult to accurately estimate the anglers' catch but in 1962-63 it appeared to be below 1,000 fish per annum; the present crop may well be higher. The most popular angling methods in 1962 were artificial minnow and spinning, dry fly was occasionally used. The Fisheries Regulations allow artificial minnow and spoon fishing in the whole lake except near the stream mouths, where only fly fishing is allowed. The 1962 records are inadequate to show any differences in catch rate between methods employed. The highest bag recorded in 1962 was only of three fish and it is unlikely that the bag limit of fifteen trout per day restricts the catch in any way. Similarly the size limit has little effect because very few small fish are caught.

No quantitative assessments of the spawning grounds have been made but considerable numbers of fish are liberated by the Society. It should be verified if natural production is insufficient for the fish stocks and inadequate to support the present low level of cropping.

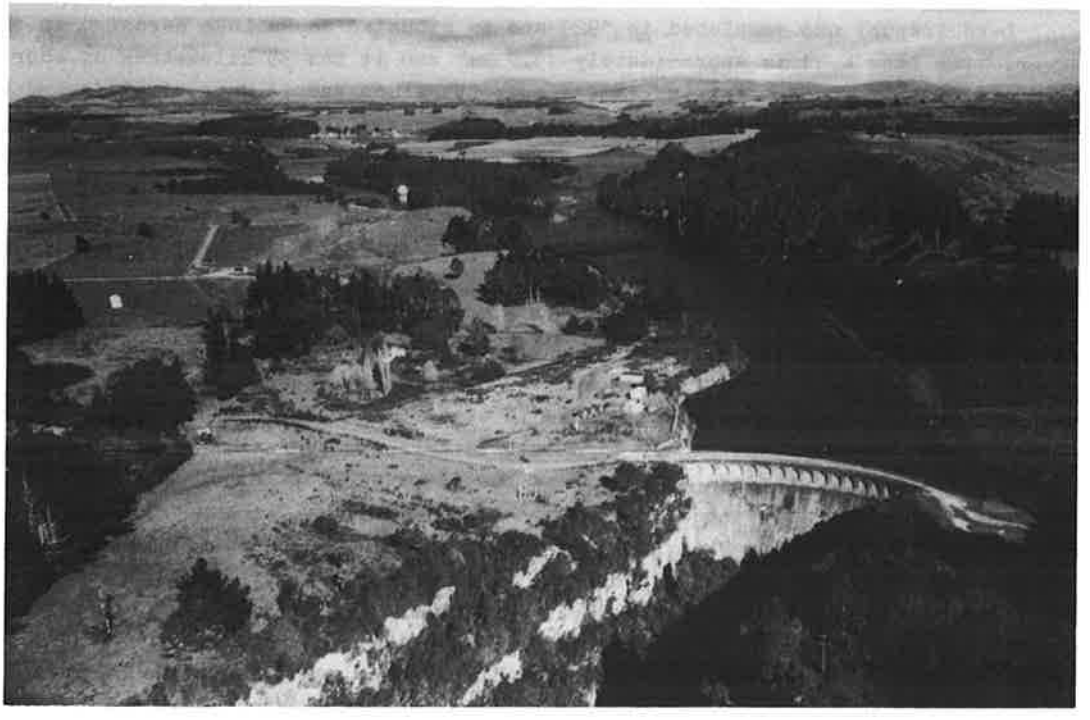
Lake Arapuni

Lake Arapuni was completed in 1929 and is situated above Lake Karapiro on the Waikato River. The lake area is approximately 13.7 km^2 and it has 35 kilometres of shoreline. This lake is suffering badly from increasing eutrophication and is severely infested with water weeds which in some places cover the entire surface of the lake. The weeds are periodically killed by water draw-down by the Electricity Department.

The majority of trout caught are rainbow trout, the percentage of brown being generally lower than 2% in the anglers' catches. The rainbow trout caught are large averaging 46.7 in length with a maximum of over 75 cm. From the diary records there is no evidence at all of any depreciation in fish size. In fact the size may have increased slightly since 1948. The number of undersized fish caught has always been low and it seems to have dropped slightly from about 15 to 5% of the catch over the last 20 years; this may be correlated with the decrease in size limit. The trout densities have not been assessed, but are possibly higher than in Lake Karapiro because the anglers' catch rate, although fluctuating through the years of the diary schemes, averages approximately 0.4 fish per hour which is twice as good as in Lake Karapiro. The lake also seems to be considerably more popular than Karapiro and this could be caused by the higher catch rates and greater fish density. The crop was estimated to be between 5,000 and 13,500 fish in 1962, and it may have increased slightly since. This crop could be quite a significant proportion of the stocks present in this lake and should be verified. I have no information on the adequacy of the spawning grounds and tributaries of this lake, so cannot comment on the hatchery liberations. The angling method restrictions are fairly

LAKE KARAPIRO (N.P.S.)

LAKE ARAPUNI (N.P.S.)



liberal in this lake. There is also a winter season in which only the month of May is closed to anglers. In 1962 the most popular method by far was fishing with a wet fly, spoon fishing was next most popular but was not as effective. In 585 days of angling in 1962 only on two days was the limit bag of fifteen fish achieved; it seems likely therefore that the bag limit has no real restrictive effect on the anglers' catches. Without more information it is very difficult to make comments on how the fishery should be managed, but it seems that collection and publication of scientific information on the trout stocks, the spawning streams and more accurate estimates of the anglers' crop are required before scientific management can proceed.

Little Waipa Stream

This small stream enters into the upper reaches of Lake Karapiro. It is described in the Auckland Acclimatisation Society newsletter 1970 which also has excellent descriptions of the other waters in this district. The diarists' records are adequate for only 1962 when dry fly and wet fly fishing were the major techniques employed, both catching rainbow trout at fairly similar catch rates. A fair number of undersized fish were caught comprising 36% of the total catch. The maximum bag was three fish, but only 55 days were recorded angling by the diarists.

Waipa River

This river is a large tributary of the Waikato which it enters below Hamilton. It is over 100 km long and rises in the extensive Rangitoto Range to the south. A great deal of deforestation has taken place in this range and the tributary rivers carry a heavy bed of shingle. Below Pirongia the gradient drops and the river slowly winds in a deep incised channel to the Waikato. The lower reaches are heavily infested with willows, suffer from extensive pollution and are generally unsuitable for fishing; some large trout are caught there, however. The majority of the angling is above Otorohanga.

As mentioned earlier, the numbers of brown trout appear to be increasing slightly in this river system, it being one of the few river systems in the country where almost equal numbers of rainbow and brown trout are found. The rainbow trout caught are of a reasonable size averaging, during the diary scheme, about 39.1 cm. Large fish have been recorded caught in the lower reaches and some other localities. There has been no historical change shown in the diary scheme in the size of trout caught. The number of undersized fish caught is fairly large and ranges from 20 to 40% of the anglers' catch; this indicates that the spawning conditions are good. Hobbs in his 1935 and 1936 surveys recorded several areas where there are excellent spawning gravels; because of this it is unlikely that hatchery liberations will have any great value. The anglers' crop in 1962 was calculated to be between 850 and 1,600 fish per annum which is quite low in comparison to the large size of the river. Whilst no direct surveys have been made of the fish stocks, it seems likely that this river could withstand a higher crop of fish. Again there is a need for more accurate fishing statistics and surveys of the actual densities of the trout stocks.

The most popular method recorded was dry fly, with wet fly and spoon coming a poor second. All methods gave similar catch rates, there being no historical change since 1948 in the diarists' catch rate which has averaged about 0.4 fish per hour for these skilled anglers. In 76 days angling recorded in 1962 the largest bag was only 5 fish a day and again it is unlikely that the bag limit will have any real restrictive effect. The method restrictions are fairly liberal except that natural bait is not allowed. The lower Waipa is open during the winter to angling except for the month of May.

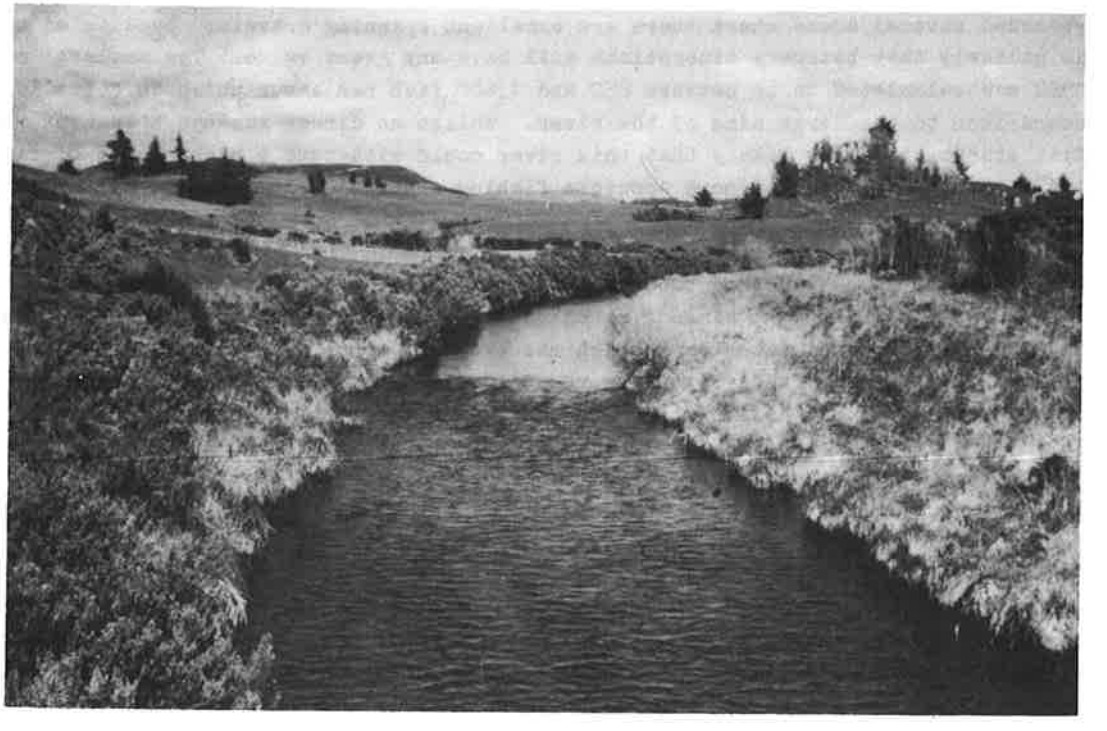
Puniu River

This river is described in the Auckland Acclimatisation Society newsletter 1970 as being fishable for 26 km and running from Ngaroma to the Waipa River at Pirongia. The upper reaches have a stony bottom with fine sand; the lower reaches are mainly of shingle and sand with mudbanks overgrown with willows.

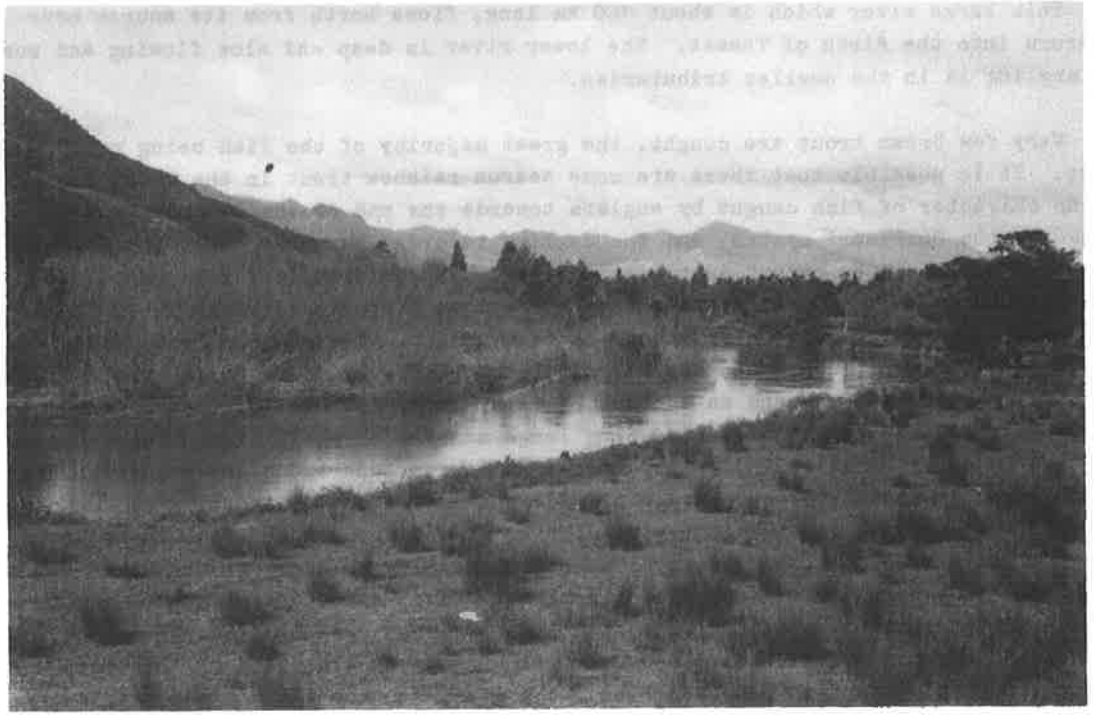
Angling records are mainly from 1962 when wet fly was more popular than dry fly.

WAIPA RIVER

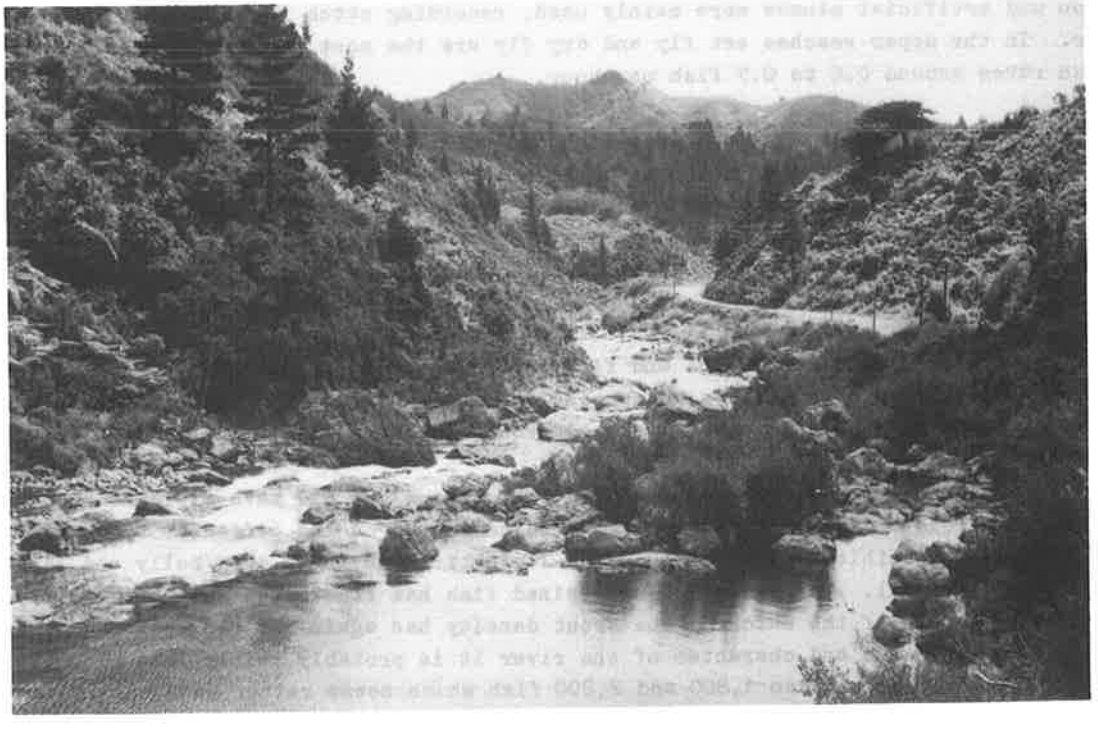
PUNIU RIVER



WAIHOU RIVER (N.P.S.)



OHINEMURI RIVER (N.P.S.)



More rainbows were caught than brown trout and the average size of fish caught was about 39.9 cm. About 30% of the fish caught were undersized. This river has been reported as suffering from pollution in various areas.

Waihou River

This large river which is about 160 km long, flows north from its source near Putaruru into the Firth of Thames. The lower river is deep and slow flowing and most of the angling is in the smaller tributaries.

Very few brown trout are caught, the great majority of the fish being rainbow trout. It is possible that there are some searun rainbow trout in the lower reaches, as the character of fish caught by anglers towards the end of the season seems to change in the Ohinemuri system, and the angling records show that later in the season larger fish seem to be caught in the main river. The existence of sea-run rainbow trout should be verified. There has been no obvious historical change in the species composition as brown trout never seemed to be abundant. The rainbow trout caught are larger in the lower reaches and are very small above the Okoroire Falls, where there are adequate spawning grounds and an absence of eels, these factors increasing production and decreasing mortality and so producing large numbers of small fish. This phenomenon has been noted by Hobbs (1940) and by Turner in Marine Department Investigation Report No. 2 (North Island). The percentage of undersized fish caught in the upper reaches is generally very large, in 1962 it was as high as 40% of the catch; this is to be expected with the small size of fish present. The actual density of trout in the upper and lower reaches has not been assessed by direct methods. Catch rates are excellent in the upper reaches and moderate in the lower reaches. The anglers' crop in 1962 was estimated to lie somewhere between 2,300 and 3,800 fish per annum. The relation of this crop to the stocks is not known at present. The catch rates for the whole river have remained fairly stable through the years, catch rates recorded in 1936 and 1939 being not unusual today. This evidence in itself is not enough to show that there has been no change in fish stock density through the years; only direct methods, which accurately record the fish stock, can determine whether there has been any change.

Spawning grounds were surveyed by Hobbs who stated that they were generally inadequate except for the upper reaches, and that the stocks in the lower reaches were derived from these areas. The most popular methods vary with locality, in the lower reaches spoon and artificial minnow were mainly used, recording catch rates around 0.4 fish per hour. In the upper reaches wet fly and dry fly are the most popular and record higher catch rates around 0.6 to 0.7 fish per hour.

The maximum bag in 1962 was of 8 fish and this was out of 240 angling days, therefore the bag limit does not seem to have any restrictive effect. The size limit has a restrictive effect in the upper reaches and because of the high density of stock there, it seems likely that it could be reduced without any deleterious effects on the stocks. Whether anglers would keep 15 to 20 cm fish is another question, however.

Ohinemuri River

This river starts near Waihi and flows through Paeroa to the Waihou River. The banks are overgrown with willows and access is fairly difficult. The stream has a bed of large rocks and there is extensive weed growth in the summer.

Only rainbow trout have been recorded from this river and have averaged about 38 cm. Numerous anglers in the diary schemes commented on the different types of rainbow trout caught, possible sea-run or estuarine living fish having a deep belly and large spots on their tail. The number of undersized fish has fluctuated but it is fairly high between 30 to 40% of the catch. The trout density has again not been assessed and from the catch rates and character of the river it is probably fairly low. The crop was assessed in 1962 at between 1,800 and 2,200 fish which seems rather high and it is possible that the fish stocks are being heavily fished. The spawning grounds are reputed to be good, if small in extent. The river is open to both spoon fishing and fly fishing,

and spinning appears to be the most popular method. Both methods appear to be equally effective.

Again fisheries management should be aimed at estimating the stocks and the anglers' crop of fish and determing the amount of spawning ground available.

Waitekauri River

This river is a 16 km tributary of the Ohinemuri. It averages from 7 to 15 metres in width and the bed is composed half of rock reefs and half of shingle and gravel.

Only a few brown trout have been recorded by diarists and the predominant species is rainbow trout. The trout are slightly smaller than those in the Waitawheta tributary of the Ohinemuri and average about 39.4 cm in length. The number of undersized fish is medium, between 20 and 30% of the catch. The catch of anglers is probably below 500 per annum but the stock has not been assessed. A survey by K.R. Allen some years ago noted that there was some suitable gravel in places for spawning. This river is principally fished using artificial fly techniques which give a fair to medium catch rate averaging about 0.4 fish per hour. There has been no evidence of any depreciation in average size or catch rate since 1948. Anglers commented that occasionally the trout were in poor condition.

Waitawheta Stream

This tributary of the Ohinemuri enters from the south. The fish stocks are probably distinct because of presence of falls near the mouth of the Waitawheta.

The rainbow trout average 40.6 cm in length, few brown trout being caught. The trout have remained at about this size for the past 20 years. The percentage of undersized fish is a little lower than in the Waitekauri and averages between 10% and 20% of the catch. This would indicate poor spawning conditions which were also found in the same survey by K.R. Allen. The stock density has not been determined; the anglers' crop in 1962 was estimated to lie between 900 and 1,100 fish per annum. I suspect from a recent look at this stream that this crop is somewhat high and that nowadays due to scrub growth and inaccessibility the anglers' catch would be far less than this. Wet fly was the prdominant method used and recorded a slightly lower catch rate than in the Waitekauri, from 0.3 to 0.4 fish per hour. This catch rate has been constant over the years. In 1962 the maximum bag in one day was 8 fish and this indicates that a bag limit of 15 fish will not have any restrictive effect.

Waiomou Stream

This stream is an upper tributary of the Waihou and it rises in the Kaimai watershed.

Large rainbow trout averaging 43.7 cm have been caught by the diarists since 1948 and there has been no historical depreciation or change in size. The number of undersized fish has changed quite erratically and could be anywhere from 5 to 40% of the catch in any given year. Anglers' catch rates have also changed erratically from a minimum of 0.2 to a maximum of 0.9 fish per hour. No spawning gravels were observed by Hobbs in his study in 1935-36 but the small tributary streams, the Omahine and Raparapa, had excellent spawning gravels. The most popular angling method recorded was wet fly but spoon was also quite popular. Again there is little difference in effectiveness between the two methods. The maximum bag recorded was only three fish per day. The most popular area fished was near Te Poi mill, the factory near there being reported to pollute the river at times.

Oraka Stream

This stream is described in the Auckland Acclimatisation Society newsletter 1970, as being fishable for 48 km before it joins the upper reaches of the Waihou. The great majority of the fish caught have been rainbow and they have been fairly small as in the other tributaries of the Waihou. Few fish caught were over 55.9 cm in length, the average size being 39.4 cm. I have no information about fish density but the anglers' catch rates have been very good and have averaged around 0.7 fish per hour for the last three years. The anglers' crop was estimated in 1962 to be between 1,400 and 1,800 fish per annum. The spawning grounds are probably adequate as in the neighbouring upper reaches of the Waihou.

In 1962 the most popular methods were artificial minnow and spoon, but wet fly was also often used, and there was no apparent difference in effectiveness between these methods. The diaries do not give any evidence of any depreciation of fish stocks in this river.

Kauaeranga River

The Kauaeranga River rises in the Coromandel Ranges and flows west into the Firth of Thames. It is fishable for about 24 km and has a shingle and boulder bed.

Rainbow trout only have been caught by the diarists and have been very consistent in average size for the past 30 to 40 years. Diary records show only a very slight drop in size from 40.6 cm in 1948 to 35.6 cm in 1967. This drop may not be at all significant. The percentage of undersized fish has always been very stable indeed at around 40% of the catch. Anglers' catch rates have shown no change over the past twenty years and have averaged 0.4 fish per hour, which indicates a fairly good density of trout for this type of river, which is reported to have adequate spawning grounds and has a protected forest catchment. The maximum bag recorded was only four fish per day, the principal angling method used being wet fly. This river, the northern-most popular Auckland trout stream, has surprisingly shown no sign of deterioration at all through the years.

Wanganui River

This large and important river is described in the Waimarino Society Report. Briefly, brown trout are generally more common than rainbow trout, there being no historic changes in species composition. Anglers' catch rates are quite good but the river has suffered in recent years from eruptions of Mount Ruapehu, and many suffer more from water abstraction for the Tongariro Power Scheme.

FISHERIES MANAGEMENT

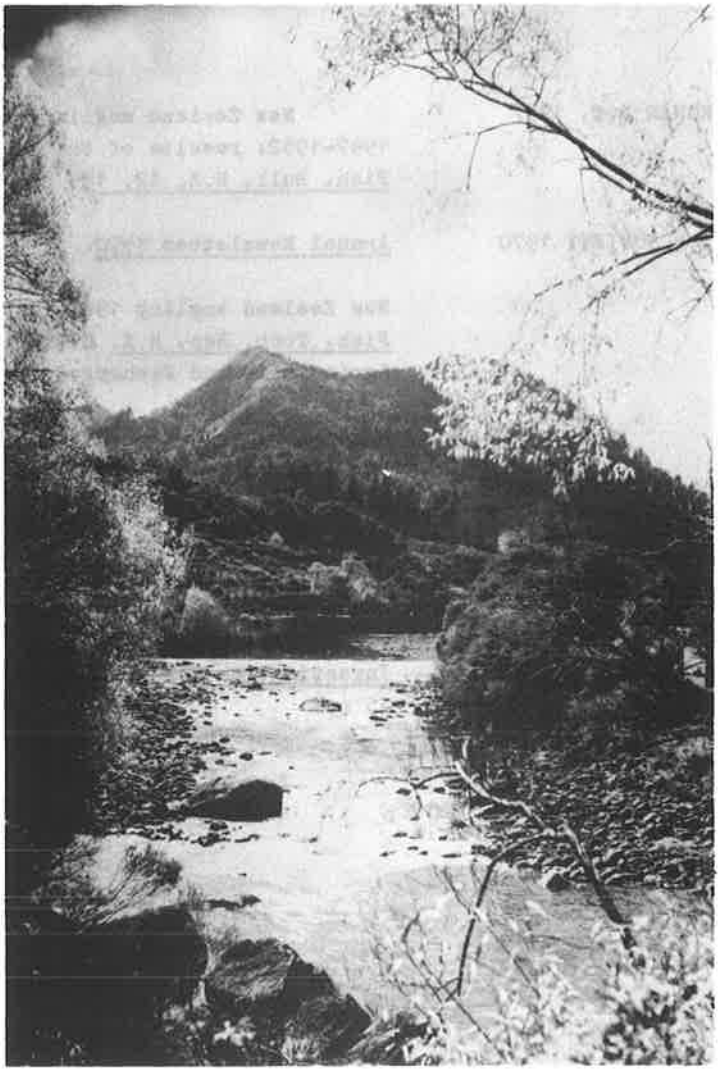
The diary schemes have given a good picture of the angling effort and catch throughout the Auckland district. It is apparent from the diarists' results that the fishery is in a fairly stable state and that any desired changes can be brought about only if they are carefully planned.

This report shows that there is a lack of scientific information on the trout fisheries and that there is a need for special studies to determine the effectiveness of hatchery liberations as compared to natural reproduction.

Surveys are also required to determine the abundance of fish stocks in this region. I consider that there is no need for any further angling diary scheme in this district because of the poor return and also the inaccuracy of certain results derived from these schemes. It would be wise for the Society to organise, with the assistance of the Ministry, creel census or postal questionnaire schemes in order to collect more accurate and relevant data on anglers' catches.

This report has not dealt with one of the most serious problems that confronts the Society and that is changes in the environment. The Society must at all times be prepared to act quickly to prevent pollution and destruction of habitat because otherwise the fish stocks will certainly decline.

KAUAERANGA RIVER (N.P.S.)



ACKNOWLEDGMENTS

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