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NEW ZEALAND MARINE DEPARTMENT

FISHERIES TECHNICAL REPORT

No.64

**SOUTHERN LAKES ANGLING STATISTICS
1947 - 1968**

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WELLINGTON, NEW ZEALAND

1971

FISHERIES TECHNICAL REPORT

SOUTHERN LAKES ANGLING STATISTICS

1947 - 1968

(With special reference to the Angling Diary Schemes)

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INTRODUCTION

The Southern Lakes district of the South Island of New Zealand is an important angling and recreation area. In over 12,000 square miles of mainly mountainous country covered with tussock or beech forest there are five large glacial lakes and many large, clear, rapid rivers.

The sports fish stocks of brown and rainbow trout, quinnat and Atlantic salmon are managed by the Department of Internal Affairs Wildlife Service with the assistance of the Fisheries Management Division of the Marine Department. At periodic intervals since 1947 information about the fisheries has been obtained by angling diary schemes as described by Allen and Cunningham (1957) and by rangers' creel censuses. This report summarises the results of these schemes and comments on future management plans.

It was originally intended that this report would give future management plans for each major water in the district. Following statistical studies Graynoth (1972) it became apparent that the diary scheme was less useful and accurate than previously thought. This report is shorter than originally planned and contains only the most reliable information.

Detailed discussion of the methods of analysis, etc. is not presented here. It is included in Graynoth 1972. Probably the only statistical term in the present report which needs clarification for the layman is, for example, from page 4 "averaged 19.5 days per season (± 12 to 95% probability)". This gives a measure of the accuracy of the calculated average of 19.5. There is a 95% chance that the true average lies between 7.5 and 31.5, i.e. $19.5 - 12$ and $19.5 + 12$.

MATERIAL AVAILABLE

Angling diary schemes were organised in 1947, 1948, 1951, 1952, 1953, 1955, 1956, 1957, 1960, 1962, 1965 and 1967. Rangers collected results of anglers' catches in 1947, 1949, 1950, 1960, 1965, 1966, 1967, and 1968.

The diaries were distributed with all licences sold during the relevant season by the Department of Internal Affairs licence sales representatives. The diaries were of a standard form (Allen and Cunningham 1957) and were pre-paid for postal return to the Internal Affairs Department or the Marine Department for analysis. Rangers' survey forms were fairly similar, but included the sex and weight of the fish caught while the diaries only recorded number and length of fish.

In all about 1,000 diaries were received recording, with the rangers' results, about 12,300 days or 30,000 hours angling for about 14,800 fish kept.

The angling diary schemes were tabulated and analysed in many different ways by many different people. In some years rangers' results were inextricably combined with those of the diarists, in other years some results were lost or incomplete. In the last three diary schemes the anglers' results were coded for computer tabulation. Of these the 1965 scheme was incorrectly coded and the calculated catch rate results are useless.

Through the years only the analysis of fish lengths has been constant and comparable.

Anglers' annual effort, catch rate and catch vary with licence type, angling experience, waters fished, methods used, location fished, etc. Only some analyses took notice of one or some of these factors. The inconsistency of the past analyses have made determination of historical trends from this angling data almost impossible. The raw data are not available for re-analysis.

Biological surveys by rangers and fisheries management officers and trapping studies of spawning runs have been made at Lake Hayes and elsewhere.

RESULTS AND TRENDS

Licence Sales

Licence sales in the Southern Lakes district increased very rapidly until 1961, but have since then fluctuated at around 15,000 per annum. From 1966 to 1968 they have dropped slightly and are below the (1961) peak. Sales of men's whole-season licences have remained stable at around 1,600 since 1958. Short term licences comprise the majority of the licence sales and daily licences are about 40% of the total sales. These short term sales are mainly to visitors and tourists; local anglers take out whole season licences.

Angling Effort

The individual anglers' and total anglers' fishing effort is primarily determined in order to estimate the catch and hence the crop of fish from the fishery.

Estimates of angling effort can be obtained from diary and questionnaire schemes and rangers' creel censuses. It is rarely possible to obtain records of all angling and so sub-sampling techniques are used. The total or individuals' effort and catch is then estimated within defined error limits. The accuracy of the diary estimates is described later.

Creel census surveys to determine total anglers' fishing effort should involve random stratified sub-sampling systems. Previous attempts with this sampling technique failed as although estimates of total angler fishing effort were satisfactory, insufficient information was collected on other topics, e.g. fish length and species. The scheme also required much expensive travelling. As a consequence rangers now collect information on anglers' catches only when and where possible and not in accordance with a sampling plan. Most information is collected on holidays when there is more angling at such points as boat landings. The visiting, short term licence holders most commonly interviewed by

such methods are not typical in some respects, and total effort and catch rate estimations should not be made without assessing the bias present.

During the shorter days of autumn, winter and spring anglers' effort tends to be concentrated at midday, with less fishing in the morning and evening. Aerial counts at midday can therefore be related to the total angler effort. This was standard practice at Lake Mendota in Wisconsin (Carlander 1956) and very effective. On Lake Aviemore in August 1970, 57 out of 63 anglers were fishing between 2 and 3 p.m. In this case an aerial count of 57 anglers at this time would have to be multiplied by 1.11 to obtain angler-days, 6.58 for total hours and 1.84 for total fish. In summer anglers' effort may be bimodal with peaks at 9 a.m. and 3 p.m. and aerial surveys would have to be at these times.

A random, stratified-sampling system using aerial surveys could be devised for individual waters or for the whole Southern Lakes district. Present indications are that this is unnecessary at the moment because the fish stocks are probably underfished.

Individual anglers fish from one to about one hundred days per season. The annual individual effort varies with licence type, whole season licence holders fishing throughout the year whilst visitors take out short term licences and only fish for a few days. In all licence categories men fish about twice as often as women or children. Diarists tend to be keener anglers than the average angler and fish more often. In Wellington Acclimatisation District in 1962 men's whole season diarists recorded 15.8 days angling per season. A subsequent questionnaire and interview scheme found that the true average angler's effort was 12.4 days per season - a significant drop.

An estimate of the average angler's yearly effort can be derived from that of the diarists. In 1965, 30 men's whole season resident diarists averaged 19.5 days per season (± 12 to 95% probability, Graynoth 1972). In 1946, 62% of the whole season licence holders lived in Otago, Southland and other Acclimatisation Districts. These anglers probably fish less than local anglers. The average whole season angler therefore probably fishes for about 14 days

days per season. This estimate, whilst subject to a large possible error, is believed to be fairly accurate. In Nelson, Marlborough and West Coast Acclimatisation Districts estimates of days fished per angler are from 10 to 14 days per season.

The large possible error is caused by the low diary returns. For early years there is even less information than in 1965. In 1957, 1962 and 1967 diaries were received from Acclimatisation Society licence holders, but not from Southern Lakes district whole season licence holders. In 1947, 1948, 1951, 1952, 1953, 1956 and 1960 less than 15 anglers in any licence category returned diaries. These few anglers recorded a great deal of angling, but cannot be taken as typical. It is therefore impossible to prove whether anglers today fish more or less than in the past. It is possible that nowadays anglers fish less than in the past as now there are more leisure activities available. Anglers' skill has probably also dropped through the year.

The average fishing effort expended by short-term licence holders cannot be accurately derived from their diaries. Many anglers bought an unknown number of weekly or daily licences and recorded up to 20 days angling on one diary. Monthly licence holders probably fish for about eight days per season, weekly licence holders for four days and daily licence holders for 0.8 days. Accurate figures could be obtained from postal questionnaire schemes if there is a high return and few nonrespondents. To eliminate nonrespondent error would probably mean interviewing or telephoning up to 100 anglers scattered from Invercargill to Christchurch.

The total district effort using the above figures from 1960 to 1968 is probably from 40,000 to 100,000 days averaging about 75,000 days per season. This has risen from about 14,000 days per season in 1948. As licence sales have stopped increasing this annual effort should not increase.

The hours spent fishing per day vary greatly between anglers, men, women and children, licence categories, waters, angling methods employed and months of the year. In 1965, men's whole season diarists averaged 2.32 hours per day and short-term licence holders 2.83 hours per day. On average from 1960 to 1968 about 200,000 hours are spent angling per season in the Southern Lakes district.

The seasonal distribution of anglers' effort appears to be stable. The distribution of fishing effort recorded in the 1962, 1965 and 1967 diary schemes was very similar and averaged 12% of the total in October and 10%, 14%, 25%, 13%, 9% and 13% in the following months (November - April). There was no clear trend in the mean hours spent angling per day through the season. Therefore, the angling pressure is highest in January with secondary peaks in October and April. The number of anglers fishing on any given day is variable depending upon the month, the weather, and whether it is a week day. In 1965 the coefficient of variation of anglers' fishing effort for week days through the entire season was 0.85, for weekends 0.59 and for all days 0.77. Hence in an eight month season 31 random days (13%) would need to be completely surveyed by a creel census for an estimation of the total anglers' effort on any given water to be accurate to $\pm 25\%$ to 95% probability.

The distribution of the total district fishing effort to the various waters cannot be accurately assessed from a few diaries as each angler tends to fish few waters. In 1965 the 208 diarists recorded that Lake Wakatipu (estimated 14,000 days) was the most popular water followed by Lake Hawea (11,000), the Clutha River (9,000), Lakes Te Anau (5,000), Wanaka (5,000) and Hayes (4,000), then the Waiau River (2,000). Each estimate may be up to $\pm 60\%$ incorrect.

Anglers' Catch Rate

The catch rate is determined for three purposes. Firstly, if the total anglers' effort is also known, the total crop of fish can be derived. Secondly, the catch rate can be used to assess the abundance of fish. Thirdly, it is a measure of the anglers' reward for effort expended and describes the quality of the fishing.

In the past, diary schemes and rangers' creel censuses have been used to determine the anglers' catch rate. In general both systems have been inadequate to allow accurate determination of catch rate for either individual waters or angler licence categories. The problems in estimating the accuracy of catch rates from diary schemes are discussed in Allen and Cunningham (1957) and Graynoth (1972). In general, because of the low diary returns and

because differences in skill between anglers are so great, about 1,000 hours must be recorded on a water for the catch-rate to be accurate to $\pm 25\%$. This quantity of information was not received for any water in any year.

Other factors affecting the individual angler's catch rate are the anglers' sex, licence category (as related to skill factors), the method used, and the water fished. Seasonal weather effects and the size, species and density of fish also affect the catch rate.

Catch rates derived from creel censuses also have the above errors. For the years 1965, 1968, 1967 and 1966 the catch rates recorded by creel census for the whole Southern Lakes District were 0.24, 0.27, 0.28 and 0.31 fish per hour. This was correlated with an increase in the mean hours recorded per day (1.58, 1.66, 1.71 and 1.85). It is unlikely that this error is caused by differences in waters fished or categories of anglers interviewed. Oversampling of visiting anglers is difficult to avoid and their catch rates would be lower than those of resident skillful anglers who may fish early and late in the day. In general insufficient data were collected by rangers.

The average Southern Lakes men's whole season diarist in 1965-66 recorded 0.62 fish per hour or 1.44 fish per day. In Wellington in 1962-63 the average catch rate of male whole season licence holders was 0.6 less than those anglers who returned diaries. If this factor is applied to the Southern Lakes data the typical men's whole season licence holder catches about 0.87 fish per day. Short term licence holders catch about 0.25 fish per hour or 0.77 fish per day (they fish longer per day than whole season anglers). Accurate historical comparisons of anglers' overall catch rates cannot be made. Diarists in the past had better catch rates, however, they fished a lot and were not typical of the average angler. Catch rates achieved by anglers from 1947 to 1957 are still obtained by anglers today.

The catch rates vary between waters. In the 1962, 1965 and 1967 diary schemes as more angling hours were recorded, the differences in catch rates between waters became smaller. All waters with more than 500 hours recorded have average catch rates fairly close to 0.44 fish per hour. With the low returns and consequent inaccuracy of most individual water figures this indicates that all waters give similar catch rates and that the differences shown are due to statistical errors.

Since 1960, Lake Wakatipu has recorded the best catch rates followed by Lake Hawea, Lake Hayes and the Waiiau River. Poorer waters are Te Anau and the Clutha River and Lake Wanaka. However, a skilled local angler fishing the Clutha could catch fish faster than most visitors on Lake Wakatipu.

Due to the inadequacy of the data available, historical trends in catch rate on individual waters cannot be accurately determined. The determination of catch rate for each season is often subject to \pm 60% error. Differences in data collection and analysis also prevent meaningful year to year comparisons (Table 1).

No relation between the abundance of fish and anglers' catch rates has yet been derived. In Wellington and Hawkes Bay rivers considerable fluctuations in fish abundance may occur without affecting catch rates (Graynoth 1972). "Manta-board" diving surveys could help clarify this relation in the future. This is a major priority and future work should be aimed to assess the fish stocks directly rather than by anglers' catch rates.

The quality of the fishing in the Southern Lakes, as described by the catch rate, is good to excellent and far better than fishing in most Acclimatisation Society districts.

Catch

The catch of sports fish from the Southern Lakes is calculated in order to determine whether the stocks are being over-exploited.

Using the catch rates and fishing effort derived from the diary schemes, the average men's whole season angler catches about 12 fish per season. Childs' and women's whole season anglers and monthly, weekly and daily licence holders respectively catch approximately 4½, 3, 6, 3 and 0.6 fish per season.

TABLE 1 CATCH RATES RECORDED BY ANGLERS FISHING
LAKE WAKATIPU, 1956-1967

Year	Days	Hours	Fish	Hours per Fish
1956	?	322.5	160	2.01
1957	38	120.5	80	1.51
1960	133	384	137	2.80
1962	50	114.8	43	2.67
1965	277	588.7	350	1.68
1967	29	61	26	2.35

Comments:

- 1956 - Complete mixture of ranger and diary results as well as all licence types.
- 1957 - Probably 1 or 2 skilled anglers and few visitors.
- 1960 - Mixture of whole season anglers' results from diaries and rangers' records.
- 1962 - 13 anglers, mixed whole season and visiting anglers.
- 1965 - 67 anglers, mainly visitors averaged 2.16 hours per fish. Five local anglers fished well over 10 days each and recorded 1.26 hours per fish thereby biasing the results.
- 1967 - 15 anglers, mainly mens whole season visitors. None fished more than 6 days.

The total catch in recent years is between 30,000 and 80,000 fish per annum and is most probably around 50,000. This is a fair increase from the estimated catch of about 20,000 fish in 1948.

The catch in various waters is difficult to determine accurately. Diary schemes in the Southern Lakes in any year recorded only about 3% of the annual catch and, because the few participating anglers showed preferences for specific waters, the diarists catch may not have been distributed over all waters in the true proportions. Table 2 shows the estimated annual catch for some waters and the error ranges. For comparison the 1969 estimated annual catch from Lake Aviemore was 12,000 and from Lake Benmore 3,900 fish (Graynoth 1970).

The estimates derived from the diary schemes are scarcely better than those which could be made by informed observers and local fishermen. If necessary, more accurate determinations of the crop from various waters can be made by creel census surveys.

Species

It is believed that most anglers can tell the difference between brown and rainbow trout. Some confusion between rainbow trout and salmon probably occurs, and salmon were often misidentified, e.g. Atlantic salmon were reported from Lakes Wakatipu and Hawea where they do not occur.

Table 3 shows the numbers of each species recorded in all major diary schemes in the last 25 years. No systematic district trends in the percentage of brown and rainbow trout or quinnat salmon are apparent. Few Atlantic salmon have been recorded in recent years. The large year to year variations are due to sampling errors. The overall percentages of each species are fairly accurate and if the total crop of fish is 50,000 then 25,000 would be brown trout, 19,000 rainbow trout, 3,500 quinnat salmon and 1,000 to 2,000 Atlantic salmon.

There have been few changes in relative abundance of species in different waters as indicated by the composition of anglers' catches (Table 4). Lakes Wakatipu and Wanaka are similar being mainly brown trout waters and showing no changes for 25 years. Lake Hawea is a rainbow trout and quinnat salmon water, brown trout have always been less important.

TABLE 2 ANNUAL CATCH FROM THE MOST IMPORTANT WATERS IN THE
SOUTHERN LAKES DISTRICT

Water	Fish Caught By Diarists						Calculated Total Catch	Range (95% Probability)	
	1956	1957	1960	1962	1965	1967		Minimum	Maximum
L. Hawea	13	15	186	497	319	61	7800	500	15200
L. Wakatipu	160	80	137	43	350	28	5700	2100	9300
Upper Clutha River	344	63	161	26	176	32	5700	1900	9600
L. Wanaka	102	75	14	76	106	108	3400	1100	5800
L. Hayes	223	8	94	7	75	1	2900	1	5700
Waiiau River	26	0	157	176	28	13	2900	0	6300
L. Te Anau	41	77	117	30	105	22	2800	700	4900
Whole District	1611	626	1083	1323	1684	650	50,000		

TABLE 3THE COMPOSITION OF THE ANGLERS' CATCH

Year	Number of Fish							Percentage				
	Brown Trout	Rainbow Trout	Unspecified Trout	Quinnat Salmon	Atlantic Salmon	Perch	Total	Brown Trout	Rainbow Trout	Quinnat Salmon	Atlantic Salmon	Perch
1947	278	124	-	15	129	-	546	51	23	3	24	-
1948	208	29	-	1	2	-	240	87	12	+	1	-
1949	201	146	-	29	25	-	401	50	36	7	6	-
1952	350	205	-	1	55	-	611	57	34	+	9	-
1953	108	221	-	41	62	-	432	25	51	9	14	-
1956	1031	690	84	37	36	-	1878	58	39	2	2	-
1957	356	202	93	91	9	1	752	55	31	12	1	+
1960	332	357	220	216	21	67	1213	36	39	18	2	6
1962	398	619	31	69	25	2	1144	36	56	6	2	+
1965	747	547	274	93	21	2	1684	54	39	6	1	+
1967	295	113	101	29	3	19	560	66	25	5	1	3
Totals	4304	3253	803	622	388	91	9461	50	38	7	4	1

TABLE 4TOTAL NUMBER OF FISH AND COMPOSITION OF ANGLERS'CATCH ON ALL SCHEMES 1947-1967

Water	Number Caught						Percentage of Catch			
	Brown Trout	Rainbow Trout	Unspecified Trout	Quinnat Salmon	Atlantic Salmon	Total	Brown Trout	Rainbow Trout	Quinnat Salmon	Atlantic Salmon
L. Hawea	195	440	144	280	-	1059	23	51	26	-
L. Wanaka	158	95	103	41	-	397	56	34	10	-
Clutha R.	639	147	102	1	-	889	81	19	+	-
L. Wakatipu	383	216	39	80	-	718	57	32	11	-
L. Te Anau	100	273	126	-	77	576	23	63	-	13
Waiiau R.	29	382	9	-	51	471	6	83	-	11

The number of quinnat salmon recorded from Lake Hawea was low, until after the lake level was raised and in 1960 many were caught. The number has since dropped. Anglers on the Clutha River over the last 25 years have recorded mainly brown trout with a constant 20% rainbow trout. Only one quinnat salmon was recorded by the diarists, but Axby (pers. comm.) stated that they occur in both the Hawea and Clutha rivers downstream to Lake Roxburgh. This river dwelling habit is unusual. Lake Te Anau and Waiau River are rainbow trout waters; brown trout are certainly present in large numbers, but are difficult to catch. The diary records show a slight drop in the numbers of Atlantic salmon caught reflecting the large drop shown in spawning runs up the Upukerora River. The stocks may be stable or still deteriorating.

The factors affecting the species of fish anglers catch are well known. The order of ease of capture is land-locked quinnat salmon, rainbow trout and brown trout. The catchability of land-locked Atlantic salmon are not known, but they are thought to be fairly easy to catch even at low densities.

There are differences between anglers, licence types, seasons and fishing localities in the proportions of each species caught. The influence of these factors was not analysed as it was thought to be smaller than the species selection of the method of angling used. The selectivity of fishing method was examined for Lakes Wakatipu, Hawea, Wanaka and Te Anau in 1965 and for Lake Hawea in 1962. For each lake the observed numbers of the three species caught by each method were compared to the expected catch by that method.

Dry fly selects brown trout, wet fly and artificial minnow select rainbow trout and spoon and trolling select salmon.

In future the abundance of each species would best be determined by direct studies such as trapping spawning runs. The diary schemes have shown that in general there has been little change in recent years. The diary system cannot define the factors affecting the trout and salmon stocks and their abundance. These factors must be directly studied and analysed if any change is to be brought about by management.

At present rainbow trout fry are being planted in some rivers entering Lakes Te Anau and Wakatipu in an attempt to build up spawning runs of this desirable species. After evaluation this programme may be extended to rivers flowing into other lakes.

The reasons for the drop in abundance of quinnat salmon in Lake Hawea are being studied, but it is unfortunate that a study of this fishery was not commenced when the stocks were abundant.

Size

The largest trout are generally taken from the inaccessible rarely fished rivers and the smallest ones from Lake Hawea. The average size of trout and salmon caught in the district is large and at 2 to 3.5lbs (Table 5 and 5a) and compares well with the small fish caught in nearby Otago and Southland. There is no real evidence of any significant deterioration in size over the past twenty years and the size should remain large for many years to come.

The angling diary data are adequate to determine average sizes and historical changes only in the larger lakes. From the lakes the anglers catch the largest fish of all species in Te Anau, then Wanaka, Wakatipu with the smallest fish in Hawea. It is not known whether the average size of fish present in the lakes is directly related to the size of angler caught fish. If it is, then the biological reasons for this drop are not known. Only field surveys can corroborate the size differences shown and explain why they exist.

Changes in the size of angler caught fish are few. The trends shown could have been caused by sampling errors or changes in fishing practice. In Lake Wakatipu the rainbow trout may have increased in size and the brown trout may have become smaller. Te Anau brown and rainbow trout and salmon may have decreased in size.

Trolling and spinning seem to catch smaller fish and dry fly and natural bait the largest. In general few fish were caught under the minimum takeable size limit. The highest percentage of under-sized fish was less than 20% (In Lakes Wakatipu and Hawea).

TABLE 5

PERCENTAGE SIZE COMPOSITION OF FISH FROM MAIN LAKES MEASURED BY DIARISTS

OR RANGERS. ALL SCHEMES 1947-1962. Hy = Hayes, Hw = Hawea, Wk = Wakatipu, Wn = Wanaka, TA = Te Anau, + = less than 1.

Lake	TROUT					SALMON							
	BROWN					RAINBOW				QUINNAT			ATLANTIC
	Hy	Hw	Wk	Wn	TA	Hw	Wk	Wn	TA	Hw	Wk	Wn	TA
No. Fish	309	159	369	139	96	373	203	85	236	100	102	19	76
Length (Ins)													
10								1					
11	+	1											
12	+	2	2	1		+	3	4	+	2			
13	1	4	4			5	6		+	21	2		
14	2	5	8	3	2	3	5		2	7	5	5	3
15	4	6	10	3	2	4	6	6	4	11	9		1
16	9	9	11	7	2	9	9	2	2	7	12	5	3
17	10	14	12	6	2	11	8	1	3	23	21	16	5
18	20	16	15	15	2	23	12	6	5	11	23	16	4
19	26	12	12	7	6	16	12	9	9	5	16	26	13
20	17	11	9	19	16	12	15	20	13	8	8	21	16
21	6	6	6	10	17	1	11	15	15	5	3	11	12
22	3	7	5	17	12	4	8	16	19		1		17
23		1	3	5	19	1	2	12	10				16
24		4	2	3	15	4	1	1	10		1		15
25		1	+	+	3	+	+	4	2				5
26		+		1	1			2	1				1
27									+				3
28			+		1								3
29				+									
30									1				

5(a) AVERAGE LENGTHS AND WEIGHTS

Fish	LENGTH (INS)					WEIGHT (LBS)				
	Hayes	Hawea	Wakatipu	Wanaka	Te Anau	Hayes	Hawea	Wakatipu	Wanaka	Te Anau
Brown Trout	18.2	18.1	17.7	19.6	21.4	2.6	2.6	2.4	3.3	4.2
Rainbow Trout	-	18.3	18.2	20.2	20.8	-	2.6	2.6	3.6	3.9
Quinnat Salmon	-	16.2	17.5	18.5	-	-	1.8	2.3	2.7	-
Atlantic Salmon	-	-	-	-	20.8	-	-	-	-	3.9

Regrettably more use cannot be made of the length records given by rangers and anglers. More knowledge of the relation between angler-caught fish and the fish stocks is necessary before anglers' size records are of any real value.

Stock

The stocks in most waters have not been assessed. The catch figures shown in Table 2 are, however, probably only a small percentage of the stock and could be increased without danger.

A few years ago, by trapping spawning runs and from tagging records, the brown trout population of Lake Hayes was estimated at about 30,000 catchable fish. This is a small productive lake and figures of the same order could apply to the large but less productive glacial lakes like Wanaka and Wakatipu.

Angling Regulations

The anglers' catch rate is generally good but the bag limit per day is rarely reached. In general the bag limit has little effect on the fishery.

Few undersized fish are caught. Return of these small fish to the water adds little to future anglers' catches. The size limit has little effect on the fishery.

Method and season restrictions are lenient, but there is no cause to suggest they become more restrictive.

DISCUSSION

The angling results recorded during the various diary and creel census schemes are of little value considering the effort expended in collection and analysis.

At present fishing data are collected from anglers by Internal Affairs Department rangers. These statistics will be more accurate than angling diary statistics (Graynoth 1972) and of more value in solving immediate management problems.

As no marked deterioration or change has been shown by diary schemes, assessments of the state of fisheries in the whole area may be necessary only every ten to fifteen years. In the chosen study year more effort can be expended and more accurate results obtained (e.g. the inclusion of a compulsory diary scheme). Linked with continuing biological studies, historical trends can be better determined this way than by inadequate, annual or five yearly schemes.

CONCLUSIONS

1. Licence sales increased until 1961 and then stabilised.
2. The total district angling effort is about 75,000 days or 200,000 hours per season to catch 25,000 brown trout, 19,000 rainbow trout, 3,500 quinnat salmon and 1,500 Atlantic salmon.
3. The catch rates are good, but were not accurately assessed by the diary and questionnaire schemes.
4. The fish are large and have not deteriorated in size.
5. Past angling diary and creel census schemes here have been of little value in fisheries management.

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