

The Geography of Freshwater Angling in New Zealand

**A summary of results from the
1994/96 National Angling Survey**

June 1998

NIWA CLIENT REPORT NO: CHC98/33

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1994/96 National Angling Survey**

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Summary

The National Angling Survey was carried out over the 1994/95 and 1995/96 angling seasons to derive nationally consistent estimates of angler usage for all lake and river fisheries under the jurisdiction of Fish & Game New Zealand.

The survey was implemented on a region by region basis, as a series of six bimonthly telephone surveys based on a random sub-sample of licence holders.

Total angling effort was 1.34 million days, with a standard error of approximately 17 500 angler days. Fifty-four percent of the effort was recorded over the summer months, December to March. Annual usage of individual waters ranged from 10 days in remote back country areas to over 50 000 days on the Waimakariri and Mataura Rivers.

River fisheries accounted for 58% of total usage, although the relative importance of river and lake fisheries varied considerably between regions. Mainstem river fisheries dominated the east and south of the South Island, with lowland rivers also important in these areas, and in Nelson, Bay of Plenty, and Waikato. Headwater fisheries usage was heaviest in Southland, Otago, West Coast, Nelson, and parts of the Hawkes Bay and Eastern regions. Lake fisheries were primarily confined to the central North Island and the central axis of the South Island.

The distribution of angling effort was strongly skewed towards anglers purchasing whole season licences, who accounted for 24% of total sales compared to 68% of the total effort.

The main source of error was statistical uncertainty associated with usage estimates based on data from a limited sub-sample of anglers. The uncertainty is reduced when usage estimates are combined over larger spatial scales.

The 1994/96 survey can be seen as a sound baseline for establishing individual waters in a national and regional context. Assuming a strategy of repeating the survey at intervals of five to seven years is adhered to, a follow-up survey will be due in 1999 or 2000. Recommendations have been made for future survey design, field procedures, and maintenance of angling licence records.

1. Introduction

1.1 Freshwater angling in New Zealand

Freshwater angling, primarily for brown trout (*Salmo trutta*), rainbow trout (*Oncorhynchus mykiss*), and chinook salmon (*O. tshawytscha*), is a major leisure time activity for many New Zealanders, and has a distinctive place in our national culture. Following their successful acclimatisation to New Zealand waters over three decades from about 1875 (McDowall 1990), all three species rapidly became the basis of lively sports fisheries, with salmon becoming firmly established on the east coast of the South Island, rainbows in the central North Island and South Island high country, and brown trout just about everywhere. In addition, there are numerous smaller and more localised fisheries for other introduced salmonids (such as brook trout (*Salvelinus fontinalis*)), and “coarse fish” (such as perch (*Perca fluviatilis*) and tench (*Tinca tinca*)).

Angling for sports species is managed by the Department of Conservation (DOC) within the Taupo Conservancy, and by Fish & Game New Zealand (FGNZ) throughout the remainder of the country (Figure 1-1). This management infrastructure was established in 1990, in response to the Government’s desire for rationalisation of the prevailing system (involving 24 Acclimatisation Societies and two DOC regions (McDowall 1994). The reforms, invoked via the 1990 Conservation Law Reform Act, led to amalgamation of several smaller Society regions (thereby resolving several long-standing boundary issues), and provided a more formal statutory basis for management of the fish and game resource.

All persons wishing to fish for acclimatised species must purchase a freshwater fishing licence at least annually. After several decades of steady increase from about 1950, licence sales have remained relatively constant over the last two decades, annual sales currently totalling around 190 000 of which c. 120 000 are the responsibility of FGNZ. The main trends over this period have been a decrease in sales to “juniors” (normally under the age of 17), and an increase in the number of short-season (daily or weekly) licences (Figure 1-2). In response to concerns over the declining sales to juniors, who are generally seen as representing the next generation of adult licence holders, many regions now provide free licences to children under the age of 12. Several factors are thought to have contributed to the increase in short term licence sales. One such factor appears to be an increasing tendency, among New Zealand residents with conflicting demands on a limited amount of leisure time, to prefer the cheaper option of a part-season licence. However, there is also evidence of a growing demand for part-season licences from overseas tourists, who are attracted by the lure of unspoilt natural environments and clear streams full of trophy sized fish, which typically feature in tourist-oriented publicity.

Nation-wide, there are relatively few fisheries where overuse or over-harvesting are seen as serious threats, and Fish & Game management activity tends to be directed more towards protection and preservation of habitat, and promotion of angling “ethics”. However, in some parts of the country, most notably Otago and Nelson, recent increases in usage of back country waters have led to concerns about the long-term sustainability of the angling resource (Hayes et al. 1997; Walrond 1996).

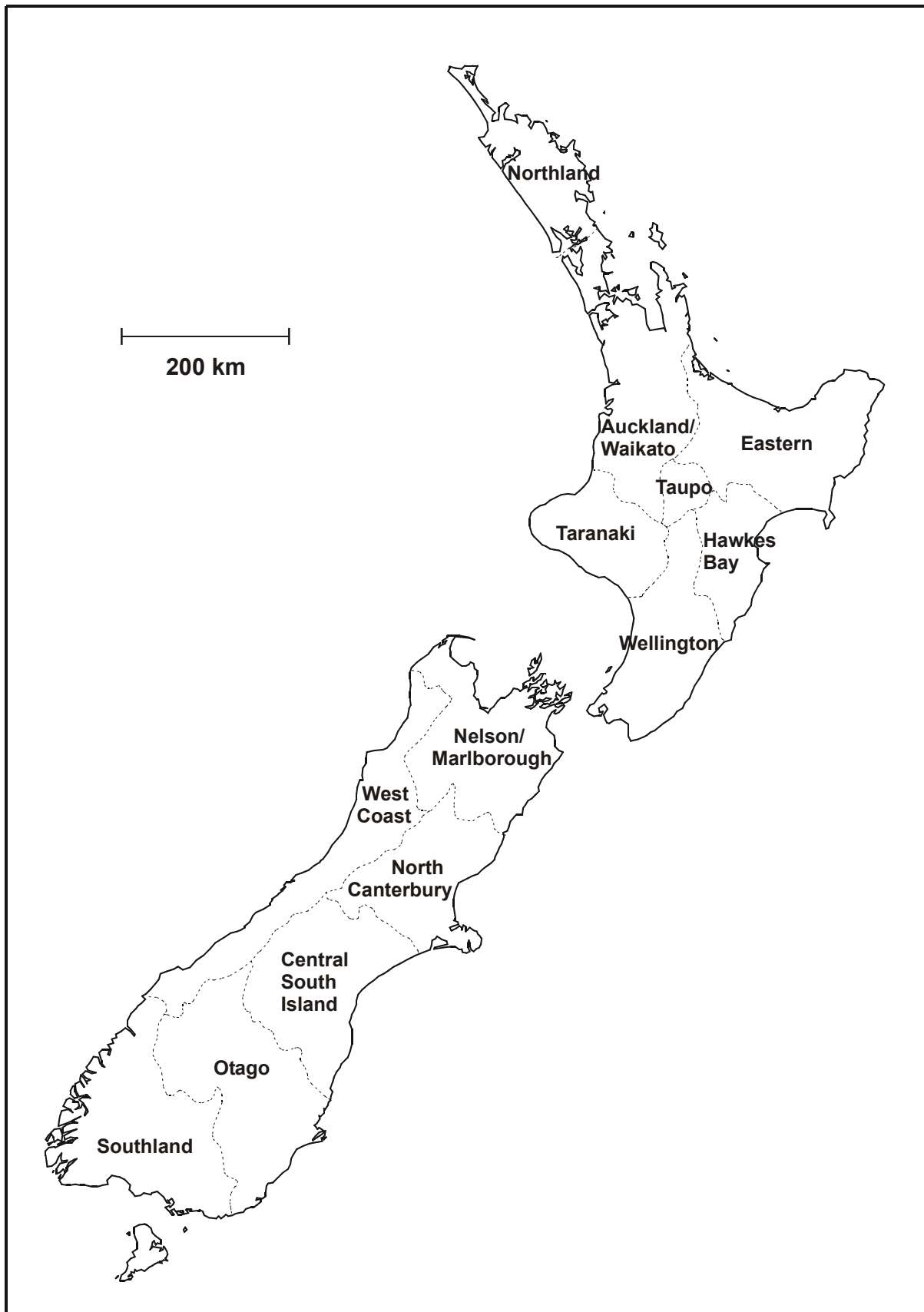


Figure 1-1. The 12 Fish & Game New Zealand regions, and the Taupo Conservancy, as they have existed since 1990.

1.2 Angling statistics

Under the 1990 Act, Fish & Game Councils have a number of clearly-defined functions and responsibilities in relation to the angling resource, including monitoring "... sports fish and game populations..." and the "... success rate and degree of satisfaction of users of the sports fish and game resource...", while also being required to "...maintain and improve the sports fish and game resource". To meet these responsibilities, Councils devote a significant proportion of their resources to monitoring fish stocks, and have also begun to address the complex issue of defining and measuring angler satisfaction levels (Brocklesby et al. 1995).

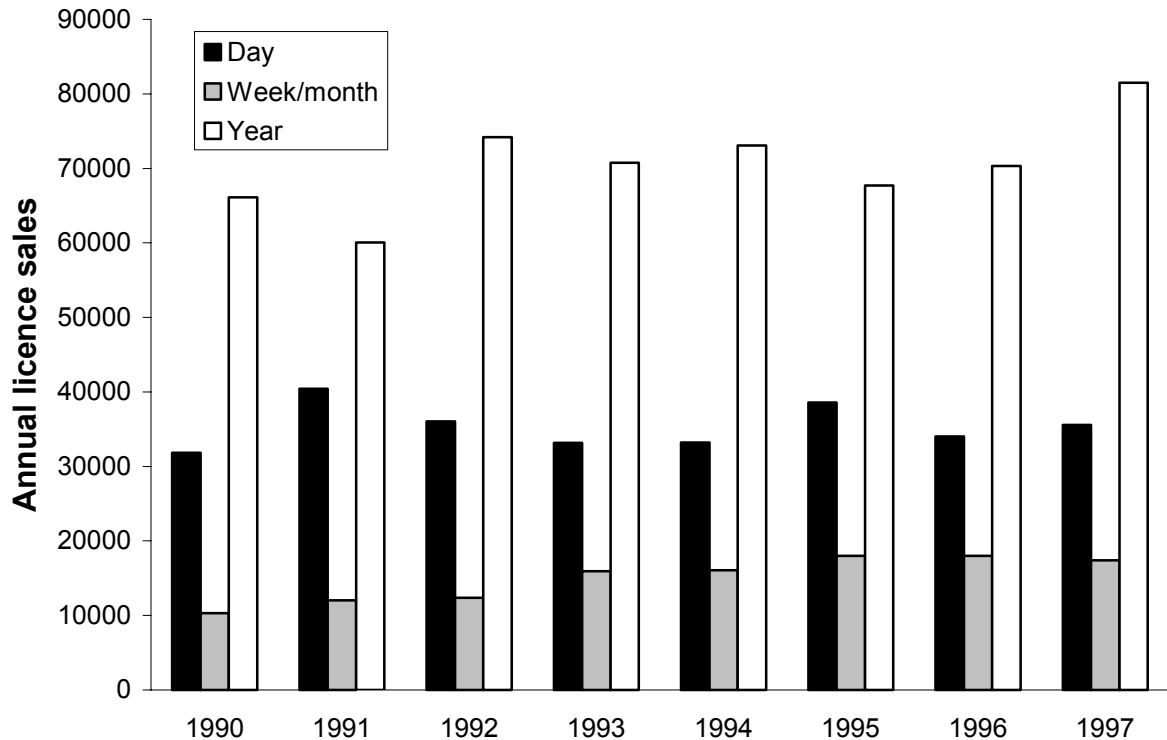


Figure 1-2. Sales of angling licences by Fish & Game Regions, 1990-1997, by year and duration of licence.

Fish & Game Councils also require data on usage of the resource, in terms of numbers of anglers and total angling effort. Although Section 26Q of the Act makes no specific reference to the need to monitor angling usage, it is difficult to see how Fish & Game's statutory functions with regard to "... management, maintenance and enhancement ..." could be implemented without information on resource usage, and most FGNZ managers would argue that collecting information on angler usage of the resource is an implicit requirement of the Act. In addition, up-to-date usage data is invariably a fundamental part of FGNZ's case in numerous day to day situations (such as Regional Council or Planning Tribunal hearings) which arise through application of the Resource Management Act.

Traditionally, fisheries management issues have generally been addressed at local or regional level, and there have been few attempts to collect angling statistics at a national level. In recent years, however, the FGNZ has moved significantly towards establishing a uniform national profile, and has recognised the need for a co-ordinated approach to the collection of usage data. The 1994/96 Angling Survey, the subject of this report, is the first in what is hoped will become an ongoing series of surveys, to be repeated at intervals of approximately

five years, designed to monitor angler usage of the freshwater fisheries resource throughout New Zealand.

1.3 Previous surveys

1.3.1 The New Zealand Angling Diary Scheme

The first attempt to collect angling statistics within a nationally consistent framework was the New Zealand Angling Diary Scheme, which was initiated by the Fisheries Branch of the New Zealand Marine Department in 1947 (Allen and Cunningham 1957) and continued at five year intervals until 1968 (Graynoth 1974). The scheme was intended to obtain information on four main areas of concern: the state of fish stocks, the size and nature of the fishing effort, the size and distribution of the angling catch, and the effect of regulations. In total, 5500 diaries were returned, containing details of 100 000 angling days during which 260 000 fish were caught. The scheme covered both lake and river fisheries, and ultimately provided effort and catch summary statistics for 129 major fisheries throughout New Zealand. Detailed summaries of the results appeared in 14 regional reports published in the Ministry of Agriculture and Fisheries (MAF) Technical Report series. However, although the 1962 and 1967 raw data were originally processed using an early Treasury computer, these records do not survive.

A major problem with the scheme was the low participation rate, which initially (1948-1952) averaged 2.3% of licence holders (Allen and Cunningham 1957). Consequently, the diary results tended to be significantly biased in favour of the more active and highly motivated anglers, and were not necessarily representative of the general angling public. Although considerable care was taken to correct for these biases when analysing the data (Graynoth 1974), participation rates as low as 1% (in some regions) meant that the statistical uncertainties involved were often formidable, with the result that information collected via the scheme tended to be used with a fair degree of caution.

Although the diary scheme served a useful purpose in providing information on the general distribution of angling effort, species caught, and catch rate, it did not provide accurate enough figures to allow changes in these statistics to be measured with any degree of confidence, and was discontinued after 1968. In discussing prospects for future studies, Graynoth (1974) pointed to the need for local fisheries managers to take responsibility for monitoring the fishery, the possibility of using postal sample surveys to measure general trends in effort and catch, and correctly predicted that newer techniques (such as drift diving) were likely to be more suitable for quantitative assessment of fish stocks. Graynoth also commented on the need to differentiate between information required for “political” rather than scientific purposes, pointing out that the latter demanded a higher degree of precision.

1.3.2 The 1979/81 National Angling Survey

The 1979/81 National Angling Survey was conducted by the Fisheries Research Division of the Ministry of Agriculture and Fisheries, in association with the Acclimatisation Societies and the Department of Internal Affairs (Teirney et al. 1982). The primary motivation for this survey was political, being prompted by the need for information on freshwater fisheries in response to a call for public submissions on a wild and scenic rivers discussion paper put forward by the Commission for the Environment in January 1978. This paper recognised that, after years of development for hydroelectricity and irrigation, there was considerable public support for legislation to restrict further cumulative losses of free flowing rivers. This activity culminated in the 1981 Amendment to the Water and Soil Conservation Act (often referred to

informally as the “Wild and Scenic Rivers Act”), which set up a formal statutory framework for protecting rivers deemed to have “outstanding” natural values, and a draft national inventory of wild and scenic rivers compiled by the National Water and Soil Conservation Organisation and released in August 1982 (Anon. 1982).

A key feature of the 1981 Amendment was its emphasis on rivers (i.e. flowing water bodies) rather than lakes, wetlands, and lagoons, reflecting a belief that still water bodies were in less need of urgent protection. The 1979/81 angling survey therefore focused solely on river fisheries, with the objective of assessing the relative importance of New Zealand rivers and streams to recreational anglers. Sub-objectives included identifying highly valued rivers for which strategies such as fixing minimum acceptable flows could be tested; identifying rivers (or sections of rivers) in need of protection; and gathering information for use in hearings and appeals involving water rights or other development proposals. To meet these objectives, the survey broke new ground by collecting data on qualitative aspects of each fishery (on a 1-5 scale), such as the overall “importance” of the fishery, ease of access, scenic and wilderness qualities, and area of fishable water, as well as more conventional statistics such as angling effort. Apart from a question seeking general information on catch rate and size of fish (also on a 1-5 scale), the survey made no attempt to gather quantitative catch data specific to each river.

The survey was implemented on a region by region basis, via a questionnaire booklet (listing all significant river fisheries) posted to a random sample of adult whole-season licence holders. A total of 4700 completed questionnaires were received (out of 10 900 originally posted out), representing a response rate of 43% and providing 20 800 individual assessments of over 800 river fisheries. The survey results were published by MAF, in a series of 16 New Zealand Freshwater Fisheries Reports, which appeared from 1982 to 1987, and in a detailed summary report identifying 25 “nationally important” rivers as potential candidates for protection under the 1981 Amendment (Teirney et al. 1982). Currently, all the raw data are archived in a Microsoft Access database held at NIWA’s Christchurch office.

The survey was successful in meeting most of its objectives, ultimately providing a valuable source of comparative data which has continued to form an essential part of FGNZ’s case at venues such as Planning Tribunal Hearings, most recently in 1995. With hindsight, perhaps the most valuable outcome of the survey was the general acceptance, by planners and resource managers, that fishery values involved attributes other than direct measures of angling success such as catch rate or total number of fish caught. In addition, the survey data have proved valuable for a number of studies unrelated to its original aims, such as compiling a list of rivers supporting “headwater” trout fisheries (Jellyman and Graynoth 1994). However, broader application of the survey results was limited by a number of inherent weaknesses, including vague or ambiguous wording of the original questionnaire, the absence of reliable usage estimates, and the exclusion of lake fisheries and part-season licence holders. Moreover, the results - which are now over 15 years old - have become increasingly out of date.

1.4 The 1994/96 National Angling Survey

The 1994/96 National Angling Survey was motivated by the need for up to date information on usage of the angling resource, and by an increasing desire within FG NZ to manage the fishery as a national resource. There was also an urgent need for quantitative information on angler usage of lake fisheries, many of which (including virtually all South Island lakes) had never been included in any previous surveys, and for data on the fishing activity of short-season licence holders.

After discussions with representatives from several Fish & Game regions, which culminated in a pilot survey in the Wellington Region for the 1993/94 angling season, the present survey was initiated in October 1994. Although this was often referred to informally as an “update” of the 1979/81 survey, the methods and emphasis of the new survey were quite different from those of its predecessor, and at no stage was there any real intention to simply repeat the 1979/81 survey. This was partly due to a desire to redress some of the design flaws of the earlier survey, but also reflected our belief that for many rivers, attributes canvassed in the 1979/81 survey were unlikely to have changed significantly even after 15 years. For example, a river fishery regarded as remote and highly scenic in 1980 would almost certainly retain those attributes today, even though usage levels and possibly catch rates might be quite different.

The 1994/96 survey had one primary objective: to obtain consistent estimates of angler usage for all New Zealand lake and river fisheries. This narrow focus was adopted in the belief that angler usage is one of the most fundamental parameters needed to characterise a particular fishery, as well as being relatively easy to define and measure. We were also motivated by a desire for the new survey to do one job well, rather than attempt to pursue a range of additional objectives which would risk introducing design compromises. In particular, the survey made no attempt to collect any information related to catch rate or size of fish, as we believe that this type of information needs to be collected by on-site methods, such as creel surveys, specifically targeting the waters of interest. By establishing baseline information on usage of the resource, and repeating this survey at regular (say five-yearly) intervals, we hope that these results will help fisheries managers to prioritise management issues, identify spatial and temporal trends in usage levels, and - ultimately - develop a database suitable for storing and retrieving all quantitative data related to the freshwater angling resource.

2. Methods

2.1 Overview

The 1994/96 survey was implemented on a region by region basis, as a series of telephone sample surveys of fishing licence holders (stratified by licence type) during either the 1994/95 or 1995/96 angling seasons. Each survey covered a period of two months, beginning with the first two months of the angling season (October and November), and was conducted as soon as possible after complete licence records for the survey period had been compiled. This strategy was adopted primarily as a way of minimising recall bias, after a pilot survey in the Wellington region (and the Wellington Region’s experience with their own gamebird surveys) indicated that anglers ability to accurately recall their fishing activity over a period of time began to decline markedly after 2-3 months. Licence holders selected for each survey were contacted by telephone, and asked to identify any lakes and rivers they had fished over the specified survey period, and the number of days spent on each water. Results for each stratum (i.e. for each region, licence sub-stratum, and time period) were compiled into a

single database, from which summary information could be extracted according to criteria such as region, water type, and catchment.

A key feature of the survey was that, when responding to each telephone interview, anglers were neither asked nor expected to be aware of the boundaries between different Fish & Game regions. By adopting this strategy, we hoped to avoid some of the problems associated with the 1979/81 survey (in which respondents were presented with a list of rivers within their “home” region, but had to rely on memory for rivers in other areas), and hence obtain more reliable data on the extent and nature of cross-boundary fishing.

2.2 Sampling design

As originally envisaged, the sampling design allowed for a separate stratum for each licence class within each region and survey period. Had this design been rigidly adhered to, a total of well over 300 strata would have been required. However, it quickly became apparent that this was impractical, because of the very large number of small strata which would have resulted (including some with licence sales in single figures). Consequently, part-season licences were often grouped together and treated as a single stratum. Similarly, young adult and junior licences were often combined. However, whenever possible, we retained adult and junior whole season licences as a separate stratum, so that for the purposes of analysis we could distinguish between three groups of anglers, comprising adult whole season, junior whole season, and part season licence holders. The main exception was the Eastern Region, where - because of the large number of short season licences sold - part-season licence holders were further subdivided into adult weekly, adult daily, and junior daily categories.

In choosing appropriate sample sizes for each stratum we were constrained by a lack of advance information as to licence sales within each survey period, making some degree of judgement necessary. As a general guideline, we aimed for a sample size of 350 for strata exceeding total sales of a few thousand, reducing to a minimum of 50 for the smaller strata (or combinations of strata). In addition, the resources available to implement the survey varied somewhat between regions, so that the number of telephone calls actually completed sometimes fell short of the desired number. Mean sample size for all strata was 98 (9.0% of the available licences), and ranged from 34 (15.2% of licences) for strata in which total sales were less than 500 to 187 (4.0% of licences) for strata in which total sales exceeded 2000. A full summary of responses by region, survey period, and licence type is given in Appendix 1.

All Fish & Game regions except Northland were included in the sampling programme¹. However, in the event (partly as a result of staff changes), the full series of six bimonthly surveys was completed in only nine of the 11 regions involved. The two exceptions were the West Coast region (three out of six surveys, covering the first six months of the angling season), and Hawkes Bay (where only the first survey was completed). For these two regions, we developed a modified estimation procedure, based on analysis of seasonal variation in usage for waters in neighbouring regions, to adjust for the missing data. In Southland, the fifth survey period (June-July) was omitted, but the final survey was extended to cover the four months from June to September. The full survey included a total of 169 separate strata. In the Eastern and Otago regions the survey was implemented over the 1995/96 angling season, while in all other regions the survey covered the 1994/95 season.

¹ Northland was excluded because of the small number of fishing licences (c. 200 whole-season and 400 part-season) sold annually. However, while this approach may be justified from a national perspective, on the grounds that angling in Northland makes a negligible contribution to the total effort, comparative angling usage data are also needed at the local and regional level. For this reason, it is essential that Northland is included in any future national surveys.

2.3 Field procedures

For each survey, regional Fish & Game staff began by extracting a random sub-sample of licence holders from the most up to date listing available. For whole-season licences, all anglers purchasing a licence prior to the end of the relevant two-monthly survey period were included in the sampling frame, so that the population size for each survey reflected cumulative licence sales over the season to date. For part-season licences, only those licences purchased during the survey period were included, so that population size varied considerably between survey periods. Short season or winter licences, typically valid for four to six months, were handled in the same way as whole-season licences.

Procedures for conducting telephone calls to selected licence holders varied slightly from region to region but generally involved casual workers (such as senior high school students), each of whom was assigned a list of names and telephone numbers. For seven regions (Auckland/Waikato, Eastern, Taranaki, Wellington, Nelson/Marlborough, West Coast, North Canterbury) we used these records to compile totals of local (within-region), other New Zealand resident (out-of-region) and overseas licence holders (Table 2-1). Most whole season licences (c. 90%) were brought by local anglers, with most of the remaining 10% brought by other New Zealand residents; very few (c. 0.5%) were brought by overseas anglers. Part-season licences were more evenly divided between local anglers (43% - 61%) and other New Zealand residents (31% - 48%), with around 8% of adult daily and weekly licences sold to overseas anglers. The absence of figures for Taupo and Otago (in Table 2-1) is likely to underestimate the proportion of overseas anglers, but the data suggest that, even if complete figures were available, relatively few whole season licences are sold to overseas anglers. This issue is considered further in Section 4.1.1.1.

Up to three attempts were made to contact each individual, after which the number was discarded and replaced with another name selected at random from the master list. Out-of-region addresses (i.e. those which required a toll call) were treated as for local addresses, but no attempt was made to contact anglers giving an overseas address. Not all regions provided full records of the number of successful calls in relation to the number of calls attempted, but for those who did the average success rate was 64%.

Table 2-1. Analysis of licence sales to local anglers (i.e. those resident within the region of sale), other NZ residents, and overseas visitors, based on data for six Fish & Game regions participating in the 1994/96 survey.

	Local NZ		Other NZ		Overseas		Total
	N	%	N	%	N	%	N
Adult whole season	8587	90.5	858	9.0	44	0.5	9489
Junior whole season	1991	88.3	260	11.5	5	0.2	2256
Adult weekly	431	43.5	476	48.0	84	8.5	991
Adult daily	735	61.4	372	31.1	90	7.5	1197
Junior daily	246	53.2	201	43.5	15	3.2	462

For each successful interview, anglers were simply asked to identify which lakes and rivers they had fished over the relevant two-monthly survey period. If they had not fished at all during this period no further questions were asked; otherwise they were asked to specify the number of days on which they had fished each water. To facilitate consistent recording and coding of the data, an interim list of all angling waters in New Zealand (largely based on the 1979/81 survey, was compiled and distributed to all regions at the start of the survey. This list provided a standard 5-digit identification number for each water, and was updated at intervals as the survey proceeded, and new lakes and rivers had to be added to the survey database. The list was also important for resolving possible errors resulting from duplicate river names (the final list contained 13 duplicates and three triples), and for locating rivers out of the respondent's (and interviewers) home region. In either case, interviewers were able to prompt for further information, such as the general location of the water in question, to help resolve any remaining ambiguity.

2.4 Data compilation

Responses to the survey were stored using commercial relational database software running on IBM compatible PCs at NIWA's Christchurch laboratory. From 1994 to mid 1996 we used Paradox 5.0, with data entry accomplished via a purpose built front end written in DELPHI. After completion of the last two-monthly surveys in late 1996, the database was transferred to Microsoft Access 7.0 running under Windows 95. Most of the subsequent analysis was accomplished via Microsoft Excel 7.0, generally using Access to retrieve structured blocks of data, and Excel's Pivot Table facility to explore the resulting data sets and generate appropriate summary tables.

In its final form, the Access version of the database comprised four primary tables, and approximately ten auxiliary tables providing lookup or additional information. The four base tables (Figure 2-1) held data specific to, respectively, each survey sample, such as the Fish & Game region, period, and licence type from which the sample was drawn, and the total number of licences sold (Table "Sample details"); each individual respondent, together with their licence number and an indication as to whether or not they had fished during the survey period in question (Table "Responses"); each respondent who had fished, identifying which waters they had fished and how many days they had spent on each water (Table "Fishing details"); and a lookup table giving the full name of each angling water along with other relevant data such as catchment number (Anon. 1956) and NZMS260 grid reference (Table

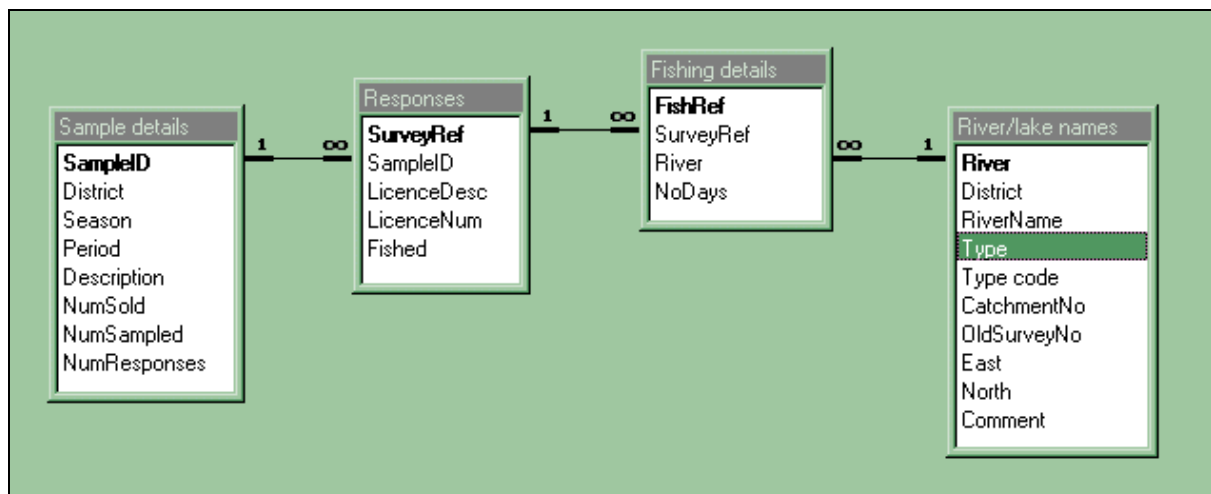


Figure 2-1 Variables and relationships for primary data tables in the 1994/96 Angler Survey database.

“River/lake names”). Each table included a primary key providing a unique identifier for each data record and facilitating linkages between related tables.

To derive usage estimates for each sample stratum, we assumed that the licence holders contacted by telephone represented a simple random sample of all licence holders in that stratum. Essentially, this is equivalent to the assumption that those individuals who could not be contacted by telephone (36% of the original sample, on average) had the same fishing characteristics as those who were contacted. We then summed the number of angling days for all angling waters fished by at least one respondent, and divided this total by the sampling fraction (i.e. the ratio of total responses to total licence sales) to yield an estimate of total usage (± 1 standard error). Since respondents sometimes fished waters outside the region in which they purchased their licence, this step potentially included figures for lakes and rivers anywhere in New Zealand. Finally, these estimates were summed over all strata to yield estimates for all waters in New Zealand, taking into account the contribution from local and non-local anglers². We estimated standard errors for each stratum by calculating the variance of the number of days fished per respondent, and deriving symmetrical confidence intervals (for the mean number of days per respondent) based on the normal distribution. For waters fished by only a few anglers (less than 5-10), these confidence intervals are likely to be only a rough approximation but become more reliable as the number of respondents fishing each water increases. A further discussion of the statistical errors involved in the survey is given in Section 4.1.2.

For summarising and reporting purposes, we merged these estimates with information on each angling water (such as catchment number and water type) to provide additional opportunities for cross-tabulation. Lake and river fisheries were classified separately, and were also broken down into one of nine generic sub-categories to allow for a finer level of

Table 2-2. Variables available for generating data summaries.

Variable type	Variable	Description
River variables		5-digit code, used to uniquely identify each river or lake
	River District	2-digit code used to identify Fish & Game region in which river/lake is located
	River Name	River/lake name. Lake names are stored as “Taupo Lake” rather than “Lake Taupo” to facilitate alphabetic sorting.
	Class	Lake or river
	Water Type	Type of water (e.g. headwater fishery, hydro lake etc.), to allow for further subdivision of lakes and rivers
	Catchment No	Catchment number as per “Catchments of New Zealand”
	Catchment	Catchment (leading 3 digits of catchment number)
Survey variables	Survey District	2-digit code used to identify Fish & Game region in which survey was implemented
	Period	Two monthly period (e.g. Oct-Nov) covered by survey
	Licence Type	Licence type(s) included in this survey
	N Sold	Number of licences sold (or active) during survey period.
	N Reply	Number of replies (i.e. number of anglers contacted)
	N Anglers	Number of respondents who fished this lake/river
	Total Days	Total number of days fished by respondents

² At the time of the survey, fishing licences for the Eastern Fish & Game Region and the Taupo Conservancy were not interchangeable with other regions. Consequently, anglers wishing to fish either region required a local licence. We therefore ignored Eastern and Taupo usage data provided by non-local anglers, on the grounds that complete usage estimates for these two regions were derivable solely from local licence sales.

tabulation. Lake fisheries were divided into large natural lakes (those exceeding 5 km² in surface area), according to Jolly and Brown (1974); small natural lakes (less than 5 km²); hydro lakes; and lakes formed by irrigation or water supply dams. We classified river fisheries as mainstem fisheries (e.g. Manawatu, Motueka, Mataura); lowland fisheries (e.g. smaller coastal streams or mainstem tributaries wholly or partly flowing through areas of intensive land use, such as the Waihou, Ashley, and Pomahaka); back country fisheries (upland tributaries characterised by extensive rather than intensive land use, e.g. the Maruia, Ahururi, and Manuherikia); headwater fisheries (often remote rivers with limited access, such as the Karamea, Dingle, and Clinton); and artificial waters such as drains and hydro canals. While these distinctions (particularly between lowland, back country, and headwater fisheries) were often partly subjective, and did not allow for the fact that many rivers change in character over their length (see Section 4.3), we believe that they serve a useful purpose by helping to quantify the distribution of angling effort by fishery type and region. The full set of parameters available for cross-tabulations is summarised in Table 2-2.

2.5 Integration of Taupo data

Estimates of annual usage for waters in the Taupo Conservancy (i.e. the Waikato River catchment above Lake Taupo) were obtained from DOC in Turangi³. These estimates were based on direct aerial counts of anglers over a 12 month period, stratified by time of day and day of the week (taking into account statutory holidays). These counts included Lake Taupo and five eastern tributaries, plus the Tongariro River, which collectively account for 87.9% of angling within the Taupo Conservancy (Shaw et al. 1985). These data provided usage estimates for the same two-monthly periods covered by the Fish & Game survey, but did not identify anglers by licence type or origin. Consequently, we used these figures only when comparing seasonal totals across waters, catchments, or regions. When estimating usage totals for each region, we scaled the Taupo data on the assumption that the figure of 87.9% still applied.

For the purposes of this report, we have also assumed that despite the different methodologies used for the Taupo and FGNZ surveys, usage estimates (when expressed in the “common language” of total angler-days) are directly comparable. However, this assumption is not necessarily valid; as discussed later in this report (see Section 4.1.3), there is some evidence of significant discrepancies between the two sets of results.

3. Results

3.1 Replies

A total of 16 595 interviews were conducted over the course of the survey. Ignoring the fact that a few whole-season licence holders may have been contacted more than once, this represents approximately 13% of Fish & Game fishing licence holders.

Of these respondents, 6967 (42%) had not fished during the relevant two month period, and a further 5946 (36%) had fished only one lake or river. By contrast, 185 anglers (1.1%) had fished more than five waters. Of those who had fished at least once, 8294 (50%) had fished on less than ten days, while 140 (0.9%) had fished on more than 30 days. These included 11 individuals who had fished on more than 60 days over a two month period. Detailed examination of the replies for each of these respondents suggested that their data were in fact

³ At the time of writing, an up to date report on the Taupo results is still in preparation, pending completion of surveys for the current angling season. We thank Glen Maclean and Shirley Oates (DOC, Turangi) and Rob Pitkethley (Eastern F&G) for making preliminary summaries of the results available.

legitimate: because respondents were asked to specify the “number of days on which they had fished” each water, an angler fishing two waters on the same day would be recorded as spending one angler-day on each water. In all such cases (which, with one exception, involved anglers from the Eastern, Otago, or Southland Acclimatisation Regions), the individuals concerned had intensively fished at least two waters in close proximity (e.g. the Oreti and Makarewa Rivers, Lake Hawea and the Hawea River, or Lake Rotorua and Ngongotaha Stream), and their replies were left to stand.

In total, the respondents accounted for over 55 000 angler days on 734 waters, comprising 566 rivers and 168 lakes. Roughly 1% of this total (542 days) was expended on waters which we could not identify from the name recorded by the interviewer. In some cases (211 days) the water involved was clearly in the angler’s home region, but for more than half the cases (331 days) we were unable to make any inference about angling location and simply recorded both the water and region as “unidentified”.

3.2 Usage estimates

Total annual angling effort, for all waters in New Zealand, was 1.34 million angler days, with a standard error of approximately 17 500 angler-days (Table 3-1). Just over half (54%) of this effort was recorded over the four “summer” months (December to March), compared to only 14% (193 000 days) over the last four months of the angling season (June - September). By region of purchase (which is not necessarily the same as region of residence), anglers from the Eastern Region accounted for the largest proportion of the total (252 000 angler days, or 19%), followed by North Canterbury, Otago, Taupo, and Southland, each of which contributed between 12.8% and 13.5% of the total.

Table 3-1 includes estimates for the missing Hawkes Bay and West Coast data, based on comparisons with a representative group of waters from nearby regions for which complete data were available, on the assumption that seasonal variation in usage was likely to be similar for fisheries of similar type and geographical location. For each region, we derived a linear regression equation relating usage over the missing months (December to September for Hawkes Bay, and April to September for the West Coast) to usage over the months actually surveyed (Figure 3-1). To avoid the possibility of generating negative estimates for waters with very low usage, these regressions were constrained to pass through the origin. We then used the resulting equations to estimate usage over the unsurveyed months (Y) from known usage over the period(s) actually surveyed (X). For the West Coast, the correction represented approximately 26% of the total annual usage, and our estimates are likely to be fairly robust. For Hawkes Bay, the available data (for October and November only) represented less than 19% of the annual total, so that our estimates represent a considerable level of extrapolation. In addition, no estimate is possible for any Hawkes Bay waters which were not fished in October or November, even though some of these waters would almost certainly have been fished later in the season. For these reasons, our estimates should be regarded as a reasonable gauge of annual effort on the more heavily used Hawkes Bay fisheries (e.g. Mohaka, Tukituki, and Ngaruroro), but only an “order of magnitude” assessment for the smaller waters.

Table 3-1. Total angling effort by region of licence purchase and survey period. Standard errors are shown in italics.

Region of origin	Oct- Nov	Dec- Jan	Feb- Mar	April- May	June- July	Aug- Sept	Total
Auckland/Waikato	6038	13747	12514	6203	4299	5044	47845
	<i>586</i>	<i>1137</i>	<i>1218</i>	<i>756</i>	<i>441</i>	<i>735</i>	<i>2104</i>
Eastern	43876	65373	50513	48041	30316	13561	251680
	<i>2820</i>	<i>4536</i>	<i>4891</i>	<i>4310</i>	<i>3171</i>	<i>2268</i>	<i>9286</i>
Taupo	26469	41016	16393	42261	26083	25539	177761
Taranaki	3304	3806	2645	1028	333	594	11710
	<i>326</i>	<i>379</i>	<i>264</i>	<i>155</i>	<i>76</i>	<i>91</i>	<i>598</i>
Hawkes Bay	6494	28542 †					35036
	<i>480</i>						<i>480</i>
Wellington	12032	24100	18290	7368	4884	4879	71552
	<i>1330</i>	<i>1961</i>	<i>1732</i>	<i>900</i>	<i>797</i>	<i>659</i>	<i>3239</i>
Nelson/Marlborough	11704	12191	8767	6876	3590	3338	46466
	<i>834</i>	<i>1305</i>	<i>1266</i>	<i>650</i>	<i>519</i>	<i>428</i>	<i>2208</i>
West Coast	2611	6395	4590	3980 ‡			17577
	<i>262</i>	<i>396</i>	<i>641</i>				<i>797</i>
North Canterbury	35284	66319	67812	16192	5122	2476	193205
	<i>2186</i>	<i>6616</i>	<i>6458</i>	<i>2755</i>	<i>1740</i>	<i>664</i>	<i>10066</i>
Central South Island	17765	46301	46152	20581	3358	4993	139150
	<i>1285</i>	<i>2490</i>	<i>3116</i>	<i>1988</i>	<i>610</i>	<i>839</i>	<i>4753</i>
Otago	34391	55320	42002	14273	14441	19333	179761
	<i>2223</i>	<i>2995</i>	<i>3278</i>	<i>2122</i>	<i>1982</i>	<i>3543</i>	<i>6756</i>
Southland	31323	44619	44342	30648	20757 §		171690
	<i>1959</i>	<i>2600</i>	<i>2197</i>	<i>2016</i>	<i>2735</i>		<i>5194</i>
Total	231292	407729	314021	197451	92425	100514	1343432
	<i>5136</i>	<i>9666</i>	<i>9873</i>	<i>6366</i>	<i>4299</i>	<i>5243</i>	<i>17429</i>

† Included in totals for December-January

‡ Included in totals for April-May

§ Included in totals for June-July

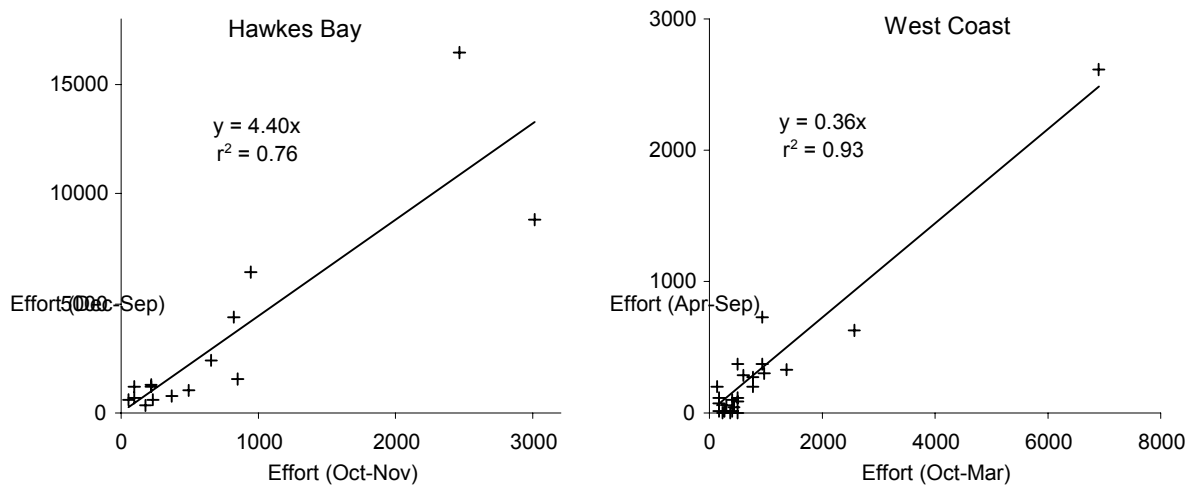


Figure 3-1. Regression relations used to estimate missing data for Hawkes Bay and West Coast.

Unidentified waters accounted for 10184 angler-days, or 0.8% of the national total. For some analyses in the remainder of this report we excluded these data, so that in the following tables total usage may be reported variously as either 1 343 432 angler-days (including all waters) or 1 333 248 days (excluding unidentified waters). A detailed summary of usage data for all 734 waters identified during the 1994/96 survey, by Fish & Game region, is given in Appendix 1.

To estimate the extent of “cross-boundary fishing”, i.e. the amount of effort expended by anglers fishing outside the region in which they had purchased their licence, we cross-tabulated the data of Table 3-1 taking into account both the region of purchase and the region in which angling actually took place (Table 3-2). This approach is the only feasible one with the available data, but tends to underestimate the true level of cross boundary fishing, because (even in regions for which the licence is inter-available) anglers do not necessarily buy their licence in the same region in which they live. In addition, the requirement for anglers fishing in either the Taupo or Eastern regions to purchase a local licence means that the survey results for these two regions do not specifically identify non-local anglers. For the Eastern Region, we estimated the proportion of the angling effort for resident and non-resident anglers using Eastern Region data on licence sales by licence type and region of residence (Table 3-3). These data suggest that non-residents (including overseas anglers) contributed just over 90000 of the estimated total of 251 680 angler-days for the 1995/96 season, or 36% of the total effort. For the Taupo Conservancy, creel survey data suggest that 23.3% of the angling effort comes from local anglers (Rob Pitkethley, pers. comm.).

Table 3-2. Estimated annual effort (angler-days) by angler origin (based on licence region) and the region in which fishing took place (based on responses to the 1994/96 survey). Standard errors are shown in italics.

Origin of anglers	Region in which anglers fished													Total	
	NTH	AKL	Eastern	Taupo	TAR	HBY	WEL	NEL	WCS	NCY	CSI	Otago	STH		Unknown
Auckland/Waikato	376	45540	0	0	106	420	210	268	145	165	74	79	245	216	47845
(AKL)	<i>130</i>	<i>2084</i>			<i>63</i>	<i>114</i>	<i>80</i>	<i>118</i>	<i>57</i>	<i>76</i>	<i>43</i>	<i>47</i>	<i>101</i>	<i>76</i>	<i>2104</i>
Eastern	0	0	251680	0	0	0	0	0	0	0	0	0	0	0	251680
			<i>9286</i>												<i>9286</i>
Taupo	0	0	0	177761	0	0	0	0	0	0	0	0	0	0	177761
				-											-
Taranaki	5	752	0	0	9640	371	634	118	69	7	35	11	0	67	11710
(TAR)	<i>5</i>	<i>110</i>			<i>565</i>	<i>101</i>	<i>104</i>	<i>54</i>	<i>29</i>	<i>6</i>	<i>32</i>	<i>7</i>		<i>31</i>	<i>598</i>
Hawkes Bay	0	0	0	0	0	35030	6	0	0	0	0	0	0	0	35036
(HBY)						<i>480</i>	<i>6</i>								<i>480</i>
Wellington	16	344	0	0	1254	1883	65608	621	85	502	256	302	229	453	71552
(WEL)	<i>15</i>	<i>119</i>			<i>268</i>	<i>350</i>	<i>3188</i>	<i>175</i>	<i>56</i>	<i>180</i>	<i>99</i>	<i>116</i>	<i>102</i>	<i>135</i>	<i>3239</i>
Nelson/Marlborough	0	35	0	0	0	0	8	39729	1873	1034	1816	736	116	1119	46466
(NEL)		<i>34</i>					<i>7</i>	<i>1955</i>	<i>303</i>	<i>245</i>	<i>847</i>	<i>280</i>	<i>47</i>	<i>324</i>	<i>2208</i>
West Coast	0	0	0	0	0	0	12	328	15060	1097	637	252	18	173	17577
(WCS)							<i>11</i>	<i>136</i>	<i>630</i>	<i>399</i>	<i>227</i>	<i>73</i>	<i>18</i>	<i>63</i>	<i>797</i>
North Canterbury	0	0	0	0	30	179	1331	4730	7528	155256	15840	4888	1640	1783	193205
(NCY)					<i>29</i>	<i>125</i>	<i>483</i>	<i>983</i>	<i>1291</i>	<i>9615</i>	<i>1959</i>	<i>1240</i>	<i>510</i>	<i>590</i>	<i>10066</i>
Central South Island	0	0	0	0	0	0	0	17	313	7417	127569	2998	806	30	139150
(CSI)								<i>17</i>	<i>124</i>	<i>1285</i>	<i>4543</i>	<i>451</i>	<i>280</i>	<i>28</i>	<i>4753</i>
Otago	0	307	0	0	369	37	333	412	1484	1174	16062	148472	10812	299	179761
		<i>175</i>			<i>255</i>	<i>36</i>	<i>188</i>	<i>135</i>	<i>472</i>	<i>398</i>	<i>2453</i>	<i>6050</i>	<i>1563</i>	<i>210</i>	<i>6756</i>
Southland	0	53	0	0	0	0	0	88	370	567	3998	25707	139515	1392	171690
(STH)		<i>49</i>						<i>60</i>	<i>127</i>	<i>255</i>	<i>758</i>	<i>1858</i>	<i>4772</i>	<i>288</i>	<i>5194</i>
Total	398	47030	251680	177761	11398	37920	68142	46312	26928	167220	166287	183446	153381	5532	1343432
	<i>131</i>	<i>2099</i>	<i>9286</i>	<i>0</i>	<i>679</i>	<i>627</i>	<i>3233</i>	<i>2208</i>	<i>1554</i>	<i>9726</i>	<i>5643</i>	<i>6473</i>	<i>5058</i>	<i>781</i>	<i>17429</i>

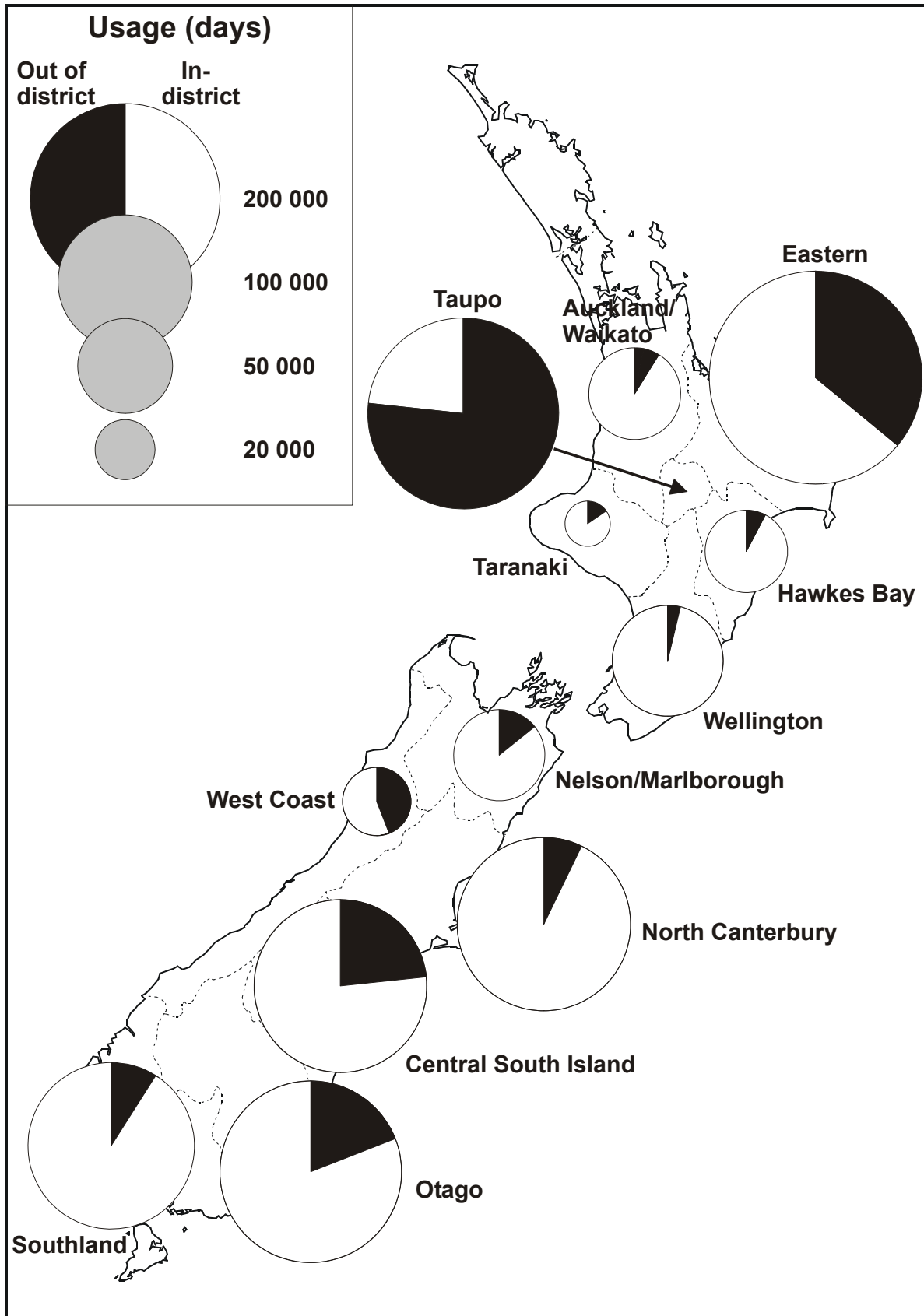


Figure 3-2 Estimated annual angling usage by region for local (in-region) and visiting (out-of-region) licence holders. At the time of writing, no data on visiting anglers were available for the Taupo conservancy.

Table 3-3. Estimated angling effort within Eastern Fish & Game Region by licence type and area of residence (local or non-local), based on 1995/96 licence sales (Rob Pitkethley, pers. comm). Within each licence class, the estimated angling effort from the 1994/96 survey has been apportioned according to the percentage of licences (in parentheses) purchased by local, other New Zealand, and overseas anglers.

Licence Type	Licence sales				Estimated angling effort			
	Total	Local NZ	Other NZ	Overseas	Total	Local NZ	Other NZ	Overseas
Adult year	9 123	6 505 (71.3%)	2 577 (28.2%)	41 (0.4%)	170 200	121 358	48 077	765
Junior year	4 829	3 511 (72.7%)	1 286 (26.6%)	32 (0.7%)	39 491	28 713	10 517	262
Adult week	8 138	1 897 (23.3%)	5 322 (65.4%)	919 (11.3%)	26 489	6 175	17 323	2 991
Adult day	12 437	3 729 (30.0%)	5 697 (45.8%)	3011 (24.2%)	12 725	3 815	5 829	3 081
Junior day	2 436	928 (38.1%)	1 224 (50.2%)	284 (11.7%)	2 776	1 057	1 395	324
Total	36 963	16 570 (44.8%)	16 106 (43.6%)	4287 (11.6%)	251 680	161 118 (64.0%)	83 140 (33.0%)	7 422 (2.9%)

Subject to these limitations, our results suggest that in most regions cross-boundary fishing made a relatively small contribution to the total angling effort (Figure 3-2). The main exceptions were Otago, Central South Island, and West Coast, where licence holders from other regions contributed 19%, 23%, and 44% of the total effort, respectively. For most regions, the main external contribution was from the neighbouring region (particularly in the lower South Island), declining rapidly as the separation between regions increased. In particular, there was very little evidence of movement between the North and South Islands, less than 0.5% of the annual estimated effort (5906 angler days) involving anglers with a South Island licence fishing in the North Island (or vice versa).

3.2.1 Usage by licence type

Whole-season licence holders (including junior and young adult) accounted for over 90% of the annual angling effort recorded within the 11 Fish & Game regions surveyed (Table 3-4). The Eastern and Otago regions were the most heavily fished by part-season licence holders, these two regions accounting for 72 000 (66%) of the estimated effort by anglers with part-season licences. In all remaining regions, part-season licence holders accounted for at most 9% of the total effort.

Table 3-4. Estimated annual angling effort in angler-days (SE in italics) expended by Fish & Game licence holders, by region of purchase and licence type.

	Type of licence		Total	% of total effort	
	Whole season	Part season		Whole season	Part season
Auckland/Waikato	44878	2967	47845	94%	6%
	<i>2087</i>	<i>264</i>	<i>2104</i>		
Eastern	209691	41989	251680	83%	17%
	<i>9095</i>	<i>1873</i>	<i>9286</i>		
Taranaki	10658	1052	11710	91%	9%
	<i>582</i>	<i>140</i>	<i>598</i>		
Hawkes Bay	32178	2859†	35036	92%	8%
	<i>472</i>	<i>86</i>	<i>480</i>		
Wellington	69931	1621	71552	98%	2%
	<i>3233</i>	<i>193</i>	<i>3239</i>		
Nelson/Marlborough	43018	3448‡	46466	93%	7%
	<i>2165</i>	<i>436</i>	<i>2208</i>		
West Coast	16267	1311	17577	93%	7%
	<i>790</i>	<i>106</i>	<i>797</i>		
North Canterbury	177116	16089	193205	92%	8%
	<i>9929</i>	<i>1652</i>	<i>10066</i>		
Central South Island	133209	5941	139150	96%	4%
	<i>4705</i>	<i>670</i>	<i>4753</i>		
Otago	149296	30464	179761	83%	17%
	<i>6317</i>	<i>2394</i>	<i>6756</i>		
Southland	170239	1451	171690	99%	1%
	<i>5192</i>	<i>135</i>	<i>5194</i>		
Total	1056480	109191	1165671	91%	9%
	<i>17059</i>	<i>3573</i>	<i>17429</i>		

† Includes some junior whole-season licences.

‡ Includes some young adult whole-season licences.

These figures contrast sharply with the distribution of licence sales, part-season licence holders currently representing around 40% of total sales. However, given the restricted number of fishing days available to such anglers, their contribution to the total effort remains small. For example, even assuming that all holders of daily, 48 hour, and 72 hour licences fish for the maximum period allowed by their licence, they account for no more than 35 000 to 40 000 angler-days per annum (based on current sales). This result is significant with regard to the 1979/81 National Angling Survey, in which part-season licence holders were not surveyed. The present results suggest that, while the 1979/81 survey would have significantly underestimated the number of anglers fishing some rivers, it was successful in capturing the views and opinions of the anglers responsible for most of the effort expended on these waters.

Because smaller licence classes were often combined into a single strata, it was not always possible to derive separate estimates for adult and junior (including young adult) licence holders. However, analysis of data for eight of the 11 Fish & Game regions covered by the survey showed that on average junior whole-season licence holders accounted for 11.1% of the total effort, ranging from 6.9% (in Southland) to 15.7% (in Eastern). Very few data were available specifically for junior part-season licence holders, but in the Eastern region these individuals accounted for just 1.1% of the total effort (see Table 3-3).

3.2.2 Types of fishery

Over the whole country, river fisheries (773 473 angler-days) accounted for 58% of the total angling effort, compared to 42% for lake fisheries (559 776 angler-days). However, the relative importance of river and lake fishing varied considerably between regions (Table 3-5; Figure 3-3). The proportion of the total annual effort devoted to lake fisheries ranged from 9% in Hawkes Bay and Wellington, to 79% in the Eastern Region. Three regions - Eastern, Taupo, and Otago - accounted for 76% of the total lake fishing effort. River fishing was more evenly distributed between regions, although was predominantly a South Island activity: 62% of the effort devoted to river fisheries occurred in the four southernmost regions (North Canterbury, Central South Island, Otago, and Southland). Nevertheless, all regions supported significant levels of river fishing: for example, more river fishing occurred in the Wellington Region (62 000 angler-days) than in either Eastern (53 000 angler-days) or Taupo (52 000 angler-days).

Analysis of fisheries by water type, as described in Section 2.4, gives further insights into regional and national trends (Table 3-5; Figure 3-3; Figure 3-4). “Mainstem” river fisheries dominate the east and south of the South Island, particularly in the North Canterbury and Central South Island regions (particularly the four main salmon rivers, the Waimakariri, Rakaia, Rangitata, and Waitaki), and Southland (most notably the Mataura and Oreti). Mainstem fisheries are also important in Wellington (Rangitikei, Manawatu, Hutt, and Ruamahunga), and Nelson/Marlborough (Motueka and Wairau). Subject to our earlier comments regarding the possible overlap between rivers classified as “lowland”, “back country”, and “headwater” fisheries, lowland rivers are important components of the fishery in the east and south of the South Island, Nelson, Bay of Plenty, and Waikato; and headwater and back country fisheries are significant resources in Southland, Otago, West Coast, Nelson, and inland parts of the Hawkes Bay and Eastern regions. The rivers flowing into Lake Taupo (e.g. Tauranga-Taupo, Hinemaiaia) do not fit easily into this classification scheme. In Table 3-5 we have classified these rivers as “back country” rather than “lowland” fisheries, but their high levels of usage (up to 12 000 angler-days) may be more consistent with a “lowland” classification.

Lake fisheries, by contrast, are primarily confined to the central North Island, and along the central axis of the South Island. Large (i.e. > 5 km²) natural lakes (including lakes such as Taupo and Te Anau which are subject to flow control) are the most important type of lake fishery, but in several areas smaller lakes also make a significant contribution to the total effort, particularly when (as in inland Canterbury) several such lakes occur in close proximity. Artificial lakes created by hydroelectric impoundments are also a heavily used resource, particularly in the Waikato, Rangitaiki, Waitaki, and Clutha catchments. Irrigation dams make a significant contribution (8000 angler-days) to the fishery in the Otago region.

Table 3-5. Estimated annual usage (angler-days) by region and water type. Standard errors are shown in italics.

Region	River fisheries					Lake Fisheries				Total
	Mainstem	Lowland	Back country	Headwater	Canal	Large lake	Small lake	Hydro lake	Irrigation	
Northland	0	0	0	0	0	0	336	0	0	336
	-	-	-	-	-	-	<i>125</i>	-	-	<i>125</i>
Auckland/Waikato	9029	19041	0	0	0	0	5726	12929	0	46724
	<i>948</i>	<i>1288</i>	-	-	-	-	<i>607</i>	<i>1213</i>	-	<i>2097</i>
Eastern	0	35313	8965	7750	1072	167953	5458	23909	0	250420
	-	<i>4199</i>	<i>1422</i>	<i>1150</i>	<i>421</i>	<i>7595</i>	<i>1262</i>	<i>2334</i>	-	<i>9267</i>
Taupo	28498	0	23774	0	0	125489	0	0	0	177761
										-
Taranaki	0	4655	3220	138	0	0	1697	1646	0	11356
	-	<i>426</i>	<i>405</i>	<i>91</i>	-	-	<i>217</i>	<i>242</i>	-	<i>678</i>
Hawkes Bay	17794	11452	3760	1483	0	0	3346	0	0	37835
	<i>467</i>	<i>332</i>	<i>166</i>	<i>102</i>	-	-	<i>157</i>	-	-	<i>625</i>
Wellington	45025	13291	3630	0	79	200	5807	0	0	68033
	<i>2695</i>	<i>1216</i>	<i>557</i>	-	<i>76</i>	<i>142</i>	<i>1171</i>	-	-	<i>3232</i>
Nelson/Marlborough	21998	10138	7323	1289	45	3086	674	1713	0	46267
	<i>1690</i>	<i>900</i>	<i>781</i>	<i>220</i>	<i>42</i>	<i>589</i>	<i>361</i>	<i>269</i>	-	<i>2208</i>
West Coast	4636	134	8973	4601	8	6200	1301	0	0	25853
	<i>426</i>	<i>40</i>	<i>816</i>	<i>749</i>	<i>4</i>	<i>741</i>	<i>237</i>	-	-	<i>1420</i>
North Canterbury	111554	30712	2439	454	2277	8214	11183	0	0	166833
	<i>8743</i>	<i>3521</i>	<i>654</i>	<i>274</i>	<i>1178</i>	<i>1362</i>	<i>1394</i>	-	-	<i>9723</i>
Central Island	93085	16400	8626	740	1962	12237	5143	27945	0	166137
	<i>4447</i>	<i>1528</i>	<i>1045</i>	<i>277</i>	<i>675</i>	<i>1350</i>	<i>925</i>	<i>2328</i>	-	<i>5643</i>
Otago	41373	17754	17123	2728	32	66076	3274	26434	8074	182869
	<i>3594</i>	<i>2168</i>	<i>1937</i>	<i>381</i>	<i>31</i>	<i>3941</i>	<i>668</i>	<i>1885</i>	<i>897</i>	<i>6469</i>
Southland	98421	8413	18968	4182	0	21705	2021	0	0	152824
	<i>4417</i>	<i>962</i>	<i>1553</i>	<i>780</i>	-	<i>1661</i>	<i>356</i>	-	-	<i>5052</i>
Total days	470528	167304	106800	23365	5476	411160	45966	94576	8074	1333248
	<i>11801</i>	<i>6498</i>	<i>3389</i>	<i>1690</i>	<i>1425</i>	<i>8976</i>	<i>2641</i>	<i>4003</i>	<i>897</i>	<i>17384</i>

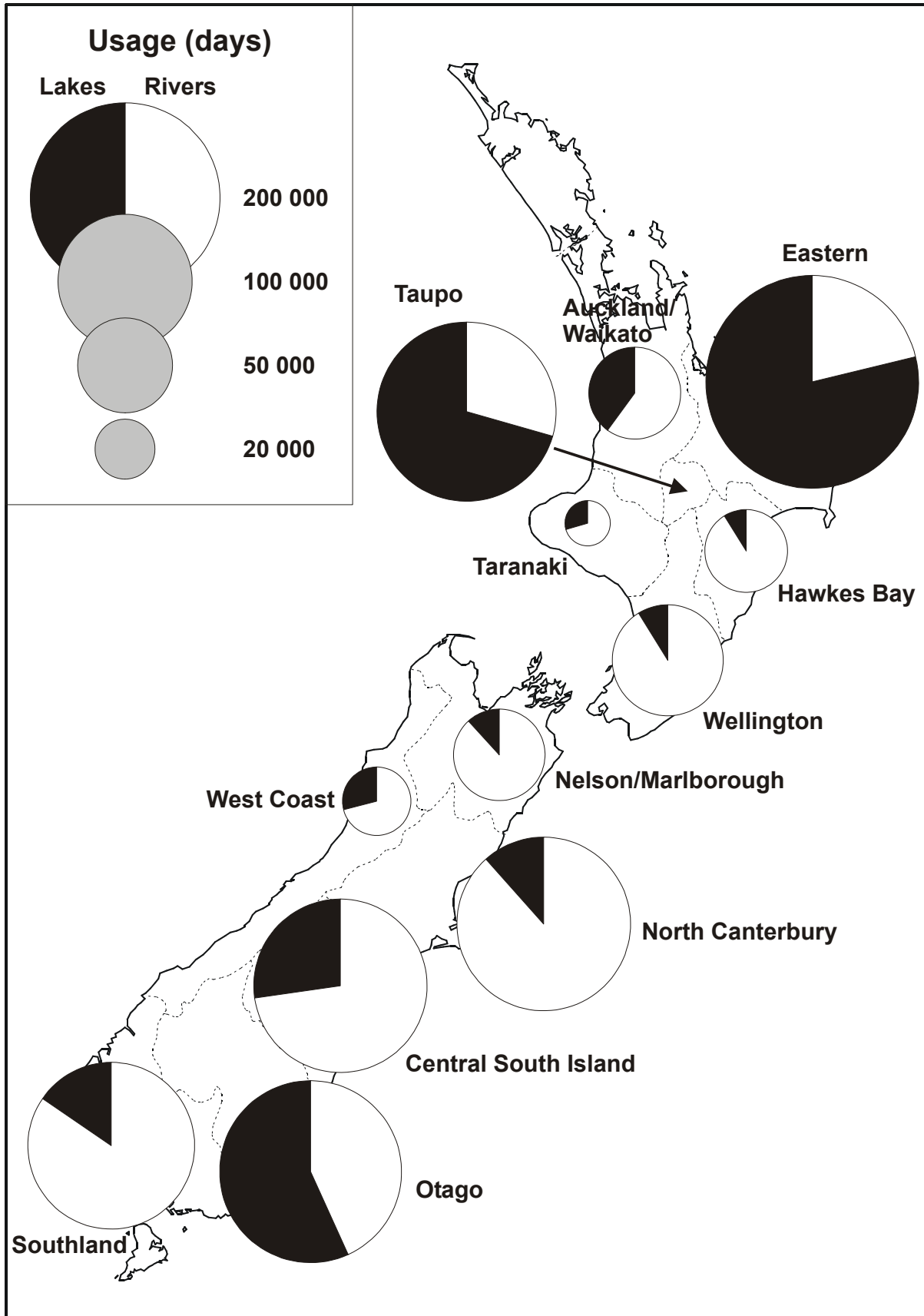


Figure 3-3 Estimated annual usage (angler-days) by region and water type (river vs lake).

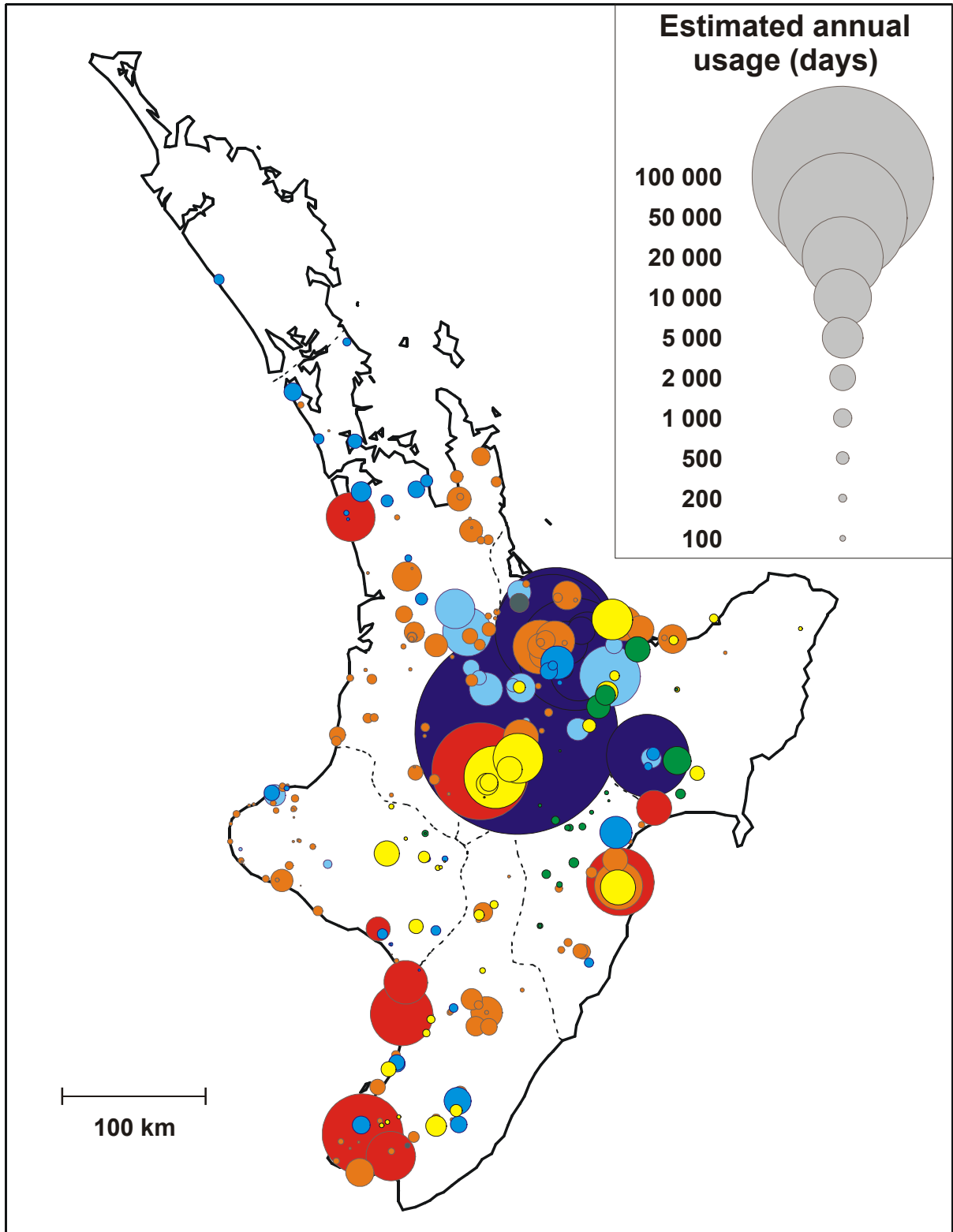


Figure 3-4. Estimated annual usage of North Island lake and river fisheries (see facing page for key). In this and the next figure, the circle representing each angling water is located either at the river mouth or confluence with a larger river (for lake fisheries). This convention has been adopted for consistency between waters, and does not correspond to the distribution of angling effort within each water.

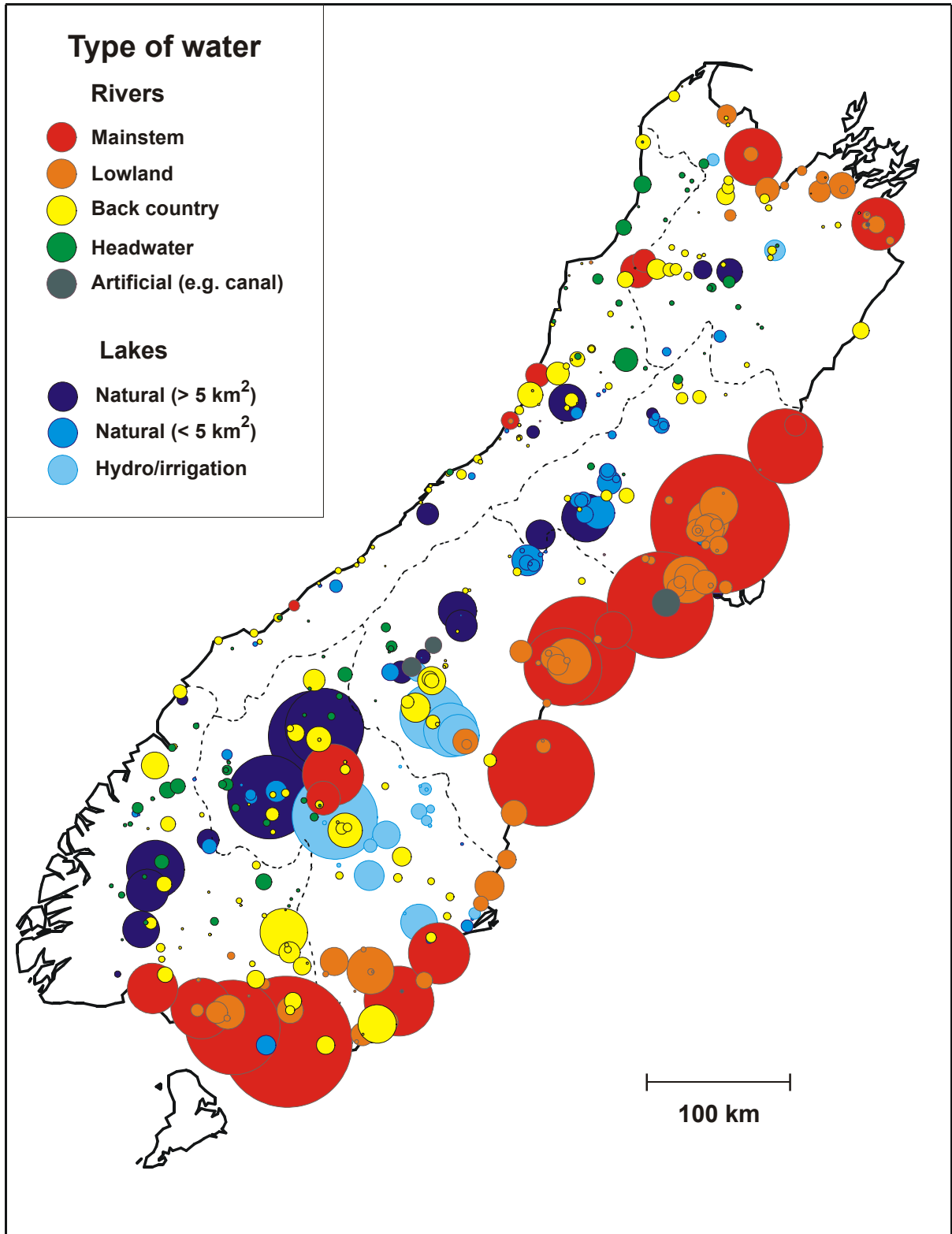


Figure 3-5. Estimated annual usage of South Island lake and river fisheries (see facing page for key).

3.2.3 Usage by catchment

Ignoring unidentified waters, anglers fished in a total of 177 catchments throughout New Zealand, including 75 in the North Island and 102 in the South Island. Annual and bimonthly usage figures for the top 25 catchments (those attracting more than 10 000 visits per year) are summarised in Table 3-6. Collectively, these catchments accounted for 87% of the total angling effort, with just over half the total (52.5%) recorded in the top six catchments (Waikato, Clutha, Kaituna/Rotorua, Waitaki, Waimakariri, and Maitara). Of the more heavily used catchments, the Clutha supported the largest number of individual fisheries (64), followed by the Waikato (41), the Waitaki (36), and the Waiau/Te Anau (32). Other catchments supporting large numbers (more than 15) of significant tributary fisheries were the Buller, Grey, Taieri, Maitara, and Waimakariri systems.

3.3 Synthesis with 1979/81 National Angling Survey data

To provide an additional perspective on the 1979/81 National Angling Survey, we conducted a retrospective analysis of the 1979/81 data on key attributes (such as overall importance and catch rate) which were estimated for each river, taking into account the 1994/96 estimates of annual usage. Our rationale for this approach was that, whereas the 1979/81 data on usage were sometimes of low reliability (as well as now being seriously out of date), data on the attributes of each river were both more reliable, and less likely to change with time (see Section 1.4). We restricted this analysis to rivers attracting more than 25 responses in the 1979/81 survey, producing a subset of 200 river fisheries for which data were available from both surveys. We took particular note of those rivers identified as either “nationally important” (24 rivers) or “possibly nationally important” (12 rivers) as identified by (Teirney et al. 1982).

On the basis of a scatterplot of mean importance grade (as measured on a 1-5 scale) vs. estimated annual usage (Figure 3-6), most rivers identified as “nationally important” were characterised by either a high mean importance grade, high usage, or both. With the possible exception of the Tarawera River, which received a relatively low importance grade given its level of use, all nationally important river fisheries fell within a well defined band to the top right of the figure. Similarly, with the exception of the Mararoa and Karamea, all “possibly nationally important” rivers lay well to the top right of the figure. For many such rivers, their original classification was influenced by other attributes not represented in Figure 3-6, such as catch rate or size of fish. The Karamea may be an example of a river for which the 1979/81 data have dated significantly; over the last 15 years it has gained a reputation as a highly valued headwater (or “wilderness” fishery), and it is likely that the 1979/81 data underestimate its relative importance.

Several rivers (identified as A-G in Figure 3-6) support high enough levels of usage, relative to their importance, to suggest that they maybe “outstanding” in a local or regional sense. These were the Hutt River (A); lower Clutha River (B); Ngongotaha Stream (C); Manawatu River (D); Wairau River (E); Ruamahunga River (F); and the Waikaia River (G). While these rivers are not generally regarded as fisheries of exceptional quality, some of them (e.g. the Hutt, Manawatu, Ruamahunga, and Wairau) are virtually the only significant river fisheries within a 100 km radius, suggesting that they are of considerable importance to local anglers.

Table 3-6. Estimated usage (angler-days; SE in italics) for 25 New Zealand catchments attracting more than 10 000 visits per annum. Catchment numbers are as listed in “Catchments of New Zealand” (see Section 2.4).

Catchment	Catchment number	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	Total
Waikato/Taupo	434	29112 <i>580</i>	55523 <i>1601</i>	26879 <i>1768</i>	46051 <i>855</i>	27551 <i>520</i>	27547 <i>662</i>	212662 <i>2732</i>
Clutha	752	26182 <i>1901</i>	49630 <i>2892</i>	31663 <i>2415</i>	17696 <i>2174</i>	10538 <i>1898</i>	13395 <i>2823</i>	149105 <i>5840</i>
Kaituna/Rotorua	146	17774 <i>1886</i>	28693 <i>3392</i>	18781 <i>3522</i>	18399 <i>2254</i>	14058 <i>2442</i>	7570 <i>2031</i>	105275 <i>6530</i>
Waitaki	711	10420 <i>856</i>	25660 <i>2073</i>	29470 <i>2519</i>	12432 <i>1705</i>	2593 <i>653</i>	5556 <i>1965</i>	86131 <i>4310</i>
Waimakariri	664	8210 <i>1018</i>	29904 <i>5359</i>	28811 <i>4834</i>	4779 <i>1695</i>	1943 <i>1255</i>	974 <i>446</i>	74620 <i>7601</i>
Mataura	775	10721 <i>1101</i>	17263 <i>1834</i>	19053 <i>1758</i>	10598 <i>1343</i>	285 <i>173</i>	8119 <i>2011</i>	66038 <i>3680</i>
Tarawera	153	12587 <i>1436</i>	11600 <i>1670</i>	13678 <i>2009</i>	16877 <i>3338</i>	8586 <i>1562</i>	1497 <i>402</i>	64825 <i>4757</i>
Rakaia	685	6293 <i>877</i>	15654 <i>2246</i>	22395 <i>3229</i>	4544 <i>1283</i>	1114 <i>479</i>	460 <i>252</i>	50461 <i>4264</i>
Waiau (Te Anau)	797	6265 <i>609</i>	9097 <i>954</i>	9198 <i>801</i>	7006 <i>784</i>	190 <i>98</i>	6186 <i>1283</i>	37942 <i>2048</i>
Rangitata	693	2942 <i>414</i>	11654 <i>1316</i>	14905 <i>1919</i>	5200 <i>925</i>	502 <i>156</i>	987 <i>271</i>	36191 <i>2557</i>
Oreti	786	8891 <i>1131</i>	7169 <i>1072</i>	7905 <i>963</i>	3543 <i>640</i>	0 <i>0</i>	5139 <i>1442</i>	32648 <i>2417</i>
Wairoa (Hawkes B)	214	4061 <i>631</i>	11385 <i>1849</i>	3258 <i>579</i>	3476 <i>788</i>	2002 <i>766</i>	1611 <i>574</i>	25793 <i>2385</i>
Rangitaiki	154	6298 <i>1253</i>	3801 <i>740</i>	6084 <i>1468</i>	3536 <i>769</i>	2589 <i>560</i>	933 <i>274</i>	23241 <i>2292</i>
Opihi	696	5551 <i>965</i>	5687 <i>977</i>	5571 <i>1032</i>	4463 <i>800</i>	555 <i>155</i>	1282 <i>310</i>	23110 <i>1926</i>
Hutt	298	2809 <i>598</i>	5211 <i>1132</i>	6541 <i>1231</i>	1580 <i>460</i>	2383 <i>703</i>	1748 <i>503</i>	20271 <i>2028</i>
Taieri	743	3749 <i>594</i>	7255 <i>909</i>	4142 <i>709</i>	975 <i>340</i>	1887 <i>384</i>	2084 <i>770</i>	20093 <i>1593</i>
Manawatu	325	4879 <i>961</i>	7219 <i>929</i>	3465 <i>563</i>	2336 <i>605</i>	748 <i>173</i>	962 <i>240</i>	19609 <i>1599</i>
Hurunui	651	2097 <i>480</i>	6680 <i>2055</i>	8160 <i>2364</i>	924 <i>537</i>	1103 <i>975</i>	0 <i>0</i>	18965 <i>3358</i>
Tukituki	232	2855 <i>356</i>	12249					15104 <i>-</i>
Ruamahunga	292	1601 <i>451</i>	4710 <i>927</i>	4214 <i>781</i>	1322 <i>317</i>	1130 <i>324</i>	878 <i>207</i>	13856 <i>1386</i>
Buller	932	4913 <i>582</i>	3525 <i>509</i>	3030 <i>743</i>	1881 <i>248</i>	135 <i>77</i>	349 <i>101</i>	13833 <i>1108</i>
Motueka	570	2695 <i>400</i>	4139 <i>1099</i>	2226 <i>601</i>	1531 <i>289</i>	648 <i>237</i>	894 <i>213</i>	12133 <i>1384</i>
Aparima	789	3807 <i>986</i>	1754 <i>426</i>	2896 <i>557</i>	2294 <i>675</i>	0 <i>0</i>	1279 <i>467</i>	12031 <i>1463</i>
Grey	914	3232 <i>540</i>	4264 <i>753</i>	1902 <i>393</i>	2584 <i>284</i>			11982 <i>1048</i>
Wairau	601	2618 <i>408</i>	2137 <i>423</i>	1768 <i>356</i>	2175 <i>370</i>	1604 <i>364</i>	1261 <i>322</i>	11562 <i>919</i>

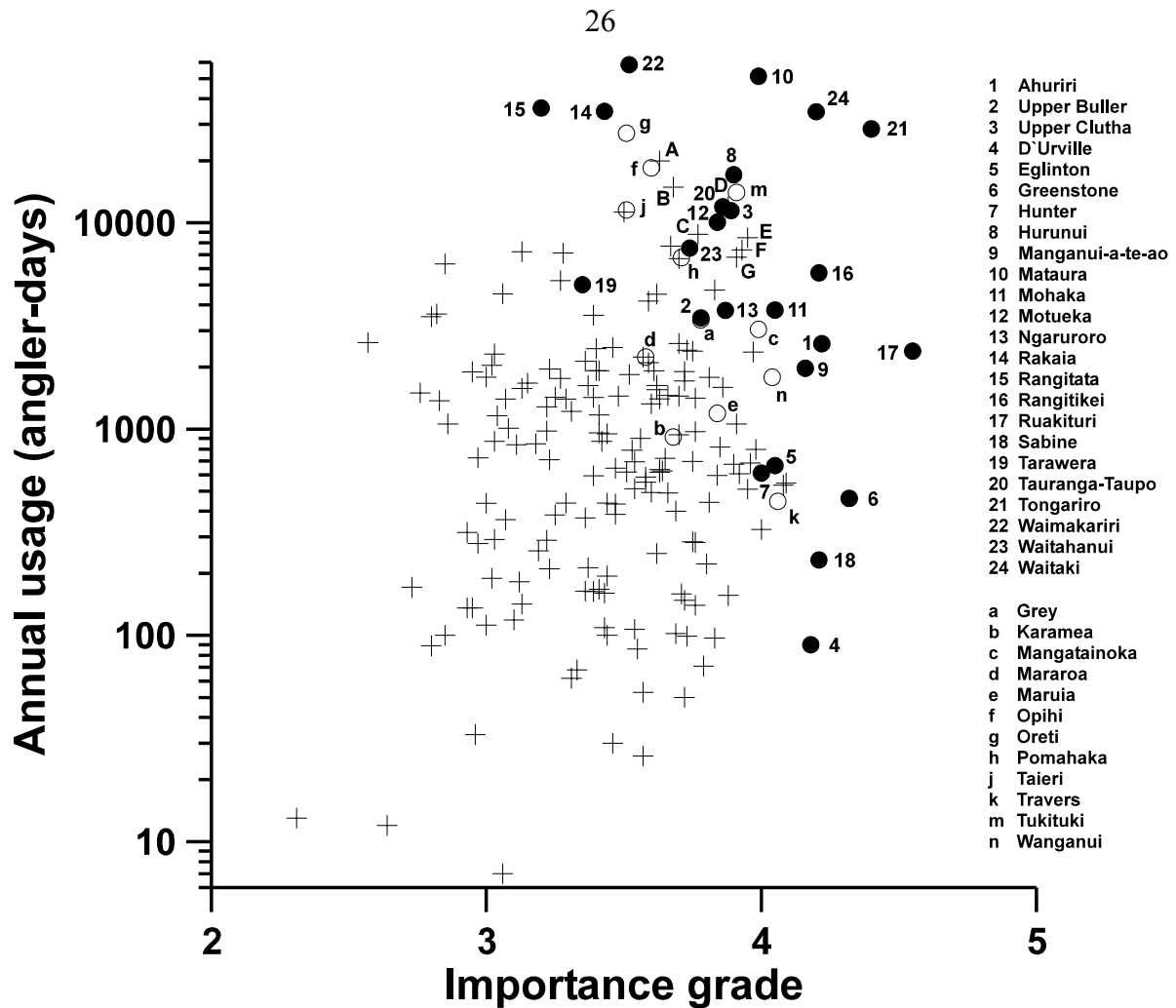


Figure 3-6. Mean "importance grade" (from the 1979/81 National Angling Survey) vs. estimated annual usage for 200 river fisheries common to both surveys. Solid circles denote rivers identified as "nationally important"; open circles denote rivers identified as "possibly nationally important". Refer Section 3.3 for further details.

Scatterplots of usage against mean rankings for six of the seven attributes surveyed in 1979/81 are shown in Figure 3-7. (We excluded one attribute, "feelings of peace and solitude", from this analysis because it was highly correlated with "scenic beauty" and showed essentially the same relationship to annual usage). With the exception of "area of fishable water", which was moderately correlated with usage ($r = 0.31$; $p < 0.001$), usage was at best weakly correlated ($0.06 < r < 0.19$) with any of the remaining attributes. However, rivers classified as nationally important showed a pronounced tendency to cluster in all six scatterplots, particularly with respect to area of fishable water, scenic beauty, and size of fish. The 1994/96 data therefore suggest that irrespective of usage, the most highly valued river fisheries were generally rated highly for at least one, and sometimes all three of these particular attributes.

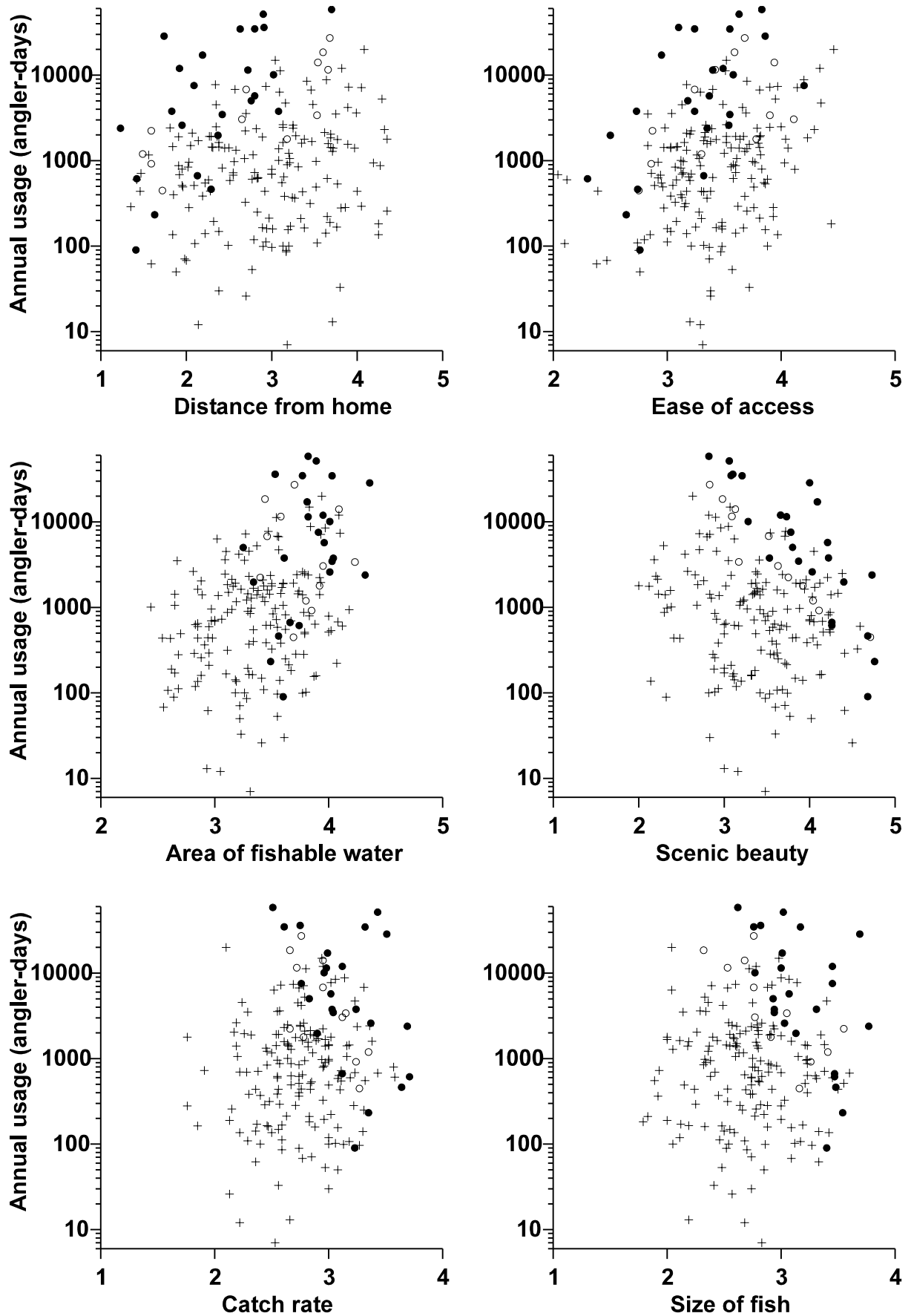


Figure 3-7 Comparison between usage estimates derived from the current survey, and six attributes used in the 1979/81 National Angling Survey, for 200 river fisheries common to both surveys.

4. Discussion and Interpretation

4.1 Limitations of the data

Throughout this report, we have presented the 1994/96 results with little comment as to their accuracy and precision other than presentation of standard errors. In fact, this approach almost certainly overestimates the precision of our results, since it ignores several other possible sources of error or bias which could potentially affect the final estimates. In this section, we examine a number of these factors, and consider what (if any) impact they may have had on the results.

4.1.1 Biases

Bias refers to any source of error which will tend to have a consistent (or systematic) effect on the responses from a given sample. Most surveys will be affected by bias to some degree. If unrecognised, bias will typically yield a distorted result in which the value for some particular statistic of interest (such as a sample mean) will differ from the true mean. Errors arising from bias therefore differ from purely statistical (or sampling errors) in that they generally arise from lapses in survey technique and can not be eliminated simply by (say) increasing the sample size. Sampling errors affect precision, while bias affects accuracy. For a full discussion of bias and other non-sampling errors, see (Kish 1965). In this section, we consider the main sources of bias likely to have affected the present survey.

4.1.1.1 Non-coverage and non-response bias

“Non-coverage bias” refers to biases associated with a failure to include all groups of anglers in the sampling frame. In the present survey, the main such group was anglers who (on the basis of their address as recorded on the licence butt) were either overseas residents, or did not leave a usable address or telephone number. In addition, a few small licence classes - which on the basis of a 5%-10% random sample would have generated sample sizes of less than about five individuals - were simply ignored. Free licences, supplied in many regions to children under 12, were not sampled.

Once a sample has been selected, possibly incorporating some of the non-coverage biases listed above, “non-response bias” describes additional biases resulting from failure to collect data from all individuals in the sample. Depending on the nature of the survey, this could include individuals who could not be contacted, and others who were successfully contacted but did not reply (including those who refused to co-operate). In the present survey, non-respondents comprised any licence holders who provided a valid telephone number (or whose phone number could be traced from their name and address), but who could not be contacted after up to three attempts.

By ignoring all such “non-contacts” in this report, our analysis simply assumes that all such individuals had the same fishing characteristics (i.e. they fished the same range of waters, with the same distribution of effort) as those who were contacted (c.f. Section 2.4). For New Zealand residents who could not be contacted this assumption is likely to be reasonable, even if not strictly true: although failure to contact a particular individual by telephone could conceivably be related to the amount of time that person spent fishing, there are also plenty of more prosaic reasons, unconnected with fishing activity, which could account for the lack of contact. However, for overseas anglers the potential for bias is more obvious, given that

(for example), in the absence of local knowledge, overseas visitors may fish a more restricted range of waters than their local counterparts.

In the absence of any detailed studies of overseas anglers, we have no information to assess how their fishing activities may differ from New Zealand residents, or whether they are more or less active than local anglers. However, given that in most regions overseas anglers make up only a small proportion of the total anglers, and tend to fish on short term licences (Table 2-1), their contribution to the total effort (and hence any subsequent bias) is likely to be small. The main exceptions are likely to be the Taupo Conservancy, and some (but not all) waters within regions such as Eastern, Nelson/Marlborough, and Otago. More detailed information on the origin of individual anglers, across all regions, would help to quantify the magnitude of this problem. Even for waters where their usage is no more than (say) 20% of the total effort, their values, expectations and behaviour are not necessarily the same as those of domestic anglers, whether local or non-local.

4.1.1.2 Recall bias

“Recall bias” describes all biases resulting from respondent’s inability to accurately recall details of their fishing activity over the relevant period. In the present survey, this could potentially result in either an incorrect number of days being recorded for each respondent, or complete failure to record any fishing activity on a particular water.

Based on other Fish & Game surveys conducted in recent years, recall bias remains small provided the recall period does not exceed two months. Once this period is exceeded bias starts to become a problem, and becomes increasingly severe as the recall period increases. Intuitively, one would expect that identifying which waters one has fished (which essentially requires a yes/no response for each water) would be less subject to recall bias than recalling the number of days involved, so that estimates of the number of anglers fishing a given water would be inherently more reliable than estimates of total usage.

Recall bias also tends to be more serious for more commonplace events, in that there is greater potential for substantial recall error among anglers who fish more often. Of the 16 340 responses received for the number of days fished on each individual water, 13 834 (85%) were for at most five days, suggesting that recall bias for these responses is unlikely to have been a problem. However, a tendency for larger numbers of days to be rounded to a multiple of 5 or 10 (e.g. 50% of the 1097 responses for waters where 10 or more days had been fished specified a multiple of 10 days) suggests that some recall error was involved. Provided any tendency to round such figures was not biased in any one direction (i.e. a reported figure of 30 days could mean anything from 25 to 35 days), this type of bias should have little impact on the results.

In practice, recall bias is most likely to have arisen where, in some regions, licence records for the relevant survey period did not become available until a few weeks (or even a few months) after the end of the period. Although the intent of the survey was to begin telephone calls as soon as possible after the end of each two month interval, this required regional staff to assemble and collate licence sales more or less continuously as the season progressed. Although this is standard practice in some regions, other regions (particularly those with large rural populations) had some difficulty maintaining up-to-date records. Streamlining procedures for collating licence records would help to minimise this problem.

4.1.1.3 Seasonal variation

Although the original intention was that the 1994/96 survey be conducted over a single season (1994/95) for all regions, some regions (e.g. Otago, Eastern) did not implement the survey until 1995/96. In addition, the Taupo data covered the 12 month period from 1 July 1995 to 30 June 1996. Consequently, the combined results for all regions were spread over at least two consecutive seasons, introducing the possibility that fishing effort during one season may have been more (or less) intense than usual. In addition, variation in fish stocks or weather patterns across New Zealand may have introduced significant variation between regions. For example, angling in the Nelson/Marlborough region was severely affected by floods over the 1994/95 summer, to the extent that some rivers (such as the Gowan) were virtually unfishable (Neil Deans, pers. comm). Conversely, along the east coast of the South Island the 1995 salmon fishing season was significantly better than average, so that usage estimates for rivers such as the Rakaia and Waitaki may have been higher than usual.

Unfortunately, biases of this type would appear to be an inherent feature of the fishery: given the vagaries of New Zealand's climate, at least one region is likely to be significantly affected by unusual weather patterns in any one season. For example, the current (1997/98) season has been characterised by dry north-westerly conditions along the east coast, and generally wet conditions in the south and west. Even if all regions were surveyed concurrently, therefore, there is no guarantee that all regions would experience "average" fishing conditions. Repeating the 1994/96 survey at intervals of (say) five years would, as successive data sets became available, help to quantify the extent to which effort varies between regions and seasons.

4.1.2 Precision of estimates

For most angling waters, particularly those with low annual usage (less than about 1000 angler-days), the major source of error is statistical uncertainty. This is simply a reflection of the fact that our estimates are based on responses from a relatively small (c. 5% - 10%) sub-sample of the angling population, and that repeating the survey with a different sub-sample would generally produce different estimates. The standard error (SE) is an estimate, based on the spread of responses contained in the actual sample, of how widely usage estimates can be expected to differ between samples. We used the ratio of the SE to the original estimate, or the coefficient of variation (CV) expressed as a percentage, to provide a basis for discussing the accuracy of the results.

The relationship between estimated annual usage and the associated CV clearly shows a rapid increase in precision as annual usage increases (Figure 4-1). Averaged across all waters, mean CV decreased from 62% for waters with an estimates annual usage of 100 days to less than 10% for waters fished for 50 000 days. As a good approximation, a ten-fold increase in annual usage produces a two-fold decrease in mean CV (Table 4-1). A similar relationship holds whenever usage estimates are combined to yield a common total for a particular group of waters, such as those in a particular sub-catchment. For example, within the Waitaki catchment, CVs range from 65% for the Hopkins River at the head of Lake Ohau (348 angler-days); to 15% for the Ohau sub-catchment (6617 angler-days); to 8% for the upper Waitaki catchment above Lake Benmore (22 000 angler-days); to 5% for the entire catchment (86 000 angler-days).

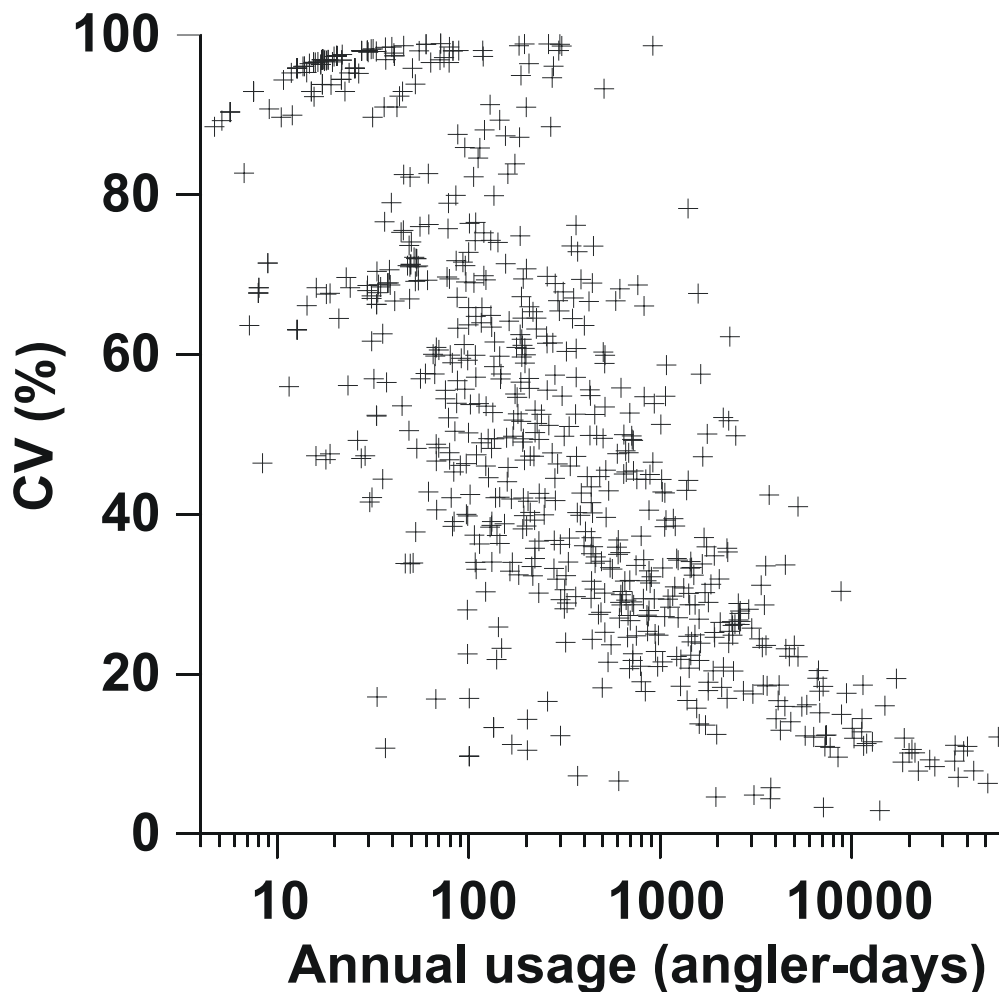


Figure 4-1. Coefficient of variation (CV) vs. estimated annual usage (angler-days) for 712 angling waters fished during the 1994/96 survey.

Table 4-1. Relationship between estimated annual usage and the statistical error of the estimate, averaged across all waters fished during the 1994/96 angling survey.

Estimated annual usage (angler days)	Standard error (SE)	Coefficient of variation (CV)
100	62	62%
200	100	50%
500	190	38%
1 000	307	31%
2 000	498	25%
5 000	944	19%
10 000	1 530	15%
20 000	2 481	12%
50 000	4 698	9%

The relatively low precision associated with usage estimates for more lightly fished waters is a fundamental characteristic of the sample survey approach, and is a direct consequence of the enormous variation in usage levels between different waters. For any one angling water, annual usage can range from less than 10 days (for the most remote back-country waters) to over 50 000 days on waters such as Lake Taupo, the Waimakariri River, and the Mataura River. The largest CVs are invariably associated with the least fished waters, particularly those fished by only one respondent from a particular stratum. In such cases, the estimated standard error (which is itself only a poor estimate of the true error) is equal to the estimated usage, typically producing a figure such as 20 ± 20 angler-days.

Although increasing the sample size could, in theory, alleviate this type of problem, a consistent technique for measuring angling usage to a reasonable level of precision (say $\pm 20\%$), applicable to all angling waters and achievable within an acceptable budget, has yet to be developed. Where angler usage is highly concentrated both spatially and temporally, as in most waters of Taupo fishery and some high use rivers near major population centres, intensive on-site methods such as direct counts and creel surveys can be cost effective. However, although these methods can also be applied to more remote rivers, the labour costs required to monitor more than a handful of waters makes such methods completely impractical at a regional or national scale.

4.1.3 Comparison with Taupo data

The contrasting methodologies of the Taupo and FGZ surveys, involving direct census and recall surveys respectively, open the possibility that usage estimates for the two surveys may differ systematically. In fact, one fundamental difference lies in the basic unit used to measure angling effort, the Taupo survey using the angler-hour as its fundamental unit of measure. To convert the Taupo data into angler-days, DOC used a multiplier of 2.90 h/day for Lake Taupo, and 2.82 h/day for fisheries on rivers and streams flowing into Lake Taupo (Rob Pitkethley, pers. comm.). Based on these figures, and allowing for the correction outlined in Section 2.5, total annual effort for the Taupo Conservancy was 177 760 angler-days.

To assess whether this figure was broadly consistent with the FGZ data, we used the latter data set to derive a relationship between total licence sales of fishing licences within each region, and the total fishing effort (E) expended by anglers fishing within their region of purchase (Figure 4-2)⁴. By classifying licence sales as either whole-season (N_{ws}) or part-season (N_{ps}), but ignoring any distinctions between adult and junior licences, we derived a satisfactory relationship ($r = 0.965$; $p < 0.001$) of the form

$$E = -3368 + 13.52N_{ws} + 2.68N_{ps}$$

in which the coefficients 13.52 and 2.68 represent the mean annual effort associated with each whole-season licence holder, and each part-season licence holder, respectively. Although Otago and Southland show some deviation from this model (see Figure 4-2), this result suggests that, in general, there is a well-defined relationship between total usage and licence sales. Applying this model to the Taupo Conservancy, based on licence sales for the 1995/96 season, yields a predicted annual effort of 363 000 angler-days, roughly 180% of the total estimate (202 000 angler-days, based on the aerial estimate of 177 761 angler days combined with Shaw et al.'s (1985) estimate that these waters cover 87.9% of Taupo angling. Taken at face value, this would appear to be evidence of a substantial systematic discrepancy between the Taupo results and figures for the FGZ regions.

⁴ We restricted this analysis to “within-region angling” to maximise consistency with the Taupo data.

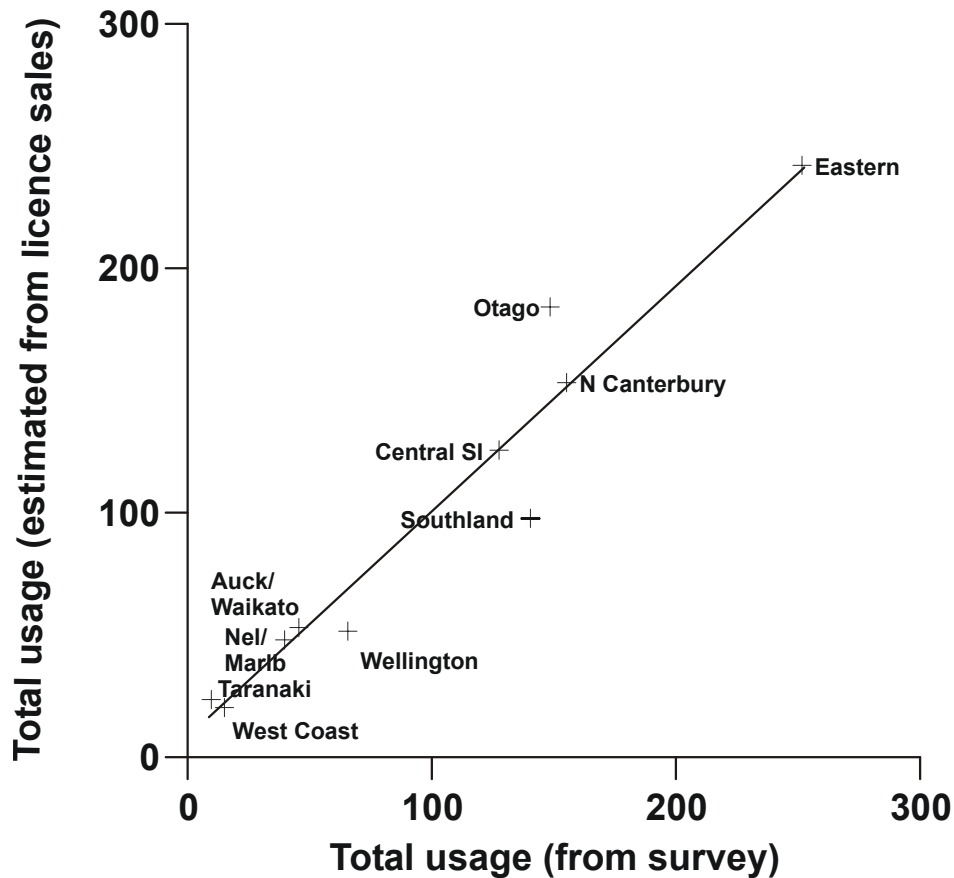


Figure 4-2. Comparison between total usage by anglers fishing within their home region (as measured by the 1994/96 survey) and predicted usage (estimated from fishing licence sales).

One obvious factor which may have contributed to this discrepancy is the fact that within the Taupo Conservancy, angling over the summer months (December to March inclusive) is virtually confined to Lake Taupo itself, with very little effort devoted to the tributaries⁵. Consequently, this period accounts for 34% of the total effort expended in the Taupo region, compared to 51% of the season total in all other regions except North Canterbury and Central South Island, and 69% of the total in the latter two regions (where angling is strongly linked to the salmon fishery). We have no information on the extent to which Taupo licence holders wishing to fish rivers over the summer period may divert their efforts elsewhere, but any such tendency would clearly reduce the mean effort per licence holder as recorded solely within the Taupo region. It may also be significant that the proportion of whole season licences bought by juniors in Taupo (33%) is substantially higher than in most other parts of New Zealand, particularly the four lower South Island regions (which contribute strongly to the regression relation shown in Figure 4-2) for which the corresponding figure is 17%. Since junior licence holders make a relatively small contribution to the total angling effort (Section 3.2.1), this increases the likelihood that the model of Figure 4-2 overestimates usage for the Taupo region.

An equally fundamental difference between the two survey methodologies is the use of different units for measuring angling effort. An “angler-day”, as used in the 1994/96 FG NZ survey, is defined as one angler fishing one water on one day, irrespective of the length of the visit. An individual who fished two waters on the same day would therefore legitimately be

⁵ Taupo tributaries were not included in DoC’s aerial survey programme for these months, so that angler usage during this period is not included in the final figures. This represents an additional (albeit small) correction which would further reduce the discrepancy between the two surveys.

recorded as having expended two angler-days. It is by no means obvious that a statistic based on total hours fished (as estimated for the Taupo region), divided by an estimate of mean hours per angling day, will necessarily yield an equivalent measure of usage. To illustrate this point, we note that Taupo licence sales for the 1995/96 angling season totalled 39 526 daily licences, 10 038 weekly and monthly licences, and 17 280 whole season licences. Assuming an average effort of one day per season for daily licence holders, and three days per season for weekly and monthly licence holders, part season licence holders accounted for an annual total of just under 70 000 angler-days. Compared to the annual total of 178 000 days (based on an annual total of 511 000 hours and an average angling day of 2.8 - 2.9 hours), this leaves a total of 108 000 angler days for the remaining 17 280 whole season licence holders, or 6.3 days per angler per season. This figure is somewhat lower than for the Fish & Game whole-season licence holders, for whom a seasonal average of 10 - 15 days is more typical.

The above considerations would appear to suggest (a) that “angler-days” as estimated from the Taupo data are a more conservative measure of angling effort usage than “angler-days” as estimated by the FGNZ survey, and (b) that Taupo anglers (particularly whole-season licence holders) tend to fish for less days per season, on average, than their Fish & Game counterparts. On this basis, an annual total of around 250 000 angler-days (as expressed in Fish & Game terms) would appear to be a reasonable figure for the Taupo region. Nevertheless, any unresolved discrepancy between this total and the actual figure of 178 000 days remains a cause for concern. While the difference is relatively small in a national context (i.e. compared to the estimated annual total of 1.33 million days), and does not affect usage comparisons between Fish & Game regions, any inter-regional comparisons involving Taupo are potentially subject to confusion as to precisely what has been measured. Until appropriate cross-validation surveys can be implemented (see Section 4.3.4), so that any biases inherent in the 1994/96 survey (or conceivably the Taupo data) can be identified and corrected for, usage comparisons across all New Zealand waters should be interpreted with a touch of caution.

4.1.4 Summary

As with any survey, the 1994/96 Angling Survey results are subject to various levels of bias and uncertainty. Non-sampling biases, recall bias, and inter-seasonal variation are all factors which could potentially confound the results, although we believe that in most cases, any such biases are likely to be small. There is also evidence of a systematic discrepancy between usage estimates derived from the Department of Conservation’s Taupo surveys, and from the FGNZ survey, to the extent that it is not even clear whether the two surveys measure the same unit of effort.

For most waters, however, the overriding source of error is simply the statistical uncertainty associated with estimate usage based on data from a limited subsample of anglers. Despite sample sizes of over 300 for most of the larger survey strata, the great majority of angling waters were mentioned by only a few licence holders in each stratum. In total, the survey provided usage estimates for 4656 waters in 169 strata. Of these estimates, over half 2499 (53.7%) were based on just one response for a particular water, while a further 1525 (32.8%) were based on no more than five responses. Only 309 (6.6%) waters attracted more than 10 responses, and just 19 of these (0.4%) received more than 50 responses. Since the standard error of the estimated usage for a water fished by only one respondent is approximately equal to the actual usage, yielding a coefficient of variation of close to 100%, low precision is the norm for most lightly used rivers.

For this reason, it is unrealistic to expect a “broad-brush” approach such as the 1994/96 survey to yield high precision estimates for all waters. The fundamental problem is that over the 1000 or more angling waters which Fish & Game managers are responsible for, usage levels vary by roughly four orders of magnitude, from 5 to 50 000 visits per annum. National sample surveys will give a fair indication as to whether a particular water receives 5, 50, 500, 5000, or 50 000 visits per annum, but are likely to be inadequate to determine whether usage of a particular water has increased from 500 to 1000 days per annum. The 1994/96 survey (and any successor) should be seen as establishing a sound baseline for placing individual waters in a national and regional context; however, it is not a panacea for all management issues, and does not obviate the need for more intensive surveys targeting individual waters in more detail.

4.2 National trends

Notwithstanding any limitations arising from the issues discussed in Section 4.1, the complete data set gathered via the 1994/96 survey, supplemented by the Taupo data, constitutes an extremely rich source for exploring national and regional trends. For the purposes of this report we have concentrated on national rather than regional analysis, on the grounds that regional Fish & Game staff are better suited to pursuing a detailed analysis of the waters within each region. To facilitate this, and to provide each region with a data resource for future analysis, an up-to-date copy of the data set (in IBM Microsoft™ Excel format) has been provided with this report. This file is highly amenable to analysis using Excel’s Pivot Table feature (implemented from Excel Version 5.0 onwards), as outlined at a workshop for Fish & Game staff in August 1996. Possibilities for generating informative cross-tabulations of the data for a specific region include:

- usage by angling water and survey period (cf. Appendix 1);
- usage by angling water and region of origin (cf. Table 3-4);
- usage by angling water, catchment, and sub-catchment;
- usage by catchment and water type;
- usage by water type and season;
- usage by angling water and licence type.

4.2.1 Overview of the fishery

To a rough “first approximation”, freshwater angling in New Zealand consists of lake fishing in the central North Island, river fishing along the eastern and southern coasts of the South Island, and lake fishing in central Otago (Figure 3-4; Figure 3-5). Collectively, these three groups of waters account for 323 000, 581 000, and 104 000 angler-days, respectively, or 904 000 (68%) of the national total of 1 334 000 angler-days per annum. Lake Taupo (125 000 days) is easily the most heavily fished water, followed by the Waimakariri River (58 000 days); the Mataura River (52 000 days); and Lakes Rotoiti (45 000 days) and Rotorua (40 000 days). Other heavily used fisheries include Lake Tarawera (38 000 days); the Rakaia, Rangitata, and Waitaki Rivers (c. 35 000 days); the Tongariro River (28 000 days); the Oreti River (27 000 days); and the upper Clutha source lakes (Wanaka, Hawea, and Wakatipu) plus Lake Dunstan (19 000 - 25 000 days).

However, while this summary clearly identifies where angling activity is most heavily concentrated, it is very much an over-simplification. In total, the 1994/96 survey identified a total of 719 waters fished by anglers, together with a number of waters which could not be identified. Moreover, the 1979/81 survey identified a further 303 river fisheries which did not

appear in the 1994/96 survey⁶. Assuming that all these rivers still provide viable fisheries today, and allowing for the lack of data for Northland, there would appear to be well over 1000 angling waters in New Zealand. The 1994/96 survey identified 167 waters which attracted more than 1000 visits per year, 308 waters attracting between 100 and 1000 visits, and 244 waters attracting up to 100 visits annually. The range of waters used by anglers, and the diversity of angling opportunities available, is one of the key characteristics of the fishery (see Section 4.2.2).

Although usage was essentially uncorrelated with travel time (as measured by the 1979/81 survey; c.f. Figure 3-7), fisheries (particularly river fisheries) near major population centres tended to attract high levels of usage. In particular, rivers flowing through major cities or even those near substantial rural population centres (e.g. Tukituki, Manawatu, Hutt, Motueka, Wairau, Waimakariri, lower Clutha, and Oreti) often attracted more than 10 000 angler-days per annum, and were consistently among the more heavily fished waters identified by the survey. The importance of local fisheries is also highlighted by the rather limited extent to which anglers tended to fish outside the region in which they purchased their licence (Table 3-2); few anglers fished further afield than the immediately adjoining region (or regions), and almost none travelled between the North and South Islands. While these figures are based on region of purchase rather than region of residence, they are consistent with data on region of residence for anglers fishing Lake Taupo (Rob Pitkethley, F&G Eastern, pers. comm.), which show that only 37 (0.8%) of 4418 Taupo anglers were South Island residents, and all but two of these were from Nelson/Marlborough or North Canterbury.

The distribution of fishing effort was strongly skewed towards anglers purchasing whole-season rather than part-season licences. Although regional variation in the types of licences available (and in the way these were grouped into individual survey strata) prevented us from making comparisons across the whole country, data for the Eastern Region (for which the same five licence classes were sampled consistently in all six two-monthly surveys) are representative of the general trend (Figure 4-3). Adult whole season licences represented only 24% of sales, but accounted for 68% of the total effort. By contrast, daily licences made up 40% of those sold, but represented only 6% of the total effort. Total estimated effort per licence holder per season ranged from 0.93 ± 0.05 days for daily licence holders to 18.5 ± 0.9 days for adult whole season licence holders.

⁶ In contrast to the 1994/96 survey, the 1979/81 survey presented anglers with a list of all known river fisheries in their region, and asked them to identify those which they had fished over the previous 3-5 years. Consequently, the 1979/81 survey tended to provide more information on lightly used waters.

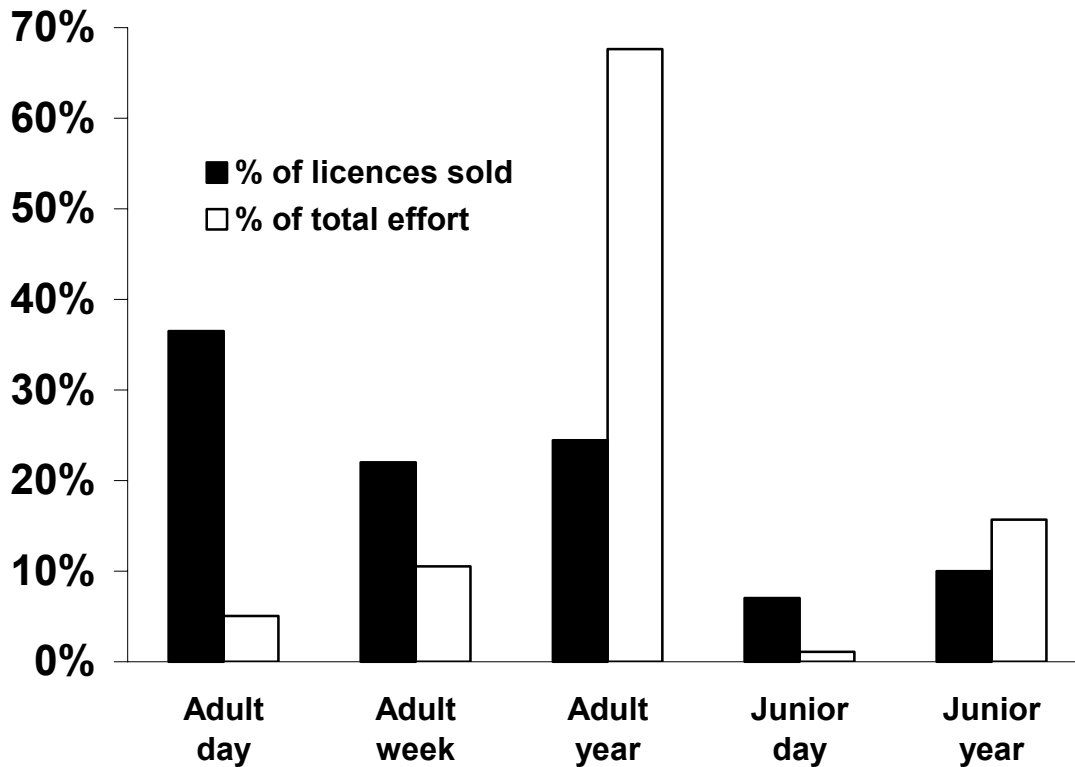


Figure 4-3. Comparison between total licence sales and total angling effort for five types of angling licences sold in the Eastern Fish & Game Region.

Based on sales of whole-season licences (by far the majority of which are brought by New Zealand residents), licence sales per head of population vary widely throughout New Zealand (Table 4-2). These figures (based on the 1996 census) give a slightly distorted picture of the number of anglers in each region because they do not take into account anglers who purchase their licence outside their region in which they live. Consequently, a significant proportion of the licences sold in the Eastern and Taupo regions will have been bought by anglers living elsewhere in the North Island (particularly Auckland and Wellington), with the result that participation rates in the North Island will be slightly more evenly spread than the Table suggests. Nevertheless, it is clear that participation rates differ substantially between the North and South Islands, and are particularly high in the lower half of the South Island. These results are consistent with a previous analysis based on the 1981 census (Teirney et al. 1982), and suggest that per head of population, the popularity of freshwater angling has changed little over the last 15 years.

4.2.2 Measures of angling “diversity”

As highlighted in the previous section, one of the key characteristics of New Zealand’s freshwater sports fishery is the range of angling opportunities available. In much the same way that ecological studies generally recognise a high species diversity as one indication of a healthy animal or plant community, we suggest that a high diversity of angling waters should be seen as a major component of a healthy sports fishery. In this section, we explore this concept by developing an index of “angling diversity”, based on indices commonly used in ecological studies. Our motives for this analysis are several. Firstly, diversity indices provide a convenient way of summarising large volumes of data, and are therefore useful for

Table 4-2 Population estimates and sales of adult whole-season fishing licences (1996 figures) by Fish & Game region. Percentages in the last column are based on the assumption that all licences are bought by local residents, and that 95% of anglers are male.

Region	Total population (1996 census)	Number of males aged 20-80	Number of adult whole-season licences	Licences as % of males aged 20-80
Northland	137 052	44 900	156	0.3%
Auckland/Waikato/Taupo	1 418 770	464 400	14 785	3.2%
Eastern	270 152	88 400	9 185	9.9%
Taranaki	183 096	59 900	721	1.1%
Hawkes Bay	142 789	46 700	2 011	4.1%
Wellington	565 870	185 200	3 297	1.7%
Nelson/Marlborough	116 649	38 200	2 398	6.0%
West Coast	37 512	12 300	1 469	11.4%
North Canterbury	359 287	117 600	10 070	8.1%
Central South Island	103 484	33 900	7 260	20.4%
Otago	190 352	62 300	9 407	14.3%
Southland	97 100	31 800	5 549	16.6%

characterising variation between regions and catchments. Secondly, the survey data are ideally suited to this type of analysis, in that they provide a complete and reasonably definitive breakdown of how angling effort is distributed between individual waters. Thirdly, we believe that diversity indices are potentially applicable to a wide variety of recreational usage data, and deserve to be more widely appreciated. Finally, we hope that by providing a quantitative basis on which to measure angling diversity, Fish & Game regions will gain an additional tool for resolving future management issues. For example, quantifying changes in angling diversity within a given region, over a period of years, could potentially help fisheries managers to identify types of waters in need of management intervention.

The most basic index of diversity is simply the number of individual waters within a given region of interest (N), corresponding to the concept of “taxonomic richness” in ecological studies (Ludwig and Reynolds 1988). Other things being equal, a fishery comprising 100 angling waters offers a more diverse range of angling opportunities than a fishery comprising 50 waters. Alternatively, there are several indices available which measure the extent to which a data set (e.g. counts of individuals in each taxonomic grouping) is spread across a range of categories. One such measure, known as the “evenness” or “relative diversity index” J' (Zar 1996), yields a value between 0 and 1 depending on whether the raw data are mostly concentrated into a small number of categories ($J' \rightarrow 0$) or evenly spread across all possible categories ($J' \rightarrow 1$).

To apply these indices to the 1994/96 survey data, we can identify all the angling waters within a given region of interest as equivalent to a range of biological taxa, and the estimated usage for each water as equivalent to the number of individuals in each taxon. In Figure 4-4, each region is represented by a point showing both the number of angling waters available (on the y-axis) and the relative diversity (along the x-axis). In fact, this figure suggests that (with the possible exception of the Taupo Conservancy), all regions support fisheries of broadly comparable diversity ($0.57 < J' < 0.77$). However, angling diversity was lowest in Southland and North Canterbury (which tended to be dominated by a few highly used fisheries such as the Maitai and Oreti, and the Waimakariri and Rakaia, respectively), and highest in Taranaki, Auckland/Waikato, and on the West Coast. For the latter three regions, their high diversity indices are consistent with the fact that angling tends to be distributed over a broad range of relatively lightly used waters, rather than concentrated in a smaller

number of heavily used fisheries. Our diversity estimate for Hawkes Bay is probably conservative, because the lack of data for all but two months of the angling season means that many lightly used waters would have gone unreported. The comparatively low diversity index for Taupo is partly a reflection of the small number of waters covered by the DOC survey, but is also consistent with the limited geographical extent of the region.

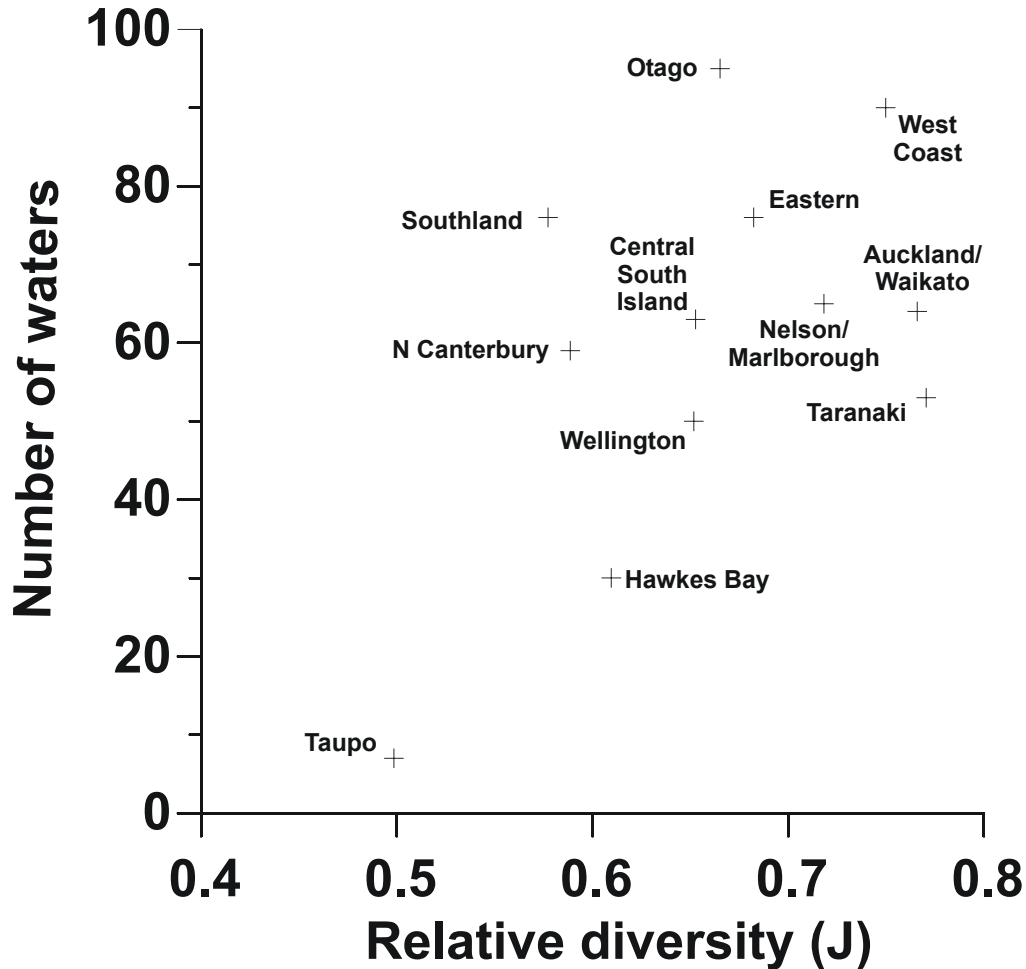


Figure 4-4. Relative diversity index vs. number of angling waters available, based on the 1994/96 survey, for 11 Fish & Game regions and the Taupo Conservancy.

An alternative application of the relative diversity index is shown in Figure 4-5, in which each point represents a single catchment. On this basis, angling diversity varies widely between catchments, ranging from 0.03 on the Rangitata River to 0.78 on the Buller River. Catchments with include large numbers of individual angling waters (e.g. Clutha, Waikato, Waitaki, Waiiau) tend to score relatively highly in terms of diversity, whereas the smaller river systems (those including less than about 25 lakes or tributary streams) tend to have more variable scores. The most diverse fisheries are characterised either by extensive fishing pressure over a large range of tributaries (e.g. Buller, Grey, Ruamahunga), or by a range of opportunities for both lake and river fishing (e.g. Rangitaiki). Conversely, the lowest rankings were generally for systems where angling was dominated by a single mainstem fishery, with only a small number of lightly fished tributaries (e.g. Rangitata, Hutt, Aparima, Tukituki). We should emphasise, however, that with the present data this index will tend to underestimate the diversity within each catchment, because longitudinal variation within a single river (e.g. Oreti, Motueka, Rangitikei) is not adequately measured.

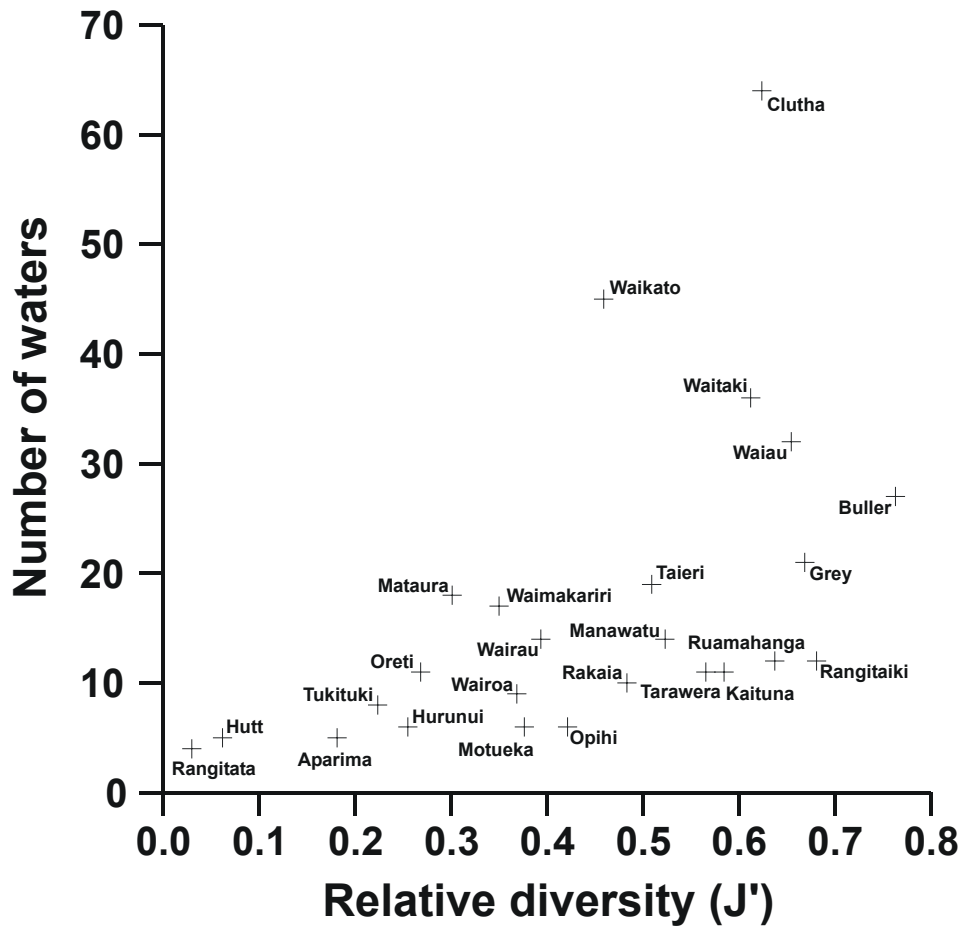


Figure 4-5. Relative diversity index vs. number of angling waters available for 25 catchments attracting more than 10 000 angler-days per annum. The points marked “Kaituna”, “Wairoa” and “Waiau” refer to the Lake Rotorua system, the Wairoa/Waikaremoana catchment, and the Waiau/Te Anau catchment, respectively.

Although diversity indices have been criticised for their potential for misinterpretation (Hurlbert 1971), there is general agreement that provided their limitations are acknowledged they remain a useful statistic (Ludwig and Reynolds 1988). There are several such indices available, and it may be that some other choice of index would be better suited to the sort of data collected by the 1994/96 survey. However, our basic point is simply that the ability to quantify angling diversity is a potentially valuable piece of equipment to be added to the Fish & Game tool kit. For example, the result that the Buller catchment supports the most diverse fishery in New Zealand (in the sense defined by Figure 4-5) would have been a useful addition to FGNZ’s case at the 1995 Planning Tribunal Hearing into the Buller Water Conservation Order.

4.3 Recommendations for future surveys

An implicit assumption when the 1994/96 survey was implemented was that it would become the first in a series of similar surveys, to be repeated at intervals of approximately five years. If this schedule is adhered to, the second such survey is due to be implemented in 1999 or 2000. We conclude this report by making a number of recommendations which FGNZ may wish to consider in relation to any future survey. The 1994/96 survey represented a considerable “learning curve”, both for NIWA staff responsible for design and analysis, and for regional Fish & Game staff who implemented the field procedures. The following suggestions, based on a number of issues which arose as the survey proceeded, are intended

to highlight areas where relatively small changes in procedure would have a substantial impact on the utility of the data collected.

4.3.1 Survey Design

1. All Fish & Game regions should be included, and all two monthly survey periods should be surveyed as originally scheduled. In the event of any situation (e.g. staff changes) which could potentially compromise survey continuity, remedial action should be taken as soon as possible.
2. To maintain consistency between regions, all licence types (except free licences distributed to children) should be sampled throughout the survey. Where necessary, licence classes can be pooled if sales over the relevant two-monthly period are insufficient to generate a meaningful sample, provided that licence type is clearly identified on the interview record (see Section 4.3.1).
3. To reduce total variances when summed across strata, it may be appropriate to adjust sample sizes for each stratum to more closely reflect the contribution made to the total variance⁷. The extent to which this is feasible will depend on the resources available within each region, but as a rule of thumb the sampling fraction for a given licence class and region should be roughly proportional to its contribution to the total angling effort (when summed over the whole of New Zealand).
4. Procedures for dealing with rivers where the fishery differs markedly in character between various reaches (e.g. Wairau, Oreti) need to be developed. Explicitly identifying such reaches as distinct river fisheries (each with a unique number) is one possibility, but may become unwieldy for interviewers to manage if more than a handful of rivers are involved. A viable alternative may be to continue to treat each river as a single angling water, but to conduct retrospective telephone surveys targeting individual rivers for which more detailed information is required. Provided that a complete licence database is available, and that interviewers consistently record the licence number with each interview, it would be simple enough to retrieve a telephone list for all respondents who fished a particular water. For example, the Wairau River was fished by 150 (0.9%) of the 16595 respondents to the 1994/96 survey, of whom 145 were from the Nelson/Marlborough region. Follow-up phone calls to each of these anglers would provide a direct and highly targeted method for collecting additional river-specific data.

4.3.2 Field Procedures

1. Procedures for processing licence sales in each region need to be streamlined to ensure that, as far as possible, complete licence records for each two-monthly survey period are available as soon as possible. Any delay between the finish of the survey period and initiating telephone calls means a direct increase in the recall period, with potentially serious impacts on accuracy of recall.
2. Steps should be taken to minimise the number of angling waters which remain unidentified. Updated copies of the master list of lakes and rivers should be available on

⁷ Standard techniques (such as Neyman optimisation) are available for allocating sample effort between strata, although if applied uniformly across all regions these will tend to under-sample the smaller regions. The results of the 1994/96 survey will be invaluable for setting sample sizes for any future survey, but defining the “optimum” sample size for any particular stratum remains partly subjective. See Kish (1965) for a full discussion of issues in sample allocation.

demand, so that interviewers who encounter waters which are not listed can press the respondent for more details as to location.

3. As a corollary to the previous recommendation, the master list should explicitly identify all waters where duplicate names are a potential problem (e.g. Waiau, Wairoa).
4. The licence number and licence type should be recorded for all interviews. This will ensure that (a) if necessary, separate estimates of usage can be made for each licence class; (b) anglers contacted during two or more surveys can be identified, thereby allowing the total number of anglers fishing each water to be estimated; (c) follow-up calls can be made to resolve situations where the interview record is unclear, or seek additional information on a particular water (see Section 4.3.1).
5. Ensure quality control of all interviewers. Most interviewers involved in the 1994/96 survey did a good job, and some were outstanding; however a few provided records which were incomplete or difficult to interpret.

4.3.3 Licence Records

The following two recommendations do not relate specifically to a follow-up of the 1994/96 survey, but are more general comments relating to possibilities for improving access to fishing licence records. In comparison to other outdoor recreational activities, freshwater angling is somewhat unusual in being subject to a strictly controlled licensing system which automatically provides a great deal of information on the geographical distribution of anglers throughout New Zealand. However, this information base remains seriously under-utilised. For example, licence records alone should be sufficient to generate a definitive study of the incidence and distribution of tourist anglers. In the context of any future survey work, well defined linkages between the survey raw data and the corresponding licence records would open up a wide range of possibilities for detailed analysis of geographical and spatial trends, and would greatly improve our understanding of issues such as cross-boundary fishing.

1. A uniform system should be implemented for recording licence sales in all Fish & Game regions. This would not preclude individual regions from providing different types of licences as they see fit. However, given that the baseline information which needs to be stored for each licence (such as name, address, type of licence, date and place of purchase etc.) would appear to be common to all regions, a common database should be relatively straightforward to develop. A worthwhile interim measure, bearing in mind that any new system would take some time to develop, would be to assemble all licence records into a common database at the end of each season. Even though there appears to be wide variation between regions in the systems currently used, the current generation of PC database software is sufficiently versatile that merging records from different systems is highly unlikely to present any problems.
2. Country of residence or nationality (if other than New Zealand) should routinely be recorded on all licences, as a separate field if necessary. Currently there is a tendency for overseas anglers (particularly those who purchase short-term licences) to give a local address such as a hotel or homestay. Recording country of residence would ensure that, even if the address is unusable for survey purposes, unambiguous information can be obtained as to nationality. This would be invaluable for identifying areas most likely to be affected by increases in tourist numbers and, in relation to future surveys, would also help to quantify some of the non-sampling biases discussed in Section 4.1.1.1.

4.3.4 Calibration Surveys

Depending on how these and other survey data are likely to be used in the future, it may be appropriate to design and implement supplementary surveys, using alternative methodologies (such as on-site surveys), to provide independent estimates of usage for key angling waters. Cross-validation surveys of this type would identify any systematic discrepancies which might exist between survey methods (as discussed in Section 4.1.3), and would also yield a measure of how to correct for any such bias. Other possibilities could include follow-up surveys to estimate non-response bias, and systematic attempts (perhaps via fishing guides) to contact overseas anglers. Although it may be impractical to implement any such surveys on a national scale, a few well-structured surveys targeting specific waters would add greatly to the credibility of any usage estimates which may subsequently be derived. Depending on the annual work programme in each region, collecting the necessary data for a particular water may require only a small amount of additional work in an existing field programme.

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Appendix 1

Usage estimates (angler-days) for all angling waters identified during the 1994/96 angling survey, by survey period and region. Standard errors are listed in italics.

Northland

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	Total
Kaiwi Lakes	10	31	49	100	131	15	336
	<i>9</i>	<i>23</i>	<i>47</i>	<i>97</i>	<i>56</i>	<i>14</i>	<i>125</i>
Unidentified Water	0	0	0	45	0	16	61
	<i>0</i>	<i>0</i>	<i>0</i>	<i>38</i>	<i>0</i>	<i>15</i>	<i>41</i>
Total Days	10	31	49	146	131	31	398
	<i>9</i>	<i>23</i>	<i>47</i>	<i>104</i>	<i>56</i>	<i>21</i>	<i>131</i>

Auckland/Waikato

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	Total
Arapuni Lake	1286	1799	1946	639	783	844	7298
	449	400	479	251	183	353	901
Awakino River	140	305	209	127	11	5	797
	48	83	104	55	10	5	152
Bombay Pond	0	236	82	14	95	29	457
	0	124	79	14	39	28	155
Chelsea Sugar Works Pond	5	22	179	57	0	339	603
	5	15	123	34	0	167	211
Hakanoa Lake	69	28	0	57	0	0	154
	50	19	0	27	0	0	60
Hamilton Lake	0	89	238	47	55	15	443
	0	56	163	34	26	14	178
Hikutaia River	0	0	0	22	0	0	22
	0	0	0	20	0	0	20
Kaiaua Gravel Pits Pond	146	139	0	57	82	29	454
	102	75	0	27	41	28	139
Kakahu Stream	17	0	0	0	0	15	32
	11	0	0	0	0	14	18
Kaniwhaniwha Stream	289	264	221	86	0	0	859
	135	106	125	51	0	0	218
Karapiro Lake	460	1289	1285	329	459	986	4806
	92	357	335	136	171	400	675
Kauaeranga River	103	0	9	29	0	0	140
	48	0	8	19	0	0	53
Kereta Lake	34	97	0	0	0	0	132
	32	55	0	0	0	0	63
Komata River	17	0	0	0	0	0	17
	16	0	0	0	0	0	16
Kumeu/Kaipara River	17	0	0	0	0	0	17
	16	0	0	0	0	0	16
Little Waipa Stream	0	77	555	14	66	15	726
	0	36	201	14	38	14	208
Mangaohae Stream	36	182	0	43	41	0	302
	20	70	0	31	39	0	89
Mangaokewa Stream	9	0	0	29	0	0	37
	8	0	0	19	0	0	21
Mangaorongo Stream	0	277	0	0	0	0	277
	0	267	0	0	0	0	267
Mangaotaki River	40	138	14	0	0	0	192
	23	69	9	0	0	0	73
Mangatangi Reservoir	0	0	0	138	454	243	836
	0	0	0	85	99	72	149
Mangatepopo Stream	0	21	0	0	0	0	21
	0	14	0	0	0	0	14
Mangati Stream	0	0	0	22	0	0	22
	0	0	0	20	0	0	20
Mangatutu Stream	186	947	180	129	123	35	1600
	56	324	60	49	75	34	348
Mangawara Stream	0	0	0	0	14	0	14
	0	0	0	0	13	0	13
Mangawhero Stream	0	69	16	0	0	0	86
	0	67	16	0	0	0	68
Marokopa River	9	101	36	0	0	0	145
	8	46	24	0	0	0	53
Moakurarua Stream	22	73	196	0	33	0	324
	12	38	189	0	31	0	196

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	Total
Mokau River	99	6	170	0	0	0	275
	59	5	159	0	0	0	169
Ngakoahia Stream	9	180	17	14	27	0	248
	8	93	16	14	26	0	99
Ngutunui Stream	9	55	0	14	0	0	78
	8	38	0	14	0	0	41
Ohinemuri River	262	255	183	326	129	469	1623
	67	79	88	175	86	306	388
Ohura River	0	53	0	0	0	0	53
	0	49	0	0	0	0	49
Okaihau (Houghtons) Lake	77	125	16	43	55	0	316
	42	63	16	24	37	0	89
Omahine Stream	5	0	0	0	0	0	5
	5	0	0	0	0	0	5
Ongarue River	65	0	359	215	55	0	694
	41	0	317	170	52	0	366
Oraka Stream	64	55	0	13	0	0	131
	35	35	0	13	0	0	51
Ototoa Lake	76	378	25	100	264	88	931
	28	250	18	45	92	34	274
Parkinson Lake	9	0	0	14	0	0	23
	8	0	0	14	0	0	16
Pokaiwhenua Stream	65	202	16	50	14	15	362
	37	94	16	28	13	14	108
Puniu River	181	654	65	61	167	91	1219
	54	208	50	30	146	51	271
Pupuke Lake	43	153	620	57	14	354	1240
	33	110	273	44	13	151	336
Rapurapu Stream	0	0	131	0	0	0	131
	0	0	97	0	0	0	97
Tairua River	26	91	92	108	0	0	317
	15	46	48	69	0	0	97
Taringamotu River	0	0	16	0	0	0	16
	0	0	16	0	0	0	16
Tawarau River	17	14	0	0	0	0	31
	16	13	0	0	0	0	21
Thomsons Lake	0	0	0	57	27	0	85
	0	0	0	34	26	0	43
Tomarata Lake	184	0	0	0	0	0	184
	161	0	0	0	0	0	161
Waihou River	315	479	339	363	123	162	1781
	147	159	110	159	62	118	320
Waikato (lower) River	480	1681	2468	873	676	1067	7245
	113	365	563	215	207	280	794
Waimakariri Stream	179	95	82	56	117	24	553
	75	47	47	43	69	22	131
Waimiha Stream	43	14	16	143	0	0	217
	24	13	16	138	0	0	142
Waiomou Stream	9	206	114	135	27	0	491
	8	77	61	92	18	0	136
Waione Stream	9	28	0	0	0	0	36
	8	27	0	0	0	0	28
Waipa River	403	1555	359	255	14	15	2600
	125	635	130	168	13	14	682
Waipapa Lake	124	196	33	459	14	0	825
	55	69	32	441	13	0	451
Waipapa River	10	119	134	108	41	29	441

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	Total
	6	53	63	52	39	20	107
Waipari River	41	0	9	0	0	0	49
	40	0	8	0	0	0	41
Waitawheta River	103	14	33	14	0	0	164
	45	13	22	14	0	0	54
Waitekauri River	34	0	0	186	77	0	298
	23	0	0	179	73	0	195
Waiwawa River	57	129	695	108	66	0	1054
	30	83	383	89	46	0	405
Wanganui River	208	344	995	114	0	124	1784
	73	99	495	57	0	69	518
Whakapapa River	166	65	25	65	5	0	326
	80	34	19	31	5	0	94
Whangamarino River	0	42	0	29	14	0	84
	0	23	0	19	13	0	33
Unidentified Water	86	107	0	36	46	29	305
	36	54	0	25	32	28	82
Total Days	6341	13449	12173	5858	4185	5023	47030
	612	1132	1212	741	437	735	2099

Eastern

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	Total
Aniwhenua Lake	2771	2312	2426	2285	1359	174	11327
	726	587	1090	674	383	139	1637
Aratiatia Lake	53	120	6	0	0	0	179
	52	83	5	0	0	0	98
Atiamuri Lake	30	149	54	11	275	19	538
	29	121	48	10	188	19	231
Awahou Stream	0	189	0	0	0	0	189
	0	127	0	0	0	0	127
Deep Creek	148	43	0	0	0	0	191
	120	29	0	0	0	0	123
Flaxy Lake	104	259	521	183	180	275	1521
	61	153	351	110	102	134	437
Hamurana Stream	30	70	0	835	131	0	1065
	29	49	0	566	129	0	584
Hangaroa River	0	568	48	0	0	0	616
	0	417	47	0	0	0	420
Hauparu River	74	0	0	0	0	0	74
	72	0	0	0	0	0	72
Horomanga River	919	0	0	42	279	0	1240
	391	0	0	41	162	0	425
Kaitawa Lake	0	0	0	183	0	0	183
	0	0	0	181	0	0	181
Kaituna River	429	730	375	656	111	157	2457
	247	367	239	382	88	97	645
Maretai Lake	0	238	212	196	0	0	646
	0	165	200	192	0	0	323
Mata River	0	0	0	46	0	0	46
	0	0	0	45	0	0	45
Matahina Lake	209	0	642	0	32	0	884
	146	0	368	0	31	0	398
McLaren's Falls Dam	178	139	0	641	426	311	1695
	123	69	0	545	225	166	629
Motu River	0	0	48	92	100	0	240
	0	0	47	90	74	0	126
Ngamuwahine River	0	79	0	0	0	83	163
	0	78	0	0	0	69	104
Ngapouri Lake	0	79	0	0	0	0	79
	0	55	0	0	0	0	55
Ngongotaha Stream	0	3945	1419	2365	289	787	8804
	0	1982	827	1412	148	726	2675
Ohakuri Lake	77	1831	150	222	107	171	2559
	57	696	106	148	74	138	738
Ohau Channel	1561	130	477	747	1563	240	4718
	689	92	259	326	635	205	1050
Okareka Lake	672	476	204	480	1282	296	3410
	238	307	134	228	625	155	797
Okaro Lake	89	0	0	11	0	0	100
	65	0	0	10	0	0	66
Okataina Lake	1063	757	1682	826	1219	279	5827
	291	292	676	250	393	206	942
Otangimoana Stream	0	0	0	0	0	19	19
	0	0	0	0	0	19	19
Otara River	0	40	0	217	0	0	256
	0	39	0	152	0	0	157
Pongakawa Stream	25	30	0	0	0	0	55
	24	29	0	0	0	0	38

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	Total
Poutu Stream	0	0	0	11	0	0	11
	0	0	0	10	0	0	10
Pueto Stream	0	82	0	0	0	0	82
	0	48	0	0	0	0	48
Rangitaiki (Sect A) River	275	109	161	94	76	0	715
	119	83	111	83	53	0	208
Rangitaiki (Sect B) River	1039	417	1476	342	44	240	3557
	877	199	742	203	43	153	1194
Rangitaiki (Sect D) River	287	79	492	454	30	69	1411
	144	78	283	262	18	68	425
Rerewhakaaitu Lake	1318	2057	2964	1979	883	192	9394
	478	735	942	864	555	181	1656
Rotoehu Lake	561	344	610	737	32	11	2294
	249	158	317	387	31	10	582
Rotoiti Lake	9431	11620	7981	8081	4788	1465	43365
	1341	1666	1675	1240	1292	1091	3432
Rotokakahi Lake	0	0	0	916	0	0	916
	0	0	0	903	0	0	903
Rotoma Lake	1092	1943	1429	855	1246	41	6606
	329	599	764	397	671	24	1288
Rotomahana Lake	340	398	108	375	0	0	1220
	197	226	95	280	0	0	421
Rotorua Lake	6048	10631	6829	5505	6444	4735	40192
	1095	2095	2667	979	1843	1529	4404
Ruahihi Canal	0	119	642	46	120	145	1072
	0	117	368	45	87	136	421
Ruakituri River	634	1250	96	137	0	267	2385
	246	516	95	101	0	206	623
Ruruanga Stream	0	175	0	0	0	0	175
	0	96	0	0	0	0	96
Tahunaatara Stream	30	0	0	275	0	137	442
	29	0	0	271	0	136	305
Takaputahi River	0	40	0	0	0	0	40
	0	39	0	0	0	0	39
Tarawera Lake	7870	6413	7779	10953	4796	629	38439
	1230	1367	1579	2911	1236	240	3991
Tarawera River	1086	1155	935	1328	406	102	5011
	340	368	412	957	240	70	1183
Tikitapu Lake	148	90	6	11	0	0	255
	145	63	5	10	0	0	159
Tuai Lake	134	670	214	92	87	0	1197
	83	410	149	90	86	0	461
Utuhina Stream	8	231	1295	46	732	0	2311
	7	122	1267	45	670	0	1439
Waiari Stream	0	119	0	0	0	137	257
	0	117	0	0	0	136	179
Waiiau River	74	119	88	0	0	0	282
	72	117	86	0	0	0	162
Waihua Stream	0	0	0	0	306	0	306
	0	0	0	0	302	0	302
Waikareiti Lake	68	332	12	102	0	0	514
	59	253	8	91	0	0	275
Waikaremoana Lake	3151	8446	2800	2961	1915	1344	20617
	567	1653	543	750	761	535	2186
Waikato River	90	559	2131	500	359	69	3708
	88	242	1501	270	281	68	1573
Waimana River	273	1192	144	102	0	206	1917

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	Total
	265	553	142	91	0	204	668
Waioeka River	237	278	1282	342	340	0	2479
	206	154	1145	195	334	0	1236
Waiotahi River	30	79	0	0	0	0	109
	29	55	0	0	0	0	62
Wairata Stream	0	109	0	0	0	0	109
	0	83	0	0	0	0	83
Wairoa River	0	0	96	46	0	0	142
	0	0	95	45	0	0	105
Waiteti Stream	193	1030	406	164	0	50	1843
	137	474	267	129	0	28	576
Whakamaru Lake	307	1810	168	797	76	206	3364
	188	932	106	394	53	151	1047
Whakatane River	0	472	796	416	0	549	2233
	0	271	449	260	0	543	799
Wheao River	84	120	96	46	44	157	547
	63	83	95	45	43	97	182
Whirinaki River	610	583	299	92	239	0	1823
	237	354	241	64	178	0	525
Unidentified Water	25	119	913	203	0	0	1260
	24	117	561	160	0	0	595
Total Days	43876	65373	50513	48041	30316	13561	251680
	2820	4536	4891	4310	3171	2268	9286

Taupo

Usage estimates for the Taupo Conservancy are based on ...

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	Total
Hinemaiaia River	231	0	0	1033	345	291	1900
Taupo Lake	17868	41016	16393	30707	9501	10004	125489
Tauranga-Taupo River	2762	0	0	2263	3506	3424	11955
Tongariro River	3628	0	0	5915	9588	9367	28498
Waimarino River	53	0	0	488	343	74	958
Waiotaka Stream	193	0	0	301	499	428	1421
Waitahanui River	1734	0	0	1554	2301	1951	7540
Total Days	26469	41016	16393	42261	26083	25539	177761

Taranaki

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Cowley Lake	23	30	0	28	0	0	81
	14	27	0	14	0	0	34
Huatoki Stream	6	0	26	24	0	0	56
	6	0	24	21	0	0	32
Kahouri Stream	0	42	0	0	0	0	42
	0	38	0	0	0	0	38
Kaiauai Stream	56	36	5	0	0	0	97
	35	28	5	0	0	0	45
Kapuni Stream	23	6	5	19	0	0	53
	14	5	5	12	0	0	20
Kaupokonui Stream	29	127	0	0	0	0	156
	19	110	0	0	0	0	111
Konini Stream	0	16	0	0	0	0	16
	0	15	0	0	0	0	15
Makatote River	0	0	120	0	0	0	120
	0	0	90	0	0	0	90
Maketawa Stream	28	42	0	28	0	0	99
	13	27	0	25	0	0	39
Makuri Stream	0	0	106	0	0	0	106
	0	0	87	0	0	0	87
Mangahume Stream	0	0	12	0	0	0	12
	0	0	11	0	0	0	11
Mangamahoe Lake	389	427	280	148	47	91	1383
	140	139	90	69	21	36	231
Mangamawhete Stream	9	0	0	0	0	0	9
	8	0	0	0	0	0	8
Manganui-o-te-ao River	285	908	728	29	21	0	1971
	72	172	158	20	15	0	246
Manganui River	11	52	65	0	0	30	159
	7	34	54	0	0	27	70
Mangaoraka Stream	148	18	21	0	0	0	187
	104	12	13	0	0	0	106
Mangatoki Stream	119	6	73	0	0	0	199
	108	5	51	0	0	0	119
Mangawhero River	68	147	222	180	0	0	617
	52	58	135	88	0	0	179
Mangorei Stream	80	24	5	0	0	0	109
	67	22	5	0	0	0	71
Namunamu Lake	73	117	46	38	16	12	301
	54	82	36	26	15	7	109
Ngatoro Stream	34	0	0	5	0	0	39
	31	0	0	5	0	0	31
Oakura River	6	6	16	0	0	0	27
	5	5	10	0	0	0	13
Ohakune Lake	43	45	5	9	0	12	114
	30	25	5	8	0	10	41
Okahu Stream	63	0	0	7	0	10	80
	47	0	0	7	0	9	48
Omarae Stream	0	0	10	0	0	0	10
	0	0	9	0	0	0	9
Opunake Lake	6	0	0	0	5	20	31
	5	0	0	0	5	18	19
Patea River	45	175	16	27	0	20	284
	24	113	9	20	0	18	119
Pauri Lake	28	0	0	0	0	10	39
	26	0	0	0	0	9	27

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Piakau South Stream	0	36	0	0	0	0	36
	0	33	0	0	0	0	33
Retaruke River	60	0	18	0	0	0	78
	57	0	17	0	0	0	59
Rotokura Lake	18	69	5	0	0	17	109
	9	31	5	0	0	15	36
Rotomanu Lake	391	28	62	59	57	121	718
	138	18	28	28	40	43	156
Rotorangi Lake	56	104	16	0	31	25	232
	19	56	14	0	28	22	70
Ruatiti Stream	0	0	31	0	0	0	31
	0	0	28	0	0	0	28
Stony River	69	12	6	9	21	31	148
	24	8	5	8	15	16	35
Taonui Stream	380	6	16	0	0	0	402
	255	5	14	0	0	0	256
Taungatara Stream	6	0	0	0	0	0	6
	5	0	0	0	0	0	5
Tawhiti Stream	6	0	0	0	0	0	6
	5	0	0	0	0	0	5
Te Henui Stream	45	143	103	0	0	0	292
	23	111	74	0	0	0	135
Timaru Stream	23	6	0	0	0	0	29
	12	5	0	0	0	0	14
Tokiahuru Stream	6	24	49	0	0	0	79
	6	22	30	0	0	0	38
Turakina River	0	63	0	0	0	0	63
	0	61	0	0	0	0	61
Virginia Lake	48	132	90	27	0	23	321
	21	62	34	16	0	16	77
Waiaua River	34	6	31	5	5	20	102
	26	5	28	4	5	18	43
Waimarino Stream	0	18	0	0	0	0	18
	0	12	0	0	0	0	12
Waingongoro River	510	613	301	33	73	20	1550
	117	195	76	17	40	9	244
Waiongana Stream	68	0	31	0	0	0	100
	44	0	24	0	0	0	50
Waitaiki Stream	0	0	21	0	0	10	31
	0	0	19	0	0	9	21
Waitara River	18	0	5	0	0	0	23
	12	0	5	0	0	0	13
Waiwhakaiho River	177	99	123	52	42	42	535
	55	47	75	36	27	20	115
Warea River	20	0	5	5	0	0	30
	11	0	5	4	0	0	13
Whangaehu River	0	0	0	5	0	0	5
	0	0	0	4	0	0	4
Wiritoa Lake	9	0	0	0	5	0	14
	8	0	0	0	5	0	9
Unidentified Water	0	23	0	5	14	0	42
	0	15	0	5	13	0	20
Total Days	3516	3608	2678	742	338	516	11398
	417	396	313	135	78	83	679

Hawkes Bay

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Esk River	362	1592	0	0	0	0	1954
	91	0	0	0	0	0	91
Hautapu River	6	45	0	0	0	0	51
	6	16	0	0	0	0	17
Inangatahi Stream	25	110	0	0	0	0	135
	18	0	0	0	0	0	18
Kaipō River	6	27	0	0	0	0	33
	6	0	0	0	0	0	6
Makahu River	19	82	0	0	0	0	101
	10	0	0	0	0	0	10
Makaroro River	7	30	0	0	0	0	37
	4	0	0	0	0	0	4
Mangaone River	69	302	0	0	0	0	371
	27	0	0	0	0	0	27
Mangaonuku Stream	37	165	0	0	0	0	202
	21	0	0	0	0	0	21
Mangatainoka River	37	165	0	0	0	0	202
	29	0	0	0	0	0	29
Mangataura Stream	19	82	0	0	0	0	101
	10	0	0	0	0	0	10
Mangatutu Stream	50	252	0	0	0	0	302
	21	31	0	0	0	0	37
Maraetotara River	94	604	0	0	0	0	698
	35	183	0	0	0	0	187
Mohaka River	650	2746	240	33	104	0	3773
	122	93	136	23	73	0	219
Ngaruroro River	633	2958	117	52	0	0	3760
	132	75	48	46	0	0	166
Ohara Stream	31	137	0	0	0	0	168
	19	0	0	0	0	0	19
Poporangi Stream	19	82	0	0	0	0	101
	17	0	0	0	0	0	17
Ripia River	25	110	0	0	0	0	135
	18	0	0	0	0	0	18
Taruarau River	16	117	89	0	0	0	222
	12	34	71	0	0	0	79
Te Hoe River	0	14	0	0	0	0	14
	0	13	0	0	0	0	13
Te Pohue Lake	44	206	9	0	0	0	258
	40	13	8	0	0	0	43
Tukipo River	102	16	18	0	0	0	136
	76	15	17	0	0	0	79
Tukituki River	2566	10993	259	77	111	16	14022
	345	126	162	52	76	15	412
Tutaekuri River	1373	5722	0	0	0	32	7127
	236	0	0	0	0	31	238
Tutira Lake	569	2503	0	0	0	16	3088
	150	0	0	0	0	15	151
Waikari River	16	70	37	0	0	0	123
	9	0	36	0	0	0	37
Waikoau River	12	55	0	0	0	0	67
	11	0	0	0	0	0	11
Waipawa River	124	467	0	0	0	16	607
	37	0	0	0	0	15	40
Waipunga River	6	27	16	0	0	0	50
	6	0	16	0	0	0	17

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Unidentified Water	55	30	0	0	0	0	85
	35	27	0	0	0	0	44
Total Days	6972	29709	783	162	215	79	37920
	503	260	232	74	105	40	627

Wellington

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Akatarawa River	0	0	71	0	0	0	71
	0	0	69	0	0	0	69
Alice Lake	0	0	14	0	0	0	14
	0	0	14	0	0	0	14
Hautapu River	0	866	0	191	0	0	1057
	0	438	0	111	0	0	451
Henley Lake	423	1030	354	0	350	95	2253
	208	643	343	0	222	92	795
Hokowhitu Lagoon	116	58	28	0	16	0	219
	91	43	19	0	16	0	104
Hutt River	2772	5185	6293	1580	2383	1748	19960
	597	1131	1226	460	703	503	2024
Kahuterawa Stream	35	32	35	0	0	8	110
	24	31	34	0	0	7	52
Kaiwharawhara Stream	18	0	0	0	0	0	18
	18	0	0	0	0	0	18
Karori Stream	72	47	0	0	0	0	120
	70	46	0	0	0	0	84
Kawhatau River	18	116	18	68	64	48	331
	18	71	17	59	38	46	113
Kopuaranga River	36	322	124	38	0	0	521
	35	208	104	26	0	0	237
Kopureherehere Lake	272	316	0	0	0	126	714
	263	220	0	0	0	83	353
Korokoro Stream	0	0	18	0	0	0	18
	0	0	17	0	0	0	17
Kourarau Dam	54	354	266	115	16	47	851
	39	180	126	58	16	34	233
Makakahi River	370	681	89	0	0	32	1171
	301	340	86	0	0	22	462
Makara Stream	51	47	0	0	0	0	99
	48	34	0	0	0	0	59
Makiekie River	0	32	0	77	0	0	108
	0	31	0	74	0	0	80
Makuri River	235	296	248	38	0	0	817
	126	119	162	37	0	0	241
Manawatu River	3014	4325	2334	1639	319	336	11966
	838	729	500	572	123	100	1355
Mangahao River	54	16	120	6	16	0	213
	30	15	61	6	16	0	71
Mangaohane Stream	0	0	0	0	0	27	27
	0	0	0	0	0	25	25
Mangaroa River	0	11	106	0	0	0	117
	0	10	77	0	0	0	77
Mangatainoka River	659	1120	445	343	200	276	3042
	251	395	145	117	93	148	534
Mangatarere Stream	51	0	211	0	0	0	262
	48	0	125	0	0	0	134
Mangatoro Stream	18	0	35	0	0	0	54
	18	0	34	0	0	0	39
Mangaweka Stream	9	79	0	0	0	0	88
	8	55	0	0	0	0	56
Moawhango River	0	16	0	172	0	0	188
	0	15	0	96	0	0	97
Ohau River	0	148	0	38	48	0	233
	0	89	0	37	26	0	100

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Oporua Spillway	0	79	0	0	0	0	79
	0	76	0	0	0	0	76
Oroua River	48	22	41	62	32	0	204
	37	16	35	59	31	0	85
Otaki River	54	180	35	0	0	424	694
	39	111	24	0	0	185	220
Pakuratahi River	0	0	53	0	0	0	53
	0	0	38	0	0	0	38
Pohangina River	217	591	0	115	166	311	1400
	194	201	0	111	69	159	347
Rangitikei River	941	2089	1154	892	290	347	5713
	221	543	243	230	102	167	703
Ruamahanga River	945	1951	2316	1035	536	602	7386
	390	458	568	302	175	171	914
Tauherenikau River	0	65	283	0	0	16	364
	0	35	274	0	0	15	277
Tauweru River	0	32	18	0	0	0	49
	0	31	17	0	0	0	35
Tiraumea River	8	0	0	38	0	0	46
	7	0	0	37	0	0	38
Tokomaru River	36	32	71	19	0	0	158
	25	22	69	19	0	0	78
Turitea Stream	69	16	18	0	0	0	102
	50	15	17	0	0	0	55
Waikanae River	91	142	177	121	79	142	752
	63	58	126	69	54	62	187
Waingawa River	0	243	94	77	0	16	429
	0	204	45	45	0	15	214
Wainui Stream	9	79	0	0	0	0	88
	8	76	0	0	0	0	77
Wainuiomata River	849	490	992	56	0	0	2388
	385	208	400	40	0	0	594
Waiohine River	91	528	407	0	212	87	1325
	52	324	175	0	157	55	408
Waipoua River	0	63	0	57	0	16	136
	0	61	0	56	0	15	84
Wairarapa Lake	0	43	142	0	16	0	200
	0	32	137	0	16	0	142
Waitawa Lake	0	0	531	261	32	0	824
	0	0	515	175	31	0	544
Whakatikei River	36	16	18	0	0	0	70
	25	15	17	0	0	0	34
Whitby Lakes	181	522	0	95	79	55	932
	175	460	0	60	63	46	502
Unidentified Water	26	12	71	0	0	0	108
	17	7	54	0	0	0	57
Total Days	11880	22290	17228	7133	4853	4757	68142
	1340	1958	1717	893	806	656	3233

Nelson/Marlborough

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Acheron River	0	0	60	18	0	0	78
	0	0	59	18	0	0	62
Alma River	0	0	0	37	0	0	37
	0	0	0	36	0	0	36
Anatoki River	0	353	0	0	0	0	353
	0	237	0	0	0	0	237
Aorere River	497	77	0	55	0	24	654
	194	63	0	31	0	23	207
Argyle Pond	158	83	344	312	207	174	1278
	59	54	131	96	91	122	237
Awatere River	0	0	0	148	0	49	196
	0	0	0	110	0	47	119
Bartletts Creek	23	0	0	0	0	0	23
	21	0	0	0	0	0	21
Baton River	45	55	133	206	0	0	438
	31	54	68	103	0	0	139
Branch River	64	16	0	148	0	0	228
	27	15	0	113	0	0	117
Buller (upper) River	1442	447	917	499	65	85	3456
	379	131	467	179	37	53	644
Clarence River	133	601	87	18	0	0	840
	92	355	65	18	0	0	373
Cobb Reservoir	109	148	0	0	118	61	435
	60	78	0	0	75	35	128
Cobb River	111	35	27	55	60	0	289
	56	34	27	40	44	0	92
Conway River	12	0	0	0	0	0	12
	11	0	0	0	0	0	11
D`Urville River	90	0	0	0	0	0	90
	42	0	0	0	0	0	42
Daniells Lake	36	130	60	0	0	0	226
	34	129	59	0	0	0	146
Glenroy River	30	0	37	0	0	0	67
	17	0	36	0	0	0	40
Goulter River	15	0	0	18	0	0	34
	14	0	0	18	0	0	23
Gowan River	68	0	0	0	0	0	68
	41	0	0	0	0	0	41
Hope River	36	0	0	0	0	0	36
	22	0	0	0	0	0	22
Kaituna River	8	0	180	0	0	0	187
	7	0	178	0	0	0	178
Leatham River	68	29	0	0	0	0	97
	33	20	0	0	0	0	39
Lee River	8	0	0	0	122	0	129
	7	0	0	0	118	0	118
Maitai River	53	38	0	61	0	31	182
	30	29	0	34	0	25	59
Mangles River	112	130	120	38	0	0	400
	57	54	118	26	0	0	144
Maruia River	684	313	97	37	0	61	1192
	312	173	69	25	0	58	369
Matakitaki River	387	77	8	28	0	12	513
	142	57	7	22	0	11	155
Matiri River	0	24	55	16	0	0	95
	0	17	53	15	0	0	58

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Motueka River	2327	3568	1553	1159	613	845	10065
	392	1086	530	251	234	212	1333
Motupiko River	67	124	137	55	0	0	383
	36	92	110	40	0	0	153
Opawa River	158	212	137	148	176	43	873
	87	174	88	143	127	27	288
Opouri River	60	114	328	0	0	0	502
	37	63	238	0	0	0	249
Owen River	30	14	55	38	0	0	136
	29	14	53	26	0	0	67
Paturau River	8	0	0	0	0	0	8
	7	0	0	0	0	0	7
Pearse River	23	6	240	0	0	0	268
	16	5	237	0	0	0	238
Pelorus River	269	573	425	281	340	207	2096
	63	227	233	119	139	67	385
Rai River	211	485	441	203	54	49	1444
	63	123	261	119	51	22	323
Rainbow River	23	53	0	0	0	0	76
	16	38	0	0	0	0	41
Riwaka River	83	177	246	18	95	0	619
	46	86	178	18	77	0	218
Rolling River	8	0	0	0	0	0	8
	7	0	0	0	0	0	7
Roses Overflow	45	0	0	0	0	0	45
	42	0	0	0	0	0	42
Rotoiti Lake	221	502	968	193	70	104	2058
	60	172	502	75	67	49	545
Rotoroa Lake	400	138	199	266	0	24	1028
	135	74	115	109	0	16	222
Sabine River	83	67	82	0	0	0	232
	30	53	59	0	0	0	85
Severn River	0	0	0	18	0	0	18
	0	0	0	18	0	0	18
Speargrass Creek	0	83	0	0	0	0	83
	0	81	0	0	0	0	81
Spring Creek	68	69	0	18	12	0	167
	40	53	0	18	11	0	70
Takaka River	474	383	27	37	241	0	1161
	213	227	27	36	144	0	346
Taylor River	8	0	109	0	0	19	136
	7	0	107	0	0	17	108
Tennyson Lake	23	407	0	18	0	0	448
	21	329	0	18	0	0	330
Tinline River	6	0	0	0	0	0	6
	5	0	0	0	0	0	5
Travers River	177	114	137	18	0	0	446
	66	57	133	18	0	0	160
Tuamarina River	0	18	0	0	0	0	18
	0	17	0	0	0	0	17
Tunakino River	8	0	0	0	0	0	8
	7	0	0	0	0	0	7
Tutaki River	60	112	0	38	0	0	210
	32	74	0	26	0	0	84
Wai-iti River	0	71	0	0	0	25	96
	0	48	0	0	0	23	53
Waihopai River	38	59	0	0	0	0	97

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
	35	57	0	0	0	0	67
Waikakaho River	0	0	16	0	0	0	16
	0	0	14	0	0	0	14
Waikoropupu River	43	0	0	0	0	0	43
	40	0	0	0	0	0	40
Waimea River	694	491	275	4	35	284	1783
	205	182	163	3	34	110	339
Waingaro River	38	0	0	0	0	12	50
	36	0	0	0	0	10	37
Wairau River	1951	1598	1162	1531	1209	1025	8477
	385	371	300	306	328	296	815
Wairoa River	45	107	55	20	0	52	279
	32	60	53	17	0	29	93
Wakapuaka River	15	61	191	16	0	0	283
	14	52	187	15	0	0	195
Wangapeka River	226	386	164	111	35	49	971
	64	137	91	91	34	28	203
Unidentified Water	0	0	33	0	0	12	45
	0	0	32	0	0	11	33
Total Days	12074	12549	9104	5885	3450	3249	46312
	884	1409	1157	568	515	426	2208

West Coast

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Ahaura Lake	0	24	0	9	0	0	33
	0	22	0	0	0	0	22
Ahaura River	14	147	281	233	0	0	676
	13	56	139	72	0	0	166
Arahura River	7	161	0	54	0	0	222
	6	75	0	14	0	0	77
Arawata River	0	16	184	0	0	0	200
	0	15	181	0	0	0	182
Arnold River	446	752	136	199	61	0	1595
	121	400	75	0	61	0	429
Awarau River	109	10	0	5	0	0	123
	66	8	0	0	0	0	66
Big River	7	90	0	35	0	0	132
	6	45	0	0	0	0	45
Blue Grey River	42	0	0	7	0	0	49
	25	0	0	0	0	0	25
Bradshaws Creek	14	0	0	5	0	0	19
	13	0	0	0	0	0	13
Brunner Lake	1365	1058	815	975	0	31	4244
	327	252	289	222	0	29	551
Buller (lower) River	203	690	230	416	0	61	1599
	44	154	129	72	0	35	221
Cascade River	40	30	116	15	0	0	200
	30	18	69	0	0	0	77
Clarke River	0	18	0	0	0	0	18
	0	17	0	0	0	0	17
Copland River	0	6	0	2	0	0	8
	0	5	0	0	0	0	5
Crooked River	58	482	0	45	0	0	585
	35	389	0	0	0	0	390
Crow River	8	58	0	0	0	0	65
	7	38	0	0	0	0	39
Deep Creek	0	6	0	2	0	0	8
	0	5	0	0	0	0	5
Ellery Lake	0	24	37	9	0	0	70
	0	22	36	0	0	0	42
Fox River	0	12	0	4	0	0	16
	0	11	0	0	0	0	11
Grey (lower) River	310	718	255	444	0	0	1727
	121	157	127	7	0	0	236
Grey (upper) River	457	628	210	364	0	0	1658
	351	393	104	161	0	0	560
Haast River	19	227	66	57	0	0	369
	13	133	54	36	0	0	149
Hapuka River	0	18	0	6	0	0	24
	0	16	0	0	0	0	16
Harris Creek	29	44	0	26	0	0	99
	14	17	0	0	0	0	22
Haupiri Lake	0	36	0	13	0	0	49
	0	33	0	0	0	0	33
Haupiri River	15	76	12	37	0	0	140
	7	28	11	0	0	0	31
Heaphy River	15	0	0	0	0	0	15
	14	0	0	0	0	0	14
Hohonu River	0	12	0	4	0	0	16
	0	8	0	0	0	0	8

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Hokitika River	192	410	184	155	0	0	940
	95	203	72	0	0	0	236
Ianthe Lake	59	28	18	38	0	0	143
	29	15	18	0	0	0	37
Inangahua River	375	173	55	187	0	0	790
	142	54	39	54	0	0	166
Jackson River	30	24	21	9	0	0	84
	29	13	20	0	0	0	38
Johnson River	20	33	0	0	0	0	53
	20	32	0	0	0	0	38
Kakapotahi River	0	36	10	13	0	0	59
	0	33	10	0	0	0	34
Kaniere Lake	64	187	126	121	0	0	498
	35	59	60	0	0	0	91
Kaniere River	0	24	0	9	0	0	33
	0	17	0	0	0	0	17
Karamea River	482	293	78	62	0	0	916
	407	109	62	7	0	0	426
Karangarua River	0	0	37	13	0	0	50
	0	0	36	0	0	0	36
Kawhaka Hydro	6	0	0	2	0	0	8
	4	0	0	0	0	0	4
Kokatahi River	5	0	0	2	0	0	7
	5	0	0	0	0	0	5
La Fontaine Stream	198	42	15	27	0	0	282
	123	23	15	0	0	0	126
Leslie River	33	0	0	12	0	0	45
	23	0	0	7	0	0	24
Little Grey River	20	0	0	0	0	0	20
	20	0	0	0	0	0	20
Little Wanganui River	14	0	0	5	0	0	19
	9	0	0	0	0	0	9
Mahinapua Creek	36	24	0	22	0	0	82
	23	22	0	0	0	0	32
Mahinapua Lake	0	0	37	13	0	0	50
	0	0	36	0	0	0	36
Mahitahi River	0	0	60	0	0	0	60
	0	0	59	0	0	0	59
Makawhio River	0	53	65	20	0	0	138
	0	37	45	0	0	0	58
Mapourika Lake	296	207	755	201	0	0	1458
	290	63	385	0	0	0	486
Martyr River	30	0	0	0	0	0	30
	29	0	0	0	0	0	29
Mawheraiti River	40	42	0	47	0	0	129
	32	33	0	18	0	0	50
Moeraki Lake	18	6	0	4	0	8	36
	13	5	0	0	0	7	16
Moeraki River	0	17	21	0	0	0	38
	0	17	20	0	0	0	26
Mokihinui River	219	252	109	140	0	0	720
	97	109	70	0	0	0	162
Montgomerie River	15	0	0	0	0	0	15
	14	0	0	0	0	0	14
Moonlight Creek	7	6	0	5	0	0	18
	6	5	0	0	0	0	8
Murray Creek	0	35	0	12	0	0	47

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
	0	16	0	0	0	0	16
Nelson Creek	0	87	0	29	0	0	116
	0	57	0	0	0	0	57
New Creek	7	0	0	2	0	0	9
	6	0	0	0	0	0	6
New River	0	10	0	3	0	0	13
	0	8	0	0	0	0	8
Ohikanui River	197	53	12	60	0	0	322
	100	25	11	0	0	0	104
Okari River	7	0	0	2	0	0	9
	6	0	0	0	0	0	6
Okarito River	0	24	0	9	0	0	33
	0	17	0	0	0	0	17
Okuru River	39	140	0	11	32	0	222
	30	110	0	0	31	0	118
Orangipuku River	51	15	18	22	0	0	107
	34	11	18	0	0	0	40
Orowaiti River	11	0	12	8	0	0	31
	7	0	11	0	0	0	13
Paringa Lake	38	154	216	67	0	0	476
	27	104	75	0	0	0	131
Paringa River	14	89	21	7	0	0	131
	13	81	20	0	0	0	85
Poerua Lake	275	21	120	21	0	0	437
	137	10	118	0	0	0	181
Poerua River	14	6	52	16	0	0	87
	13	5	35	0	0	0	38
Pororari River	15	24	0	14	0	0	54
	14	22	0	0	0	0	26
Punakaiki River	14	36	0	18	0	0	68
	13	24	0	0	0	0	28
Roaring Lion River	0	53	0	55	0	0	108
	0	51	0	40	0	0	65
Rough River	117	55	0	24	0	0	196
	88	26	0	0	0	0	92
Stony (Te Wharau) River	74	0	0	2	0	0	76
	42	0	0	0	0	0	42
Styx River	0	6	13	7	0	0	26
	0	5	12	0	0	0	13
Taipo River	9	0	0	3	0	0	12
	6	0	0	0	0	0	6
Taramakau River	232	637	590	416	17	0	1893
	103	275	251	14	17	0	387
Thomas River	17	0	0	0	0	0	17
	16	0	0	0	0	0	16
Totara River	0	10	0	3	0	0	13
	0	8	0	0	0	0	8
Trent River	0	6	0	2	0	0	8
	0	5	0	0	0	0	5
Turnbull River	10	33	21	4	0	0	68
	9	23	20	0	0	0	32
Wahapo Lake	0	6	0	2	0	0	8
	0	5	0	0	0	0	5
Waitaha River	21	138	0	34	0	0	193
	18	79	0	0	0	0	81
Waitahu River	55	34	0	19	0	0	108
	31	19	0	0	0	0	37

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Waitakere River	0	30	0	11	0	0	41
	0	27	0	0	0	0	27
Waitangi-taona River	24	49	0	26	0	0	98
	10	26	0	0	0	0	28
Wanganui River	112	0	0	2	0	0	114
	98	0	0	0	0	0	98
Whataroa River	0	24	0	9	0	0	33
	0	22	0	0	0	0	22
Unidentified Water	0	6	212	857	0	0	1075
	0	5	180	605	0	0	632
Total Days	6668	8979	5220	5851	110	100	26928
	803	904	699	677	70	46	1554

North Canterbury

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Ada River	0	0	0	18	0	0	18
	0	0	0	18	0	0	18
Ashley River	2072	1367	1037	23	35	0	4533
	547	764	468	22	34	0	1051
Avon River	868	0	104	0	0	46	1017
	438	0	101	0	0	44	452
Boyle River	30	332	0	0	0	24	386
	29	265	0	0	0	23	268
Broken River	53	391	240	0	0	0	684
	37	222	237	0	0	0	327
Bruce Stream	60	12	74	0	0	0	145
	49	8	71	0	0	0	87
Bryndwyr Lake	296	0	0	0	0	0	296
	290	0	0	0	0	0	290
Cam River	473	1043	60	0	0	0	1577
	264	1032	59	0	0	0	1067
Catherine Lake	0	0	553	71	0	0	624
	0	0	341	71	0	0	349
Coleridge Lake	1767	1233	1932	1264	613	286	7094
	376	514	893	575	391	183	1311
Cust River	237	65	60	0	0	0	362
	169	64	59	0	0	0	190
Ellesmere Lake	355	70	0	0	0	0	424
	275	68	0	0	0	0	283
Eyre River	77	0	0	0	0	0	77
	54	0	0	0	0	0	54
Forsyth Lake	308	0	0	0	0	0	308
	169	0	0	0	0	0	169
Georgina Lake	463	342	80	0	0	0	885
	167	213	62	0	0	0	278
Glentui River	0	0	207	0	0	0	207
	0	0	115	0	0	0	115
Grasmere Lake	296	265	260	0	0	0	821
	152	205	119	0	0	0	282
Halswell River	1065	695	0	0	0	0	1760
	563	678	0	0	0	0	881
Hanmer River	24	0	0	0	0	0	24
	23	0	0	0	0	0	23
Harper River	118	0	0	0	0	0	118
	116	0	0	0	0	0	116
Harts Creek	195	813	0	0	0	0	1008
	128	501	0	0	0	0	517
Hawdon Lake	177	0	0	0	0	0	177
	108	0	0	0	0	0	108
Hawkins River	77	130	0	0	0	0	207
	46	129	0	0	0	0	137
Heathcote River	30	0	0	0	0	0	30
	29	0	0	0	0	0	29
Hope River	148	261	104	0	0	0	512
	119	258	101	0	0	0	302
Hororata River	30	130	0	0	0	0	160
	29	129	0	0	0	0	132
Hurunui River	1328	6299	7450	924	1103	0	17105
	403	2049	2339	537	975	0	3327
Ida Lake	30	0	479	0	0	0	509

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
	29	0	474	0	0	0	475
Irwell River	107	326	0	0	0	0	433
	52	232	0	0	0	0	237
Kaiapoi River	391	145	4251	286	0	174	5247
	150	94	2124	223	0	172	2150
Kaituna River	89	0	0	0	0	0	89
	87	0	0	0	0	0	87
Katrine Loch	89	0	104	0	0	0	192
	87	0	101	0	0	0	134
Kowai River	13	0	0	0	0	0	13
	12	0	0	0	0	0	12
L II River	801	261	0	1071	0	0	2132
	269	203	0	1059	0	0	1111
Lewis River	12	261	0	0	0	0	273
	11	258	0	0	0	0	258
Little River	473	42	0	0	0	0	515
	306	40	0	0	0	0	309
Lyndon Lake	1455	1517	222	94	0	0	3289
	479	632	104	74	0	0	803
Mason Lake	0	0	300	0	0	0	300
	0	0	296	0	0	0	296
Minchin Lake	0	196	0	0	0	0	196
	0	193	0	0	0	0	193
Motunau River	17	0	0	0	0	0	17
	16	0	0	0	0	0	16
Nina River	0	261	0	0	0	0	261
	0	258	0	0	0	0	258
Pearson Lake	221	514	797	214	0	0	1746
	112	244	545	157	0	0	628
Porter River	0	130	240	0	0	0	370
	0	129	237	0	0	0	270
Poulter River	30	0	0	0	0	0	30
	29	0	0	0	0	0	29
Rakaia River	2137	11021	18129	2943	245	174	34649
	585	2002	3014	1136	191	172	3846
Ryton River	0	0	0	71	0	0	71
	0	0	0	71	0	0	71
Sarah Lake	325	65	173	0	0	0	563
	144	64	100	0	0	0	187
Selfe Lake	166	162	214	0	61	0	604
	97	133	136	0	61	0	222
Selwyn River	2310	2469	527	1045	351	0	6702
	509	979	314	705	264	0	1372
Sheppard Lake	59	65	109	0	0	0	233
	58	64	76	0	0	0	115
Silverstream	89	1116	0	23	0	174	1402
	87	589	0	22	0	172	620
Styx River	335	65	37	0	0	0	437
	175	64	36	0	0	0	190
Sumner Lake	237	151	0	0	0	0	387
	135	95	0	0	0	0	165
Taylor Lake	385	165	198	0	0	0	748
	198	97	122	0	0	0	252
Tentburn Outfall	0	0	2277	0	0	0	2277
	0	0	1178	0	0	0	1178
Waiiau River	12	323	966	111	0	32	1444

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
	<i>11</i>	<i>186</i>	<i>442</i>	<i>107</i>	<i>0</i>	<i>31</i>	<i>493</i>
Waimakariri River	3926	25236	22385	4257	1943	610	58357
	<i>734</i>	<i>5190</i>	<i>4284</i>	<i>1673</i>	<i>1255</i>	<i>373</i>	<i>7095</i>
Waimakariri S Branch River	1568	671	309	0	0	15	2563
	<i>514</i>	<i>383</i>	<i>246</i>	<i>0</i>	<i>0</i>	<i>15</i>	<i>687</i>
Wairarapa Stream	226	0	0	0	0	0	226
	<i>143</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>143</i>
Unidentified Water	0	0	212	0	0	174	387
	<i>0</i>	<i>0</i>	<i>180</i>	<i>0</i>	<i>0</i>	<i>172</i>	<i>250</i>
Total Days	26045	58611	64089	12413	4351	1710	167220
	<i>1877</i>	<i>6354</i>	<i>6418</i>	<i>2536</i>	<i>1670</i>	<i>543</i>	<i>9726</i>

Central South Island

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Ahuriri River	113	1497	823	127	33	0	2592
	54	622	339	89	32	0	716
Alexandrina Lake	1119	1624	1163	551	22	0	4478
	252	463	424	233	21	0	716
Ashburton River	412	2278	1228	255	0	0	4173
	223	594	431	128	0	0	778
Aviemore Lake	985	3343	1808	982	347	1384	8850
	236	694	505	353	223	888	1325
Avon Burn	0	17	0	0	0	0	17
	0	17	0	0	0	0	17
Benmore Lake	2513	3986	2935	2327	445	623	12829
	446	610	580	1038	210	412	1483
Bowyers Stream	15	130	0	0	0	0	145
	14	129	0	0	0	0	130
Camp Lake	216	50	414	0	0	0	680
	120	36	138	0	0	0	186
Clearwater Lake	710	1585	441	142	0	21	2899
	418	673	162	106	0	21	816
Coal River	20	0	0	0	0	0	20
	20	0	0	0	0	0	20
Deep Creek	0	22	0	0	0	0	22
	0	21	0	0	0	0	21
Deep Stream	14	28	37	111	0	0	189
	14	27	36	107	0	0	117
Emily Lake	0	22	0	0	0	0	22
	0	21	0	0	0	0	21
Emma Lake	16	249	171	0	0	0	435
	10	113	102	0	0	0	153
Fork Stream	0	39	0	0	0	0	39
	0	27	0	0	0	0	27
Godley River	0	28	73	0	0	0	101
	0	27	72	0	0	0	77
Grays River	0	67	20	0	0	0	87
	0	55	19	0	0	0	58
Hakataramea River	298	999	548	71	0	0	1916
	118	344	311	71	0	0	484
Heron Lake	157	1379	784	102	195	0	2617
	63	558	416	99	190	0	731
Hinds River	30	52	20	0	0	108	210
	29	50	19	0	0	78	99
Hopkins River	20	0	0	0	0	328	348
	20	0	0	0	0	224	225
Huxley River	102	0	155	0	0	0	257
	100	0	102	0	0	0	143
Irishman Creek	0	0	20	0	0	0	20
	0	0	19	0	0	0	19
Kakahu River	0	0	12	109	0	0	121
	0	0	12	106	0	0	107
Kakanui River	357	583	535	0	175	388	2038
	123	263	403	0	171	384	650
Kelland Pond	0	17	0	0	0	0	17
	0	17	0	0	0	0	17
Kurow River	0	104	106	0	63	0	273
	0	86	76	0	62	0	130
Larch Stream	0	100	0	0	0	0	100
	0	73	0	0	0	0	73

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Maerewhenua River	138	229	99	0	0	0	466
	120	174	96	0	0	0	232
Maitland Stream	0	17	0	0	0	0	17
	0	17	0	0	0	0	17
Maori Lakes	29	39	0	0	0	0	68
	19	27	0	0	0	0	33
Mary Burn	30	0	0	0	0	0	30
	20	0	0	0	0	0	20
McGregor Lake	0	17	0	0	0	0	17
	0	17	0	0	0	0	17
Middleton Lake	561	76	238	0	0	0	875
	309	59	163	0	0	0	355
Mystery Lake	0	0	60	0	0	0	60
	0	0	59	0	0	0	59
Ohapi Creek	0	0	119	0	0	0	119
	0	0	116	0	0	0	116
Ohau Canal	89	104	89	163	0	632	1077
	39	58	48	115	0	616	632
Ohau Lake	424	502	333	173	0	84	1516
	118	236	242	92	0	82	378
Ohau River	118	195	322	0	0	0	636
	71	87	157	0	0	0	193
Omarama Stream	217	156	49	71	0	0	493
	124	80	38	71	0	0	168
Opihi River	4784	5072	4626	2591	501	879	18453
	777	957	897	592	151	246	1661
Opuha River	0	22	32	1318	0	126	1498
	0	21	23	468	0	123	485
Orari River	943	1522	1724	884	546	713	6332
	208	429	387	262	312	221	769
Otematata River	236	234	79	29	0	15	594
	173	108	54	28	0	14	213
Pareora River	43	104	0	0	0	42	189
	31	101	0	0	0	41	113
Parsons Rock Creek	0	35	20	0	0	0	54
	0	34	19	0	0	0	39
Pukaki Lake	23	52	519	29	0	0	623
	16	50	177	28	0	0	187
Rangitata River	2928	11588	14868	5089	502	987	35963
	414	1316	1918	919	156	271	2554
RDR Canal	0	17	0	0	0	0	17
	0	17	0	0	0	0	17
Roundabout Lake	0	52	0	0	0	0	52
	0	37	0	0	0	0	37
Ruataniwha Lake	20	230	557	214	11	0	1033
	20	95	312	106	11	0	344
Tekapo Canal	347	133	151	127	109	0	867
	145	103	118	75	70	0	236
Tekapo Lake	463	852	358	481	674	174	3003
	170	427	216	298	472	172	774
Tekapo River	311	611	1200	219	32	42	2416
	107	272	378	108	31	41	493
Temuka River	118	445	346	41	54	277	1281
	49	169	155	40	38	143	280
Tengawai River	30	17	40	0	0	0	86
	20	17	39	0	0	0	47
Twizel River	177	306	240	0	0	0	723

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
	146	222	237	0	0	0	356
Waihao River	118	173	355	0	0	0	646
	66	123	255	0	0	0	291
Waihi River	620	131	515	405	0	0	1670
	569	94	482	238	0	0	789
Waimate Creek	0	0	0	0	22	0	22
	0	0	0	0	21	0	21
Waitaki Lake	596	2535	1334	224	524	21	5233
	177	1000	491	102	255	21	1161
Waitaki River	1498	7537	16233	6643	333	2253	34496
	308	1122	2142	1218	183	1561	3145
Wardell Lake	0	17	0	0	0	0	17
	0	17	0	0	0	0	17
Unidentified Water	45	0	33	71	0	0	149
	32	0	32	71	0	0	84
Total Days	22003	51217	55829	23550	4589	9098	166287
	1464	2901	3450	2124	798	2058	5643

Otago

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Albert Burn	33	0	0	0	0	0	33
	23	0	0	0	0	0	23
Arrow River	20	165	21	0	0	0	207
	20	114	20	0	0	0	118
Bannockburn River	0	154	37	0	0	0	191
	0	111	36	0	0	0	117
Blakeleys Dam	266	330	0	0	0	129	726
	240	186	0	0	0	128	330
Blue River	20	0	0	0	0	0	20
	20	0	0	0	0	0	20
Butchers Dam	20	55	36	0	58	0	170
	20	54	25	0	57	0	85
Caples River	61	35	0	96	0	0	193
	60	34	0	66	0	0	96
Cardrona River	0	0	0	31	0	0	31
	0	0	0	30	0	0	30
Catlins River	947	1006	1144	981	412	15	4505
	597	512	1086	664	254	14	1518
Cluden Stream	41	0	0	0	0	0	41
	40	0	0	0	0	0	40
Clutha (lower) River	882	3755	3133	4950	1898	274	14893
	241	900	935	1684	1042	256	2393
Clutha (upper) River	1516	2531	3050	1283	1211	1852	11443
	438	484	1080	531	557	1540	2135
Coal Pit Dam	0	382	73	0	0	0	455
	0	228	72	0	0	0	239
Conroys Dam	0	0	0	0	61	0	61
	0	0	0	0	42	0	42
Dart River	0	0	0	33	54	0	87
	0	0	0	32	38	0	50
Deep Stream	20	165	0	0	0	0	186
	20	138	0	0	0	0	139
Diamond Creek	30	0	0	0	0	0	30
	20	0	0	0	0	0	20
Diamond Lake	20	0	15	298	0	0	334
	20	0	15	169	0	0	171
Dingle Burn	68	55	0	0	0	0	123
	42	38	0	0	0	0	57
Dunstan Creek	17	0	139	0	0	0	156
	16	0	135	0	0	0	136
Dunstan Lake	4383	8336	5157	1464	864	2048	22251
	609	1173	846	309	361	622	1754
Falls Dam	0	28	0	0	0	0	28
	0	27	0	0	0	0	27
Fraser Dam	0	55	0	0	0	0	55
	0	54	0	0	0	0	54
Fraser River	222	103	37	17	29	0	407
	124	78	36	17	28	0	154
Great Moss Swamp	33	138	0	51	0	0	222
	23	97	0	50	0	0	112
Greenstone River	303	35	89	0	0	33	461
	140	34	64	0	0	26	160
Hamiltons Dam	41	0	0	0	0	0	41
	40	0	0	0	0	0	40
Hawea Lake	4296	5498	2663	1524	1907	2934	18824
	696	786	449	531	976	1605	2261

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Hawea River	181	659	406	348	321	8	1924
	75	196	194	322	197	7	474
Hayes Lake	275	502	352	83	222	0	1434
	139	331	259	59	167	0	477
Hoffmans Dam	0	33	0	0	0	0	33
	0	32	0	0	0	0	32
Hunter River	138	169	186	119	0	0	612
	76	80	85	89	0	0	165
Kaihiku Stream	0	0	0	17	0	0	17
	0	0	0	17	0	0	17
Kaitangata Channel	0	0	0	0	32	0	32
	0	0	0	0	31	0	31
Kaiwera Stream	0	0	62	34	0	0	96
	0	0	60	33	0	0	68
Kawarau River	1248	1145	283	679	149	0	3505
	529	681	130	490	99	0	1005
Kirkpatrick Lake	174	331	0	0	0	0	504
	129	275	0	0	0	0	304
Knights Dam	0	28	0	0	0	0	28
	0	27	0	0	0	0	27
Lee Stream	112	28	0	0	32	0	171
	79	27	0	0	31	0	89
Lindis River	34	151	95	0	0	0	280
	33	58	79	0	0	0	103
Lochy River	41	70	15	0	0	8	134
	40	56	15	0	0	7	71
Logan Burn	278	464	294	62	0	0	1098
	142	238	153	61	0	0	323
Lone Pine Dam	20	0	0	0	0	0	20
	20	0	0	0	0	0	20
Luna Lake	0	0	37	0	0	0	37
	0	0	36	0	0	0	36
Maclennan River	13	0	0	0	0	0	13
	12	0	0	0	0	0	12
Mahinerangi Lake	1209	1549	964	33	246	129	4131
	386	452	305	32	113	128	691
Makarora River	619	281	393	34	0	129	1457
	222	158	177	33	0	128	351
Manor Burn	41	138	42	0	0	0	221
	28	71	41	0	0	0	87
Manorburn Reservoir	159	255	36	62	0	0	513
	59	94	25	61	0	0	130
Manuherikia River	339	1586	926	117	339	259	3566
	184	621	448	81	130	256	842
Mathias Dam	0	83	0	0	127	129	339
	0	47	0	0	76	128	156
Matukituki River	203	264	173	233	0	0	873
	117	130	88	146	0	0	244
Minaret Burn	13	33	0	0	0	0	46
	12	32	0	0	0	0	34
Moke Lake	51	55	127	133	0	0	365
	49	54	89	129	0	0	173
Mototapu River	0	114	0	33	0	0	147
	0	78	0	32	0	0	85
Nevis River	0	55	0	51	0	0	106
	0	54	0	50	0	0	73
Northern Reservoir	0	28	0	0	0	0	28

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
	0	27	0	0	0	0	27
Onslow Lake	348	996	1009	305	63	0	2721
	113	239	371	161	62	0	487
Owaka River	82	0	1102	119	95	0	1399
	56	0	1085	116	70	0	1095
Pomahaka River	1234	2161	2440	304	127	517	6783
	413	635	850	195	88	359	1213
Poolburn Reservoir	623	668	115	66	285	517	2275
	220	218	83	64	161	403	543
Rees River	17	276	0	0	0	0	293
	16	195	0	0	0	0	195
Roxburgh Lake	0	53	0	0	0	0	53
	0	36	0	0	0	0	36
Rutherfords Dam	20	165	0	0	0	0	186
	20	114	0	0	0	0	116
Shag River	317	464	147	0	0	129	1057
	141	183	114	0	0	128	287
Shotover River	0	58	37	0	32	0	126
	0	40	36	0	31	0	63
Southern Reservoir	20	303	73	0	32	0	429
	20	224	72	0	31	0	238
Staircase Creek	0	83	0	0	0	0	83
	0	81	0	0	0	0	81
Sullivans Dam	37	276	0	0	95	8	416
	26	171	0	0	70	7	186
Sutton Creek	102	44	0	0	0	0	147
	72	43	0	0	0	0	84
Tahakopa River	13	1069	461	85	0	0	1628
	12	858	366	83	0	0	937
Taieri River	1442	3653	2686	763	1293	1696	11532
	312	643	611	323	305	738	1275
Tautuku River	41	15	0	0	0	0	56
	40	14	0	0	0	0	42
Temple Creek	0	17	0	20	0	0	38
	0	17	0	20	0	0	26
Teviot River	46	78	37	0	0	0	160
	31	56	36	0	0	0	74
Timaru Creek	34	82	21	0	32	0	169
	23	37	20	0	31	0	57
Tokomariro River	440	303	73	0	32	0	848
	183	181	72	0	31	0	269
Tuapeka River	0	55	31	0	0	0	86
	0	54	30	0	0	0	62
Twelve Mile Creek	20	0	0	0	0	0	20
	20	0	0	0	0	0	20
Von River	74	117	0	0	0	0	191
	61	71	0	0	0	0	94
Waiholo Lake	122	0	0	0	190	0	312
	100	0	0	0	187	0	212
Waikerikeri Creek	25	0	0	0	0	0	25
	24	0	0	0	0	0	24
Waikouaiti River	1044	662	478	155	32	259	2629
	462	371	252	91	31	256	700
Waipahi River	401	450	469	307	222	517	2366
	123	169	180	222	93	512	629
Waipori Lake	0	41	82	0	0	0	123
	0	29	80	0	0	0	85

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Waipori River	82	125	42	66	0	0	315
	63	122	41	64	0	0	157
Waitahuna River	13	0	0	0	0	0	13
	12	0	0	0	0	0	12
Waitati River	246	0	10	410	0	0	666
	167	0	10	251	0	0	302
Waiwera River	0	0	0	17	95	0	112
	0	0	0	17	93	0	95
Wakatipu Lake	3966	8977	4323	2066	826	1254	21411
	1177	1416	895	475	263	511	2179
Wanaka Lake	3662	8752	5523	2834	1713	3045	25529
	615	1229	857	658	947	1292	2371
West Eweburn Dam	0	28	0	0	0	0	28
	0	27	0	0	0	0	27
Wilkin River	163	0	0	34	0	0	197
	111	0	0	33	0	0	116
Wye Creek	82	193	147	99	0	0	521
	40	104	145	97	0	0	207
Young River	25	0	0	0	0	0	25
	24	0	0	0	0	0	24
Unidentified Water	48	110	90	163	158	8	577
	29	108	54	158	69	7	213
Total Days	33179	61120	39383	20584	13281	15898	183446
	2151	3238	2986	2324	1957	2940	6473

Southland

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Acton Stream	0	15	0	0	0	0	15
	0	14	0	0	0	0	14
Alabaster Lake	25	0	0	0	0	0	25
	24	0	0	0	0	0	24
Aparima River	3548	1415	2742	2294	0	1279	11278
	982	375	552	675	0	467	1444
Argyle Burn	20	0	0	0	0	0	20
	20	0	0	0	0	0	20
Arthur River	148	26	0	0	0	0	174
	145	18	0	0	0	0	146
Borland Burn	25	0	36	0	0	0	62
	17	0	20	0	0	0	26
Cleddau River	59	0	0	34	0	0	93
	58	0	0	33	0	0	67
Clinton River	114	74	336	135	0	0	660
	78	37	298	61	0	0	317
Dipton Stream	56	29	95	0	0	0	181
	25	20	89	0	0	0	95
Dome Burn	0	0	0	7	0	0	7
	0	0	0	6	0	0	6
Doon River	0	0	62	0	0	0	62
	0	0	47	0	0	0	47
Dunsdale Stream	13	320	31	0	0	0	364
	12	205	30	0	0	0	208
Eglinton River	0	289	201	175	0	0	665
	0	137	102	92	0	0	195
Electric River	0	0	15	0	0	0	15
	0	0	15	0	0	0	15
Etal Stream	25	0	0	0	0	0	25
	24	0	0	0	0	0	24
Eyre Creek	0	206	0	0	0	0	206
	0	199	0	0	0	0	199
Fortune Creek	13	0	0	0	32	0	44
	12	0	0	0	31	0	33
Glaisnock River	0	0	31	17	0	0	48
	0	0	30	17	0	0	34
Gow Burn	41	0	0	0	0	0	41
	40	0	0	0	0	0	40
Grebe River	25	55	15	17	0	0	113
	17	54	15	17	0	0	61
Gunn Lake	0	18	0	17	0	0	35
	0	17	0	17	0	0	24
Hamilton Burn	56	15	124	0	0	0	194
	30	14	70	0	0	0	77
Hankinson Lake	13	0	0	0	0	0	13
	12	0	0	0	0	0	12
Hauroko Lake	0	0	93	34	0	0	127
	0	0	52	23	0	0	57
Hedgehope Stream	13	0	0	0	0	0	13
	12	0	0	0	0	0	12
Hollyford River	243	110	211	33	0	0	597
	203	108	164	32	0	0	284
Iris Burn	0	11	0	0	0	51	62
	0	10	0	0	0	50	51
Irthing Stream	25	15	0	51	0	0	91
	17	14	0	50	0	0	54

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
Junction Burn	13	21	0	0	0	0	34
	12	20	0	0	0	0	23
Letham Burn	0	0	15	0	0	0	15
	0	0	15	0	0	0	15
Lill Burn	0	0	31	85	0	0	116
	0	0	30	68	0	0	74
Lora Stream	25	59	15	0	0	0	100
	24	57	15	0	0	0	64
Makarewa River	1435	752	1018	256	0	153	3614
	480	317	289	137	0	127	670
Manapouri Lake	278	1605	1138	672	32	1761	5486
	98	386	227	181	31	722	874
Mararoa River	634	545	696	360	0	0	2234
	185	156	224	188	0	0	379
Mataura River	7313	12887	15747	8659	253	6498	52242
	857	1462	1679	1264	170	1818	3383
McKerrow Lake	243	83	0	0	0	39	364
	203	81	0	0	0	36	221
Mimihau Stream	127	127	241	358	0	45	900
	67	57	96	255	0	42	290
Mokoreta River	13	206	31	0	0	0	250
	12	100	30	0	0	0	105
Monowai Lake	521	860	1243	560	32	818	4034
	134	320	266	178	31	341	582
Monowai River	18	214	206	0	0	0	438
	13	115	114	0	0	0	162
Morley Stream	25	0	0	0	0	0	25
	24	0	0	0	0	0	24
Nokomai River	559	44	160	0	0	0	764
	512	25	110	0	0	0	525
North Mavora Lake	577	294	323	222	0	0	1416
	182	167	115	110	0	0	294
Orauea River	407	209	139	0	0	0	755
	273	172	93	0	0	0	336
Oreti River	7020	5427	6699	3116	0	4917	27179
	1020	982	913	618	0	1435	2298
Otamita Stream	118	366	31	341	0	517	1374
	53	236	30	168	0	512	591
Otapiri Stream	279	552	46	51	0	18	947
	71	195	33	50	0	17	216
Otautau Stream	51	0	0	0	0	0	51
	49	0	0	0	0	0	49
Pourakino River	127	324	31	0	0	0	482
	71	202	30	0	0	0	216
Pukerau Stream	0	0	19	0	0	0	19
	0	0	18	0	0	0	18
Pyke River	13	83	0	0	0	0	95
	12	81	0	0	0	0	82
Redan Stream	13	0	0	0	0	0	13
	12	0	0	0	0	0	12
Snag Burn	0	0	0	17	0	0	17
	0	0	0	17	0	0	17
South Mavora Lake	229	45	256	154	0	8	691
	76	32	92	72	0	7	143
Spey River	0	15	0	34	0	0	49
	0	14	0	33	0	0	36
Steeple Burn	20	0	0	0	0	0	20

	Oct-Nov	Dec-Jan	Feb-Mar	April-May	June-July	Aug-Sept	
	20	0	0	0	0	0	20
Te Anau Lake	845	2525	2579	2159	127	2042	10278
	190	599	436	438	88	856	1232
Thomas Lake	51	15	15	51	0	0	132
	30	14	15	37	0	0	52
Tomogalak Stream	18	15	0	34	0	0	66
	13	14	0	33	0	0	38
Upukerora River	94	262	170	102	0	0	628
	44	121	102	74	0	0	180
Waiau River	1813	1463	1464	1731	0	1251	7721
	336	328	325	403	0	461	838
Waikaia River	2018	1385	1636	754	0	1013	6807
	432	430	402	245	0	689	1033
Waikaka Stream	225	356	297	102	0	0	980
	94	161	132	84	0	0	244
Waikawa River	114	605	155	119	32	0	1025
	98	402	101	101	31	0	439
Waikiwi Stream	13	0	0	68	0	51	132
	12	0	0	66	0	50	84
Waimatuku Stream	406	211	449	256	0	102	1424
	137	147	293	176	0	100	408
Waimea Stream	68	29	31	17	0	0	145
	47	20	30	17	0	0	61
Wairaki River	127	74	15	0	0	0	216
	45	51	15	0	0	0	70
Waituna Lagoon	441	44	477	154	0	9	1125
	197	32	226	106	0	8	319
Wapiti River	46	43	0	0	0	255	344
	31	30	0	0	0	250	253
Weydon Burn	13	0	0	0	0	0	13
	12	0	0	0	0	0	12
Whitestone River	195	15	108	393	0	0	710
	79	14	91	333	0	0	354
Winton Burn	0	0	0	71	0	0	71
	0	0	0	71	0	0	71
Worsley Stream	215	447	99	34	0	0	795
	163	232	83	23	0	0	297
Wyndham Stream	156	755	860	324	0	45	2140
	91	281	257	212	0	42	447
Unidentified Water	25	0	64	468	0	0	557
	17	0	43	241	0	0	245
Total Days	31402	35560	40500	24539	507	20873	154266
	2002	2233	2269	1843	201	2828	5138