

NEW ZEALAND FRESHWATER FISHERIES MISCELLANEOUS REPORTS

This report is one of a series initiated in January 1989, and issued by the Freshwater Fisheries Centre, MAF Fisheries. The series was established to ensure that reports prepared for clients, tribunal hearings, internal use, etc., are collected together and available to future users. They are for limited circulation, and some may be confidential.

ISBN 0-477-08454-0



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Enquiries to:

The Librarian
Freshwater Fisheries Centre
PO Box 8324
Riccarton, Christchurch

MOHAKA RIVER WATER CONSERVATION ORDER
APPEAL HEARING EVIDENCE

IN THE MATTER of the Water and Soil
Conservation Act 1967

AND

IN THE MATTER of two objections under
Section 20C of the Act

BETWEEN ELECTRICITY
CORPORATION OF NEW
ZEALAND LIMITED

(211/90)

AND NGATI PAHAUWERA IWI

(253/90)

Objectors

AND THE MINISTER FOR THE
ENVIRONMENT

Respondent

AND THE NEW ZEALAND FISH
AND GAME COUNCIL
(successor to the Hawke's Bay
Acclimatisation Society)

Applicant

EVIDENCE OF JODY RICHARDSON

INTRODUCTION

1. My full name is Jody Richardson and I have been employed by the Fisheries Research Centre, MAF Fisheries, since 1976. I obtained my BSc degree in 1972 from Washington State University in the USA. My research experience is

principally with salmonid stocks and fisheries, although my involvement with the freshwater fish database has given me considerable knowledge about native fish.

2. I have been associated with the National River Angling Survey since it began in 1979, and am the senior author or co-author of 16 published reports evaluating the data collected. I am also a member of the MAF Fisheries drift diving team which has surveyed over 90 rivers nationwide, including the Mohaka. In addition, I assisted with the field work during the 1983 fisheries survey of the Mohaka catchment.
3. My evidence covers the fish stocks and fisheries of the Mohaka River catchment. It is largely a summary of information published in *Fisheries Environmental Reports 28, 42, 55, and Freshwater Fisheries Report 87*. Data from two surveys conducted in 1991 are also included in my evidence.

MOHAKA RIVER CATCHMENT

4. The Mohaka River stretches for 172 km from the Kaimanawa Range to Hawke Bay (Fig. 1). My evidence often refers to the upper, middle, and lower reaches of the river, and I would like to explain what these are. The three sections roughly divide the river into equal lengths, but are also based on factors influencing fish and fisheries within the catchment.
5. The upper reaches, or headwaters, are located upstream of the Ripia confluence. Here, the Mohaka valley is dominated by manuka scrub with tongues of beech forest on the upper slopes. Prior to May 1990, this section of the river lay within Central North Island Wildlife Conservancy and was open for angling from 1 October to 30 June each season (9 months).
6. Below the Ripia, the Mohaka formed the boundary between Central North Island Wildlife Conservancy and Hawke's Bay Acclimatisation Society, and

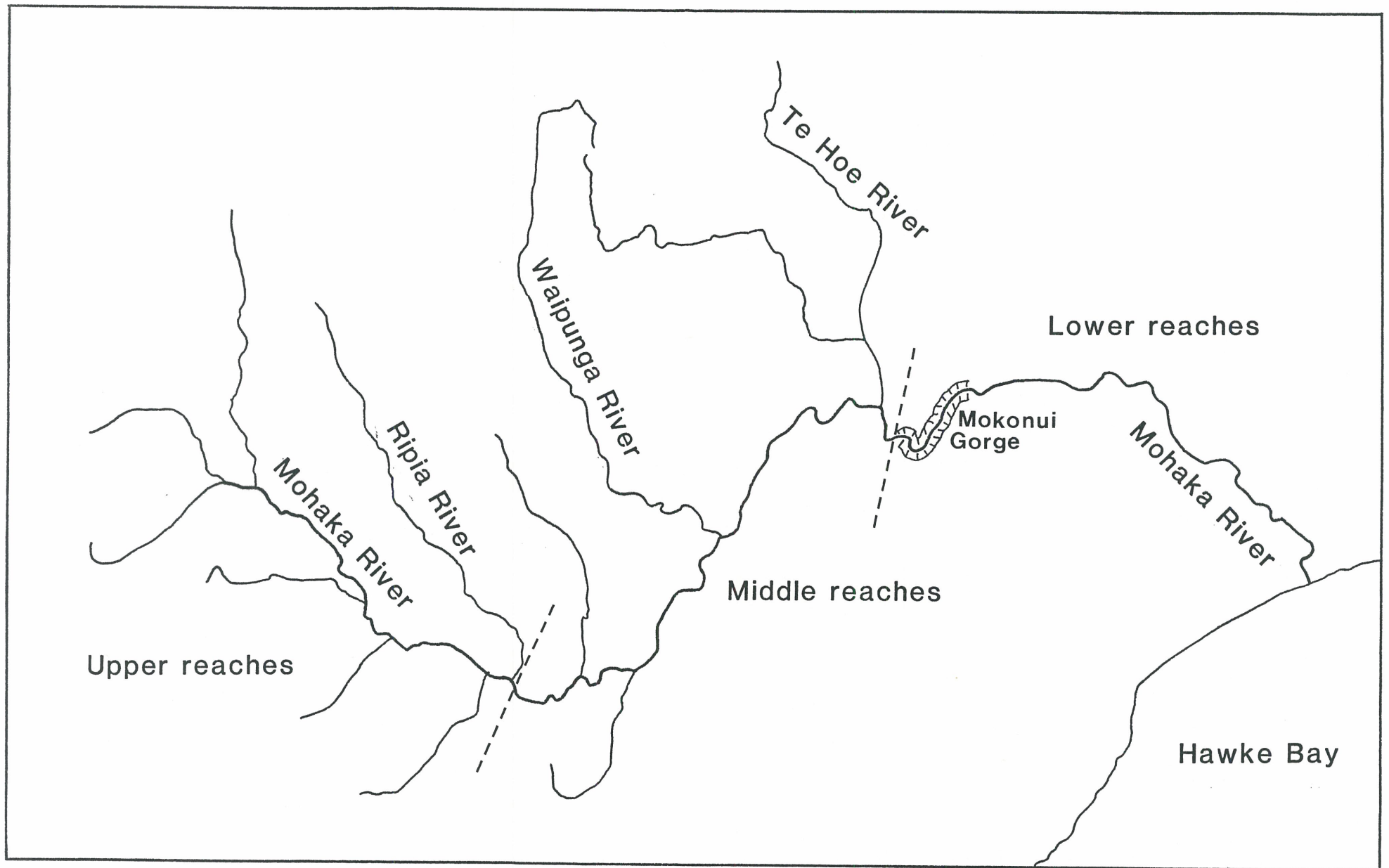


Figure 1 The Mohaka River Catchment

anglers could fish the river all year. From the Ripia to the Te Hoe, the river valley is fairly entrenched, but opens out in places to pastureland and scrub.

7. Just below the Te Hoe confluence, the Mohaka enters a deeply entrenched, turbulent gorge known as Mokonui Gorge. My evidence will show this gorge has a significant impact on native fish distribution within the catchment. Thus, the middle reaches extend from the Ripia confluence to the top of Mokonui Gorge, while the lower reaches cover the remainder of the river.
8. In May 1990, acclimatisation society boundaries were altered in conjunction with the formation of the new fish and game councils. The entire Mohaka River catchment now lies within the Hawke's Bay Fish and Game Council district. However, this does not affect the reach definitions nor the data presented in this report.

FISH STOCKS

9. In 1983, MAF Fisheries carried out an intensive electric fishing survey of the Mohaka system (Strickland 1985). Assistance and partial funding for this survey were provided by several government departments and other interested parties. In total, 73 sites were sampled throughout the catchment; 65 sites were on tributaries and eight were along the margins of the mainstem. The sites were chosen to encompass as much of the catchment as possible and to ensure the full range of available habitat types was sampled. In addition, data from another seven sites are available from the freshwater fish database. All these data have been combined in my presentation (80 sites in total).

Native Fish

10. A total of 10 native freshwater fish species have been recorded from the Mohaka catchment (Table 1). With the exception of both species of eel, all the fish listed in Table 1 breed in freshwater. However, all but one, Cran's bully, require access to the sea to complete their life cycles. In addition, marine species periodically occur in the lower river/river mouth area. These

TABLE 1. Native freshwater fish species recorded from the Mohaka River catchment (80 sites).

<u>Common name</u>	<u>Scientific name</u>	<u>Sites recorded</u>		<u>Distribution</u>
		No.	<u>from</u> %	
Longfinned eel*	<i>Anguilla dieffenbachii</i>	56	70	b
Shortfinned eel*	<i>Anguilla australis</i>	13	16	c
Koaro*	<i>Galaxias brevipinnis</i>	9	11	a
Common bully*	<i>Gobiomorphus cotidianus</i>	7	9	c
Torrentfish*	<i>Cheimarrichthys fosteri</i>	6	8	c
Common smelt*	<i>Retropinna retropinna</i>	4	5	c
Inanga*	<i>Galaxias maculatus</i>	2	3	c
Bluegilled bully*	<i>Gobiomorphus hubbsi</i>	2	3	c
Cran's bully	<i>Gobiomorphus basalis</i>	1	1	c
Black flounder*	<i>Rhombosolea retiaria</i>	1	1	c
*migratory to/from sea				
Distribution	a = above Mokonui gorge b = above and below gorge c = principally below gorge			

include kahawai and yellow-eyed mullet, and possibly grey mullet, yellow-belly flounder, snapper, gurnard, and spotted dogfish.

11. The single most significant feature affecting the distribution of the native fish was the Mokonui Gorge. Five species (torrentfish, Cran's bullies, black flounder, smelt, and inanga) were not recorded at any sites above the gorge, while the density of two other species, shortfinned eels and common bullies, decreased significantly above there. On the other hand, koaro were found only above the gorge, but were confined to steep, bush covered tributaries with coarse substrate. The only widespread native species was the longfinned eel, which was recorded at nearly three-quarters of the sites surveyed.

12. Longfinned eels are widespread throughout New Zealand and are often the most abundant native fish caught during electric fishing surveys. For example, electric fishing surveys of the Manganuioteao, Rangitikei, Motu, and Mohaka catchments all found longfinned eels were the most abundant native fish species recorded (Cudby & Strickland 1986; Hicks 1985; Rowe 1981; Strickland 1985). Comparative length data are available from the Motu catchment, a river "noted for its large eels" (Rowe 1981). However, only 3% of the longfinned eels caught in the Motu were over 500 mm long, whereas in the Mohaka, over 20% were over 500 mm long. Almost all the large eels in the Mohaka catchment were found above the Mokonui Gorge, and length increased with distance upstream (Strickland 1985).

Introduced Fish

13. Introduced fish species in the Mohaka catchment are confined to brown and rainbow trout. In 1878, brown trout were liberated into the Taharua River. From that and subsequent liberations, brown trout have thrived and extended their range to the whole catchment. Rainbow trout were probably introduced to the Mohaka about 1900 (Wellwood 1968).

Juvenile Trout

14. During the 1983 survey (Strickland 1985), brown trout juveniles and yearlings (length < 20 cm) were found to be widely distributed throughout the Mohaka system. They occurred at over 50% of the sample sites and were the most abundant species in the total catch. The highest density of small brown trout was found in the Waipunga River above Waipunga Falls, an area devoid of eels.
15. The 1983 survey found that small rainbow trout were concentrated in the middle section, with the highest densities occurring in the Waipunga River below the falls. Small rainbow trout were not found in the lower section, and densities were low in the upper section. Few juvenile trout of either species have been observed in the mainstem of the Mohaka.

Adult Trout

16. Information about the distribution and density of adult trout in the Mohaka River can be extracted from MAF Fisheries' drift diving survey database. In total, 93 rivers nationwide have been surveyed and nearly 200 dives carried out. Four reaches of the Mohaka have been drift dived, two reaches in the headwaters and two in the middle reaches. Results from these dives and from dives which have been done in nearby rivers in the Kaimanawa and Kaweka Ranges are presented in Table 2. The data are presented as abundance of fish (no/km) for comparison. Where more than one dive has been carried out, the average count is shown.
17. It is obvious from Table 2 the Mohaka is unique in several ways, particularly in regard to the headwaters. Not only are there twice as many large fish in the Mohaka headwaters as the other rivers, but brown trout predominate. This is a unique North Island phenomenon for mixed species fisheries; other headwater fisheries are principally based on rainbow trout. The middle reaches of the Mohaka did not hold as many trout as the internationally renowned Tongariro or Tauranga-Taupo Rivers, but trout numbers were fairly

consistent throughout the Mohaka's middle reaches and headwaters, and according to Strickland (1991) "similar to those of other important angling rivers".

TABLE 2. Abundance of trout from 6 North Island rivers located in the Kaimanawa and Kaweka Ranges.

River	Abundance (no/km)						Total (M+L)
	Brown trout			Rainbow trout			
	L	M	S	L	M	S	
Mohaka* headwaters							
1. Poronui	54	3	3	3	0	0	60
2. Otupua	77	36	52	1	1	7	115
middle reaches							
1. SH5	12	21	23	10	11	22	54
2. Glenfalls Reserve	17	12	8	9	19	9	57
Rangitikei* headwaters	3	0	0	13	3	1	19
Ngaruroro* headwaters	6	1	0	14	5	5	26
Taruarau headwaters	5	1	2	16	6	11	28
Tongariro* middle reaches	40	5	4	36	68	99	149
Tauranga-Taupo* middle reaches	1	1	1	33	133	127	168

L(arge) = >40cm
M(edium) = 20-40cm
S(mall) = <20cm

* Nationally important angling river.

18. Another measure of trout density is biomass, which takes into account the size of the fish and the size of the river. Two measures of biomass were calculated; kg/km is the total weight of trout divided by the reach length, whereas g/m² is the kg/km value divided by the river width and converted to g/m².
19. The Mohaka headwaters ranked tenth nationally out of 158 river reaches for which biomass data are published (Teirney & Jowett 1990) (Table 3). Of the rivers listed above the Mohaka, only five are not lake outlet or spring-fed fisheries, and only three rivers, the Waihou, Tauranga-Taupo, and Tongariro, lie in the North Island.
20. The middle reaches of the Mohaka ranked about 40 for kg/km, and about 70 for g/m² out of the 158 river reaches. Biomass rankings for the Mohaka's middle reaches were similar to other nationally important North Island rivers such as the Tarawera, Ngaruroro, Manganuioteao, and Rangitikei (Teirney & Jowett 1990).
21. In general, the fish fauna of the Mohaka catchment is similar to that of other Hawkes Bay rivers such as the Tukituki and Ngaruroro, as well as other large North Island rivers (Table 4). An important aspect of the Mohaka fish fauna is that introduced species are confined to brown and rainbow trout; there are no perch or goldfish as are present in nearly every other river listed in Table 4.

FISHERIES

Native Fish

22. Little quantitative information is available for the native fish fisheries of the Mohaka catchment. The lower river, including the mouth and adjacent beaches, is a traditional supplementary food source for local residents and includes fisheries for whitebait, smelt, eels, kahawai, mullet, flounder, kingfish, snapper, and sharks. The mouth area is also a popular surfcasting area. However, the quality and quantity of these fisheries is not well researched.

TABLE 3. Trout biomass ranking for 10 New Zealand river reaches assessed by drift diving.

River reach	Biomass rank (kg/km)	Biomass rank (g/m ²)
Buller* at L.Rotoiti outlet	1	1
Clutha* at L.Wanaka outlet	2	- ⁺
Gowan* at L.Rotoroa outlet	3	2
Riwaka* at Moss Bush	-	3
Hurunui* at L.Sumner outlet	4	6
Arnold* at Kotuku	5	-
Waihou* at Whites Road	-	4
Motueka at Woodstock	6	-
Shag at Dunbach	-	5
Haupiri* at L.Haupiri outlet	7	8
Tekapo below Maryburn	8	-
Tauranga-Taupo at pump pool	-	7
Tongariro at Turangi	9	-
Spring Ck* at Odwyers Road	-	9
Mohaka at Otupua	10	10
*lake outlet or spring-fed		
+ - => 10		

23. The lack of information about the composition of the whitebait fishery is of particular concern as it is not known whether the main species is koaro, as occurs in the nearby Motu River, or inanga, the principal catch of most east

coast rivers. If the main species is koaro, then dams constructed in the lower Mohaka could restrict koaro whitebait from reaching their adult habitat. This would eventually exclude koaro from the Mohaka system unless lake populations became established. However, even the existence of a lake population would be unlikely to support a whitebait run at the mouth of the Mohaka.

TABLE 4. Comparative information on fish stocks of selected North Island catchments.

River	Number of native species	Number of introduced species
Mohaka	10	2
Ngaruroro	10	3
Tukituki	10	4
Rangitikei	9	4
Wanganui	13	5
Waikato	16	12
Manawatu	12	2

24. Inanga spawn among estuarine vegetation, mainly during autumn spring tides. Identification and preservation of these areas would be essential to maintaining the whitebait fishery if inanga were the principal catch.
25. The extent of any commercial eel fishery is likewise unknown. The Mohaka catchment probably does support a small commercial fishery based on the longfinned eel. Catch figures are not available for the catchment, but the whole of Hawkes Bay has about 10 eel permit holders who take an average of 80 tonnes per annum (1983-84) (Towns 1985). This represents about 6% of the total harvest.

Introduced Fish

26. Information about the Mohaka River trout fishery is based on results from MAF Fisheries' National River Angling Survey (NRAS) which was conducted between 1979-81, and a survey of the Mohaka River which was conducted in 1991.

The National River Angling Survey (NRAS)

27. The NRAS was undertaken to provide a framework whereby rivers throughout New Zealand could be evaluated and compared. It provides a comparable database on each river fishery within New Zealand, more than 750 rivers in all. Although these data are now 10 years old, this is the only national database available for comparing salmonid fisheries, and data from the angling survey have previously been presented as substantive evidence in support of several water conservation orders.

NRAS Methods

28. Distribution of survey booklets to anglers from New Zealand's 22 acclimatisation societies and two wildlife conservancies began in March 1980. Whole season adult fishing licence records were used to obtain a random sample of anglers' addresses from each of the 24 districts. Anglers in each sample were posted a reply-paid envelope and survey booklet for the district in which they purchased their fishing licence.
29. Rivers supporting stocks of trout or salmon in each district were listed in the survey booklet for that district. Anglers were asked to evaluate their fishing experiences separately for each river. At the back of each survey booklet, a section was provided for anglers to evaluate rivers they fished outside their acclimatisation district.
30. For each river, the data collected provide information on angling use (number of whole season anglers and number of visits), the overall importance of the river to anglers, and anglers' assessments of seven listed factors that contribute

to the quality of the angling experience. These factors were distance from home, access to the river, area of fishable water, scenic beauty, feelings of peace and solitude, catch rate, and size of fish caught. Information on the reach of river fished, angling methods used, and other recreational activities associated with angling was also gathered. Data relating to the Mohaka River are presented in Appendix I.

31. Data from the NRAS relating to individual rivers has been published in 16 regional reports, (e.g. Richardson *et al.* 1984b) and a national report (Teirney *et al.* 1982). Details about NRAS data collection and analysis are presented in these reports.

NRAS Nationally Important River Criteria

32. A three-step process was used to identify and classify angling rivers of national importance. First, rivers were assessed to determine whether they were nationally important. Rivers were immediately excluded unless the most frequently recorded value given to overall importance was the highest possible. Rivers which satisfied this condition were then assessed for angler use. Those supporting high levels of use were automatically classified as nationally important. Rivers which received less use were still considered, but had to have higher importance ratings; at least 45% of the anglers had to award the highest grade possible to overall importance. For borderline cases, a final decision was based on how many anglers were attracted from other society districts.
33. The rivers identified as nationally important were then assigned to one or more of three categories of river fishery, recreational, scenic, or wilderness. These categories took into account the level of use of each river, how some of the seven listed qualities were assessed, the angling methods employed on each river, and other recreational pursuits typically associated with angling. Table 5 outlines the definitive criteria used to classify river fisheries into the three categories.

TABLE 5. Criteria used to classify river fisheries into wilderness, scenic, or recreational categories.

Wilderness river fisheries share these characteristics:

They are remote from population centres.
They are not accessible by road.
They are not heavily fished.
Access to the river is difficult.
Scenic beauty and solitude are exceptional.
Trout caught are very large.
Anglers prefer to use artificial flies.
Camping, tramping, and shooting are often associated with fishing.
Any catchment modifications are minor.

Scenic river fisheries share these characteristics:

They are usually remote from population centres.
They are accessible by road.
Scenic beauty and solitude are highly valued.
Spinning may be as popular as artificial flies.
Camping and picnicking are often associated with angling.
If modifications to the catchment or river have occurred, they are not major.

Recreational river fisheries share these characteristics:

They may be close to population centres.
They are easily accessible with extensive road access.
They are more heavily fished.
Spinning is often the preferred angling method.
Picnicking is the most commonly associated activity.
Major modifications may have occurred to the catchment or river.

General Features of the Mohaka Fishery

34. When the NRAS was conducted, the Mohaka River formed the boundary between Central North Island Wildlife Conservancy and Hawke's Bay Acclimatisation Society. Although Central North Island Wildlife Conservancy licences are not usually interavailable, a verbal agreement between the two districts meant Hawke's Bay licence holders could fish the Mohaka from the Mangatainoka confluence to the sea, even though the actual boundary was below the Makino confluence. Hawke's Bay licence holders could also fish the Waipunga, Ripia, and Te Hoe Rivers, but not the Hautapu, Makino, or Mangatainoka.
35. Owing to the steep mountainous nature of the surrounding country, coupled with a general lack of roads, access to the Mohaka is limited, particularly in the headwaters. Despite this, and the river's distance from any major population centre, it was heavily fished, within the top 15% of all New Zealand rivers. Anglers were able to fish large areas of water in the midst of exceptional scenic beauty and solitude, and a good catch rate of fairly large trout was reported.
36. Anglers employed wet flies, nymphs, spinners, and to a lesser extent, dry flies while fishing the Mohaka. Camping and enjoying the scenery were unusually popular activities associated with angling on the Mohaka, being recorded by over 50% of the anglers. In fact, the Mohaka was one of the few rivers in the North Island, along with the Motu, Wanganui, Manganuioteao, and Ngaruroro, where at least seven of the eight recreational pursuits listed in the questionnaire were engaged in by over 10% of the anglers.

National Importance of the Mohaka River

37. From the total of more than 750 rivers for which data were available, only nine North Island and 14 South Island rivers qualified as nationally important (Table 6). The NRAS survey results for the Mohaka River show it clearly met all three criteria for national importance. First, it was very favourably assessed

overall by the anglers who fished it; over 40% of the respondents rated the quality of the angling experience as outstanding, while a further 37% gave it the second highest importance grade. (Appendix I).

38. The Mohaka was also heavily fished. Based solely on estimates from the Central North Island and Hawke's Bay districts, whole season licence holders made over 7000 visits to the Mohaka River a year. Further, anglers were attracted to the Mohaka from throughout New Zealand, with outside licence holders accounting for about 13% of the whole season anglers who fished the Mohaka. Total angling use would be considerably more than 7000 visits a year if whole season anglers from other districts, as well as part season anglers and overseas visitors, were included in the estimates.

Classification of the Mohaka River

39. Of New Zealand's 23 nationally important river fisheries (Table 6), 18 clearly fell into a single category (recreational, scenic, or wilderness) based on the criteria in Table 5, while a further five qualified for inclusion into two or three categories. The Mohaka fell into the second group, with a scenic and recreational classification.
40. The middle reaches of the Mohaka were the most popular with anglers, 80% of whom fished this section of the river. About half of the anglers visited the headwaters. The two reaches offered a somewhat different angling experience. The headwaters of the Mohaka displayed several features of a wilderness fishery. These included being remote, having exceptional scenic beauty and solitude, the anglers' preference for artificial flies, and the frequent association of camping, tramping, and hunting with fishing. However, the presence of limited road access, farming and forestry modifications to the catchment, and fairly high angler use made a scenic classification most appropriate.

TABLE 6. Nationally important angling rivers in New Zealand.

<u>River</u>	<u>Reach</u>	<u>Classification</u>
North Island Rivers		
1. Tarawera	Lake Tarawera to Tarawera Falls	Scenic
2. Ruakituri	Source to Erepihi Rd bridge	Scenic/wilderness
3. Mohaka	Source to Mokonui Gorge	Scenic/recreational
4. Ngaruroro	Source to Whana Whana	Wilderness
5. Rangitikei	Source to sea	Recreation/scenic/ wilderness
6. Manganuioteao	Source to Wanganui confluence	Scenic
7. Tongariro	Poutu Intake to Lake Taupo	Recreational/scenic
8. Tauranga-Taupo	Source to Lake Taupo	Recreational
9. Waitahanui	Source to Lake Taupo	Recreational
South Island Rivers		
10. Motueka	Wangapeka confluence to sea	Recreational
11. Buller	Lake Rotoiti to Gowan confluence	Recreational
12. D'Urville/ Sabine	Source to Lake Rotoroa	Wilderness
13. Hurunui	Lake Sumner to Mandamus confluence	Scenic
14. Waimakariri	Source to sea	Recreational
15. Rakaia	Source to sea	Recreational
16. Rangitata	Source to sea	Recreational
17. Waitaki	Waitaki Dam to sea	Recreational
18. Ahuriri	Source to Lake Benmore	Recreational
19. Clutha	Lake Wanaka to Kawarau confluence	Recreational
20. Hunter	Source to Lake Hawea	Wilderness
21. Greenstone/ Caples	Source to Lake Wakatipu	Wilderness
22. Eglinton	Lake Gunn to Lake Te Anau	Scenic
23. Mataura	Source to sea	Recreational

41. The middle reaches were the most heavily fished and had more extensive road access than the headwaters. Anglers employed mainly wet flies and spinners in the middle reaches and picnicking became a popular associated pastime. Nevertheless, many of the criteria of a scenic fishery, such as high scenic qualities and a lack of major catchment modifications, were still applicable. The Mohaka was therefore classified as a nationally important scenic and recreational river fishery in its middle reaches and headwaters.

Mohaka River Tributaries

42. According to NRAS data, ten tributaries of the Mohaka also received use by anglers. These tributaries were the Te Hoe, Hautapu, Waipunga, Ripia, Taharua, Kaipo, Oamaru, Mangatainoka, Makahu, and Inangatahi (Appendix I). Only the Waipunga and Ripia attracted significant use by whole season anglers, with the Hautapu, Oamaru, and Kaipo being the next most popular. These five tributaries were valued for several reasons, but exceptional scenic beauty and solitude and large trout were qualities they all had in common. The Ripia has been singled out as a locally important wilderness fishery in the Central North Island district (Richardson *et al.* 1987).
43. In addition to supporting fisheries in their own rights, the 10 listed tributaries, as well as other streams, have been shown to be important for spawning and rearing of trout (Strickland 1985). The high number of juvenile trout found in the tributaries, coupled with the paucity of juvenile fish in the mainstem, suggest the tributaries are critical in maintaining the high value of the Mohaka fishery.
44. No attempt was made to assign a single importance grade to the entire Mohaka catchment. Anglers were asked to evaluate each river individually, not by catchments. The mainstem of the Mohaka was clearly nationally important in the middle reaches and headwaters. The tributaries were fished, but are most important for their spawning and rearing facilities.

The 1991 Angling Survey

45. One shortcoming of the NRAS questionnaire was that anglers were asked to specify which reach of each river they fished (headwaters, middle, or lower reaches, or a combination), but these reaches were not defined geographically. Instead, reach boundaries were determined after consultation with the local acclimatisation society. For the Mohaka River, there is good agreement about where the headwaters are, but the middle reaches have been variously described as upstream of Willow Flat (Wellwood 1968, Teirney *et al.* 1982) or above the Te Hoe confluence (Strickland 1985, Richardson 1989).
46. The primary aim of the 1991 survey was to establish precisely which reaches of the Mohaka River were the most popular and could therefore be considered part of the nationally important fishery. Secondary aims were to update angler use data for comparison with the NRAS, and to collect data on anglers' catch for the various reaches.

1991 Survey Methods

47. Like the NRAS, a postal survey was selected for collecting the data. In January 1991, a one-page questionnaire and covering letter (Appendix II), and reply-paid envelope were posted to a random sample of anglers who held adult whole season (AWS) licences in Hawke's Bay and Rotorua districts for the 1989/90 fishing season. Anglers from both districts were surveyed because the Mohaka River still fell partially within each district during the 1989/90 fishing season.
48. For the Rotorua district, a random sample of 300 anglers was selected from the 7106 AWS licence butts available. Total Rotorua AWS licence sales for 1989/90 were 9206, but 2100 licence butts had not been returned and were therefore not able to be used. The missing butts were spread throughout the district and are not thought to have biased the results. All 1438 AWS licence butts sold were available for Hawke's Bay, and a random sample of 300 anglers was selected from these butts.

49. On the questionnaire, the Mohaka River was divided into five mainstem zones (A - E) and a zone for the lower Te Hoe River (Zone F) (Appendix II). The zones were based on historical definitions, easily identified geographical markers, and areas of interest for development. If an angler did fish the Mohaka, then they were asked to write down how many times they visited each zone during the 1989/90 fishing season, and how many legal-sized trout (greater than 30 cm) they caught in each zone.
50. Data were analyzed by acclimatisation district and zone, and for the whole mainstem (Zones A - E). Estimates of angler use were made following standard techniques described by Cochran (1977).

1991 Survey Results

51. A combination of follow-up letters and telephone calls produced a high response rate to the 1991 survey; 261 replies were received from Rotorua anglers (87%), and 277 replies were received from Hawke's Bay (92%). Of these replies, 9 Rotorua and 111 Hawke's Bay respondents fished the Mohaka. District/zone results are shown in Table 7.
52. For Rotorua AWS licence holders, the most popular zone was Zone E (Ripia confluence to the Kaipo and Oamaru junction), followed by the next most-downstream zone, Zone D (Waipunga confluence to the Ripia confluence). An estimated 1200 visits were made to these two zones by Rotorua AWS licence holders during the 1989/90 season. Few Rotorua anglers fished the other four river zones, which were further away from the main population centres of the Rotorua region.
53. For Hawke's Bay AWS licence holders, Zone D was the most popular, followed by Zone E, then Zone C (Te Hoe confluence to Waipunga confluence). Collectively, these three zones received an estimated 4100 visits by Hawke's Bay anglers during the 1989/90 season. Angler use of the lower

Table 7. Angler use data for Zones A-F for (a) Rotorua and (b) Hawke's Bay AWS licence holders.

Zone	No. of respondents	No. of visits	Visits per respondent	% of total angling effort	Estimated no. of visits	95% confidence limits
(a) Rotorua						
A	1	1	1.0	2.6	35	69
B	1	1	1.0	2.6	35	69
C	1	1	1.0	2.6	35	69
D	3	14	4.7	36.8	494	717
E	5	19	3.8	50.0	670	764
F	1	2	2.0	5.3	70	138
(b) Hawke's Bay						
A	5	9	1.8	1.1	47	44
B	9	15	1.7	1.8	78	56
C	38	124	3.3	15.1	644	309
D	82	371	4.5	45.1	1926	693
E	4	5	1.2	0.6	26	27
F	4	5	1.2	0.6	26	27

mainstem (Zones A and B) and the lower Te Hoe River (Zone F) was considerably lower, although all zones did receive some use.

54. Most respondents from Rotorua and Hawke's Bay only fished one zone in the Mohaka River and none fished more than four zones. Of those who fished two zones, the combination of Zones D and E was the most frequent (50%), followed by Zones C and D (25%), and Zones C and E (8%). Anglers who fished three zones combined Zones C, D, and E the most frequently (79%).
55. Fishing success in the Mohaka River was impressive (Table 8); for most zones at least 75% of anglers who fished there were successful in catching trout. The catch rate for Rotorua anglers in all zones was about 2-3 times higher than that for Hawke's Bay anglers. Whether Rotorua anglers really do catch more fish than Hawke's Bay anglers, or whether the Rotorua results are biased by the small sample size, is unknown. In order to avoid overestimating catch figures for the Mohaka River, all catch estimates were based on the more accurate zone catch rates calculated for Hawke's Bay anglers. However, it was then not possible to calculate confidence limits for Rotorua anglers. Estimated numbers of fish landed were in the thousands for some zones, with Zones D and E having the highest catch for both districts.
56. When results for both districts were combined (Table 9), the high angler use and fish numbers in Zones D and E was further highlighted. Collectively, these two zones accounted for over 80% of the fishing effort made on the Mohaka mainstem. The third most popular zone was Zone C, which received less than one third as many visits as Zones D or E. Angler use of Zones A and B was negligible compared to the other three zones. In total, an estimated 320 Rotorua and 580 Hawke's Bay AWS anglers fished the Mohaka mainstem during the 1989/90 season.

TABLE 8. Angler catch data for Zones A-F for (a) Rotorua and (b) Hawke's Bay AWS licence holders.

Zone	No. of fish landed	% success	Fish per visit	Estimated no. of fish per season	95% confidence limits
(a) Rotorua					
A	2	100	2.0	24	-
B	5	100	5.0	49	-
C	3	100	3.0	32	-
D	55	100	3.9	692	-
E	44	100	2.3	1005	-
F	6	100	3.0	84	-
(b) Hawke's Bay					
A	6	40	0.7	31	43
B	21	78	1.4	109	96
C	110	74	0.9	571	316
D	533	68	1.4	2767	1744
E	437	78	1.5	2269	1112
F	6	100	1.2	31	32

Comparison of NRAS and 1991 Survey Results

57. There was a marked increase in angling use of the Mohaka River above the Te Hoe confluence, although the zones above the Waipunga confluence clearly received the most use (Table 9). The estimated number of fish landed showed a similar pattern. Whether Zone C should be included as part of the nationally important fishery is not entirely clear. Access is more restricted in Zone C than Zone D, and often prohibited during summer due to forest fire risk. This could partially account for the lower use of Zone C.
58. Angler use is only one measure of a fishery's value. Anglers who responded to the NRAS rated the middle reaches (down to at least the Te Hoe confluence (Wellwood 1968)) highly, and the river does not change character between Zones D and C. In addition, Strickland (1991) has stated "it is unlikely that any significant decrease in trout density occurs downstream of Glenfalls until the gorge area above Willow Flat". These facts suggest Zone C should be included as part of the nationally important fishery.

TABLE 9. Combined Rotorua and Hawke's Bay angler use and catch data for Zones A-E (Mohaka mainstem).

Zone	Estimated no. of visits	% of total angling effort	Estimated no. of fish	Fish per visit
A	82	1.5	55	0.7
B	113	2.1	158	1.4
C	679	12.3	603	0.9
D	2420	43.9	3772	1.6
E	2217	40.2	2353	1.1
Total	5511± 1432	100.0	6941	1.3

TABLE 10. Comparison of estimated angler use of the Mohaka mainstem between the NRAS and the 1991 survey. For comparison, all estimates are rounded to two significant figures.

Rotorua district			
Season	AWS licence sales	Estimated no. of	
		anglers	visits
1980/81 ¹	16060	580	2500
1989/90	9206	320	1300
% decrease	43	45	48

Hawke's Bay district			
Season	AWS licence sales	Estimated no. of	
		anglers	visits
1979/80 ²	2125	820	4900
1989/90	1438	580	4200
% decrease	32	29	14

Data sources

¹Teirney *et al.* 1982

²Richardson *et al.* 1984b

59. Comparison of Mohaka River angling use between the NRAS and the 1991 survey suggest angler use of the Mohaka River has decreased about 25% over the past 10 years (Table 10). This decrease has paralleled a decline in AWS licence sales in these two districts, a trend experienced by a majority of acclimatisation societies nationwide, and particularly in the North Island. Most North Island districts recorded a drop in AWS licence sales of 20 - 30% between 1980 and 1990 (B. Parkes, Fish and Game Council National Executive, Wellington, pers. comm.).
60. For Rotorua anglers, the percentage decrease in estimated numbers of anglers and visits is about the same as the percentage decline in AWS licence sales (Table 10). Hawke's Bay anglers visit the Mohaka River relatively more now than previously; licence sales have dropped by one third whereas estimated visits have decreased by only 14%. This suggests the Mohaka is still used relatively the same as it was 10 years ago by Rotorua anglers, and more so by Hawke's Bay anglers.

61. A similar decline in angling use has been reported for the majority of rivers which have been recently surveyed and compared with the NRAS (Table 11). Most rivers showed a drop of at least 20% in the estimated number of visits made during recent seasons. However, one survey concluded that "although there was a change in the estimates of absolute use, the rankings of rivers for angling use did not change significantly" (Smith 1989). Other surveys also confirmed this (Houlbrooke and Ward in prep.)
62. Anglers' catch in the Mohaka River strengthens its nationally important status. When compared to other nationally important trout fisheries for which estimated catches are available, the Mohaka catch per angler exceeded that of all the other rivers (Table 12). Table 3 of my evidence showed the Mohaka River held a high biomass of trout compared with other New Zealand rivers, and anglers obviously are successful at catching them.

POTENTIAL IMPACTS OF HYDRO DEVELOPMENT

63. At the time of writing, no specific data on the site, size, or operation of any potential hydro-electric developments are available. For the purposes of this discussion, it is assumed the main area of interest would be the lower river up to about the Te Hoe confluence and up to three dams could be built. It is also assumed the generation pattern of any dam would follow the national load pattern, i.e. there would be daily and weekly variations in discharge. The main impacts for fisheries of such a scheme would be:
 - (1) A barrier to fish passage.
 - (2) Fluctuating downstream flows.
 - (3) Substitution of a lake environment for a riverine environment.

TABLE 11. Comparison of estimated angler use between the NRAS and recent surveys. For comparison, all estimates are rounded to two significant figures.

River	National River Angling Survey			Recent Surveys		
	Season	Estimated no. of		Season	Estimated no. of	
		anglers	visits		anglers	visits
Oreti	1979/80 ¹	2900	31000	1989/90 ⁵	2100	19000
Manawatu	1979/80 ²	880	15000	1985/86 ⁶	980	8600
Rangitikei*	1979/80 ²	850	9300	1985/86 ⁶	1100	9600
Hutt	1979/80 ²	690	840	1985/86 ⁶	720	6200
Motueka*	1979/80 ³	1100	12000	1988/89 ⁷	1100	10000
Wangapeka	1979/80 ³	640	3100	1988/89 ⁷	530	2500
Riwaka	1979/80 ³	320	1800	1988/89 ⁷	290	1400
Mohaka*	1979/81 ⁴	1400	7400	1989/90	900	5500

*Nationally important angling river

Data sources

¹Teirney *et al.* 1984

²Richardson *et al.* 1984a

³Richardson *et al.* 1984c

⁴Teirney *et al.* 1982

⁵Rodway 1990

⁶Smith 1989

⁷Houlbrooke and Ward (in prep)

TABLE 12. Comparison of estimated seasonal catches of trout by AWS anglers in nationally important rivers.

River							
	Waitahanui ¹	Hurunui ²	Tauranga- ¹ Taupo	Waitaki ³	Tongariro ¹	Rangitikei ⁴	Mohaka
Season	1982/83	1981/82	1982/83	1981/82	1982/83	1985/86	1989/90
Catch/angler	3.6	4.6	4.9	7.0	7.2	7.6	7.7

Data sources

¹Shaw *et al.* 1985²Bonnett *et al.* (in press)³Pierce & Smith 1989⁴Smith 1989

Barrier to Fish Passage

64. Any dam in the lower river would affect the passage of most native fish species found in the Mohaka catchment. Koaro, possibly an important component of the whitebait catch, and longfinned eels migrate extensive distances upstream in the Mohaka catchment. Downstream passage of fish, eggs, and larvae is also important for eels, koaro, torrentfish, and bullies. Large trout and eels are particularly vulnerable to being damaged while passing through turbines (Mitchell 1989).
65. Successful upstream fish passes have been constructed for native species which are good climbers (eels, koaro, possibly lampreys and common bullies) but how recruitment from fish passes relates to natural recruitment has never been studied. The distribution pattern and size structure of the Mohaka longfinned eel population could be altered by obstructions to upstream and downstream migrations, and Strickland (1985) suggested "the quality of the trout fishery in the middle reaches is partly dependent on the presence of eels in those reaches".
66. Along with smelt and common bullies, koaro will form landlocked populations in hydro reservoirs. However, it is unlikely a lake population of koaro could support a whitebait fishery at the Mohaka River mouth.

Fluctuating Downstream Flows

67. The extent of this impact would be related to the amount and duration of the flow fluctuations. Significant impacts could be the periodic dewatering of fish habitats along river margins, variations in the size or depth of runs, pools, and riffles, altering the tidal regime which is important for inanga spawning, and making conditions for fishing more dangerous.

Substitution of Lake for River Fishing

68. Depending upon its location and height, a dam near the Te Hoe confluence could drown a significant portion of the middle Mohaka. The productivity of such a lake would depend upon the amount of littoral habitat, how much the lake level fluctuates, and the water clarity and residence time. Lake fishing is popular with many anglers, but Hawkes Bay already has several lake trout

fisheries. These include Lakes Tutira, Waikopiro, Opouahi, Blue, Te Pohue, and Hawkestone. Lake Taupo, one of the North Island's finest lake fisheries, is only another hour's drive away, and Central North Island anglers have a wide choice of high quality lake fisheries around Rotorua. Even the creation of an artificial lake with high trout production may not be an acceptable reason for drowning a nationally important river fishery.

SUMMARY

69. The Mohaka catchment has a fairly diverse native fish fauna, typical of the large North Island rivers. The distribution of the native fish is strongly influenced by the Mokonui Gorge, with only two species, longfinned eels and koaro, being found much above the gorge. Nine of the 10 native species are migratory, and require access to or from the sea at some stage of their life cycles.
70. The NRAS identified the trout fishery of the Mohaka mainstem as being nationally important, one of only 23 such rivers nationwide. The Mohaka supports a large biomass of trout, tenth highest in New Zealand, fourth highest in the North Island, and sixth highest of all New Zealand rivers which are not lake or spring-fed. Some of the tributaries also support trout fisheries, and the Ripia has been identified as a locally important wilderness fishery. In addition, many tributaries are important for spawning and rearing.
71. The most heavily fished zone in the Mohaka River was between the Waipunga confluence and the Ripia confluence, followed by the next most-upstream zone, from the Ripia confluence to the Kaipo and Oamaru junction. Collectively, these two zones accounted for over 80% of the fishing effort anglers expended on the Mohaka mainstem. However, Zone C (Te Hoe confluence to the Waipunga confluence) should be included as part of the nationally important fishery because the reach is highly valued and trout stocks are equal to those further upstream.
72. AWS licence sales have declined nationally and this has been paralleled by less angler use of rivers. However, the Mohaka River is still used relatively the

same by Rotorua anglers, and relatively more by Hawke's Bay anglers than it was 10 years ago.

73. About 75% of anglers who fished the Mohaka River caught trout. The estimated total seasonal catch per angler in the Mohaka exceeded that of other nationally important rivers, highlighting this river's value as a trout fishery.
74. The tribunal appointed by the Ministry for the Environment drafted a National Water Conservation Order for the whole Mohaka River system based on four outstanding features, including the nationally important trout fishery. I fully support the draft order as it ensures both the trout and native fish populations are protected from possible adverse impacts of water abstraction, waste disposal, and hydro-electric development.

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APPENDIX I. NRAS data for the Mohaka River catchment (from Richardson *et al.* 1984b and 1987).

TABLE 1. Measures of angler use.

River	No. of respondents from				Total no. of visits
	Hawke's Bay	CNIWC*	Other Districts	Total	
Mohaka	82	33	18	133	681
Te Hoe	1	6	-	7	21
Hautapu	-	11	1	12	73
Waipunga	16	27	7	50	181
Inangatahi	6	-	-	6	33
Makahu	9	-	-	9	19
Ripia	10	11	1	22	93
Mangatainoka	-	9	-	9	23
Taharua	-	5	1	6	21
Oamaru	-	9	2	11	49
Kaipo	-	9	1	10	48

*Central North Island Wildlife Conservancy

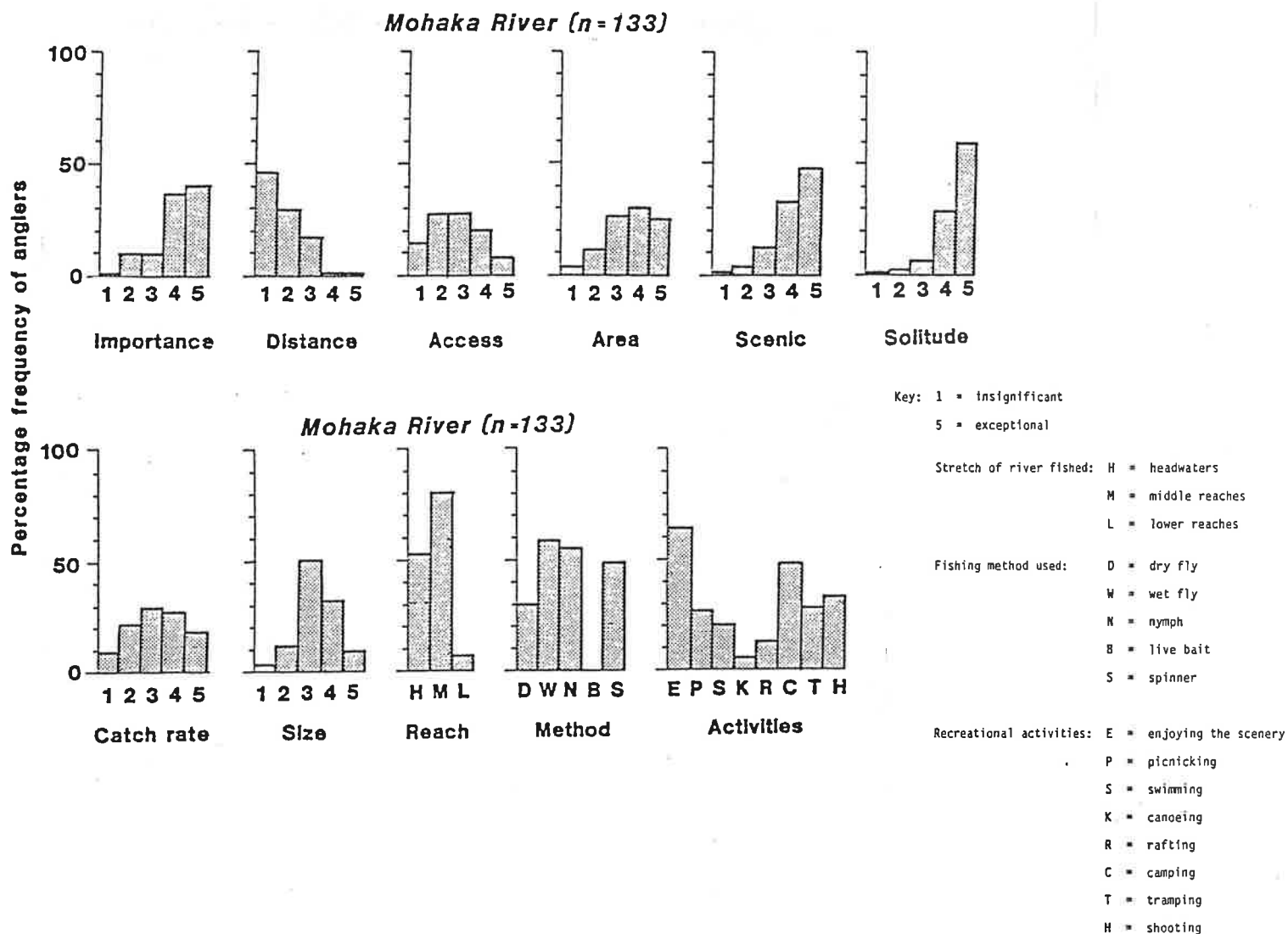


Figure 1. Frequency histograms of anglers 1-5 ratings assigned to the Mohaka River

APPENDIX II. Questionnaire and covering letter from the 1991 angler survey.

A. Questionnaire

Mohaka River Angling Survey

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1. Did you fish the Mohaka River for trout during the 1989/90 fishing season?

No	
Yes	

If you did NOT fish the Mohaka River, please mark the "No" box and return this questionnaire in the envelope provided. If you did fish the Mohaka River, please continue.

The next two questions refer to the zones marked on the map below.

2. Please enter the number of days you fished in each zone or zones marked on the map. If you did not fish in a particular zone, enter 0 under "Number of days fished".

	Number of days fished	Number of trout landed
Zone A		
Zone B		
Zone C		
Zone D		
Zone E		
Zone F		

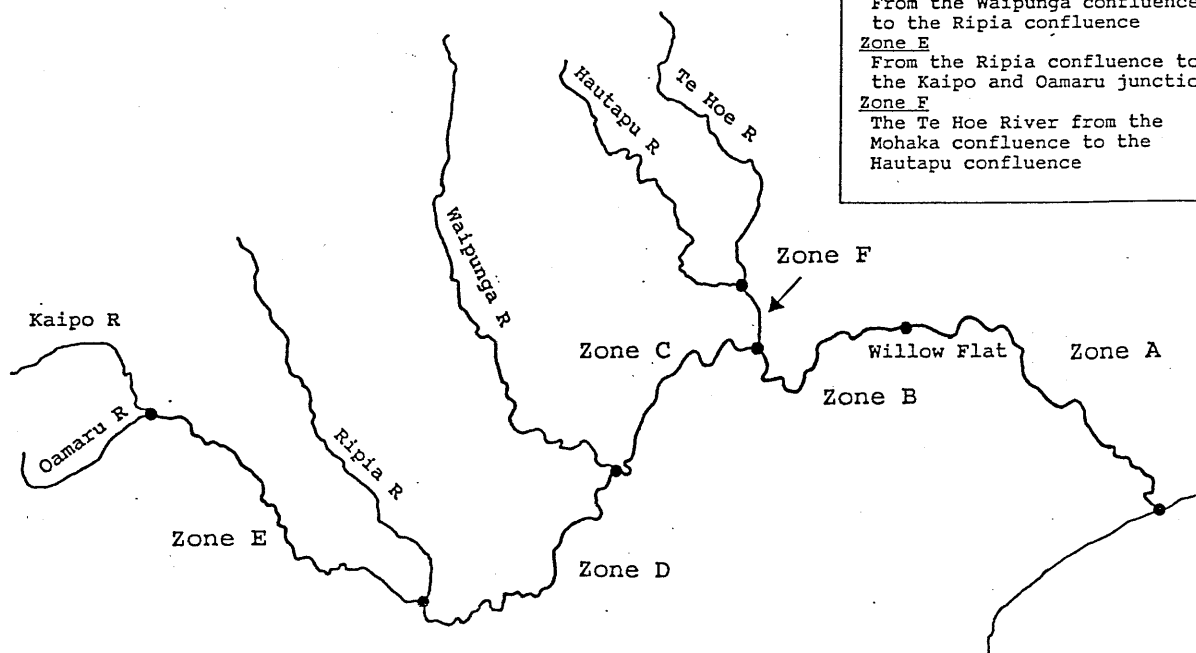
3. Please enter the number of legal sized (over 30 cm) trout you landed (either kept or returned alive) from each zone in which you fished. If you fished in a particular zone but landed no trout, enter 0 under "Number of trout landed".

Put this questionnaire in the reply-paid envelope provided and mail it as soon as possible. Thank you for your co-operation.

Hawkes Bay Fish & Game Council
PO Box 259
Napier

Mohaka River and survey zones (mainstem only - do not include tributaries except zone F)

- Zone A
From the mouth to Willow Flat
- Zone B
From Willow Flat to the Te Hoe confluence
- Zone C
From the Te Hoe confluence to the Waipunga confluence
- Zone D
From the Waipunga confluence to the Ripia confluence
- Zone E
From the Ripia confluence to the Kaipo and Oamaru junction
- Zone F
The Te Hoe River from the Mohaka confluence to the Hautapu confluence



B. Covering letter

HAWKE'S BAY FISH AND GAME COUNCIL

Secretary:
 G T KING B.B.S., A.C.A.
 Phone 8353385
 P O Box 259
 Napier

MARITIME HOUSE
 CNR BYRON & BROWNING STS
 NAPIER, N.Z.
 Game Farm & Hatcheries:
 22 Burness Road
 Greenmeadows
 Phone 8442-291

21st January 1991

Dear Angler

The Hawkes Bay Fish & Game Council is conducting a study of angling in the Mohaka River. Our main aims are to find out where anglers fish the Mohaka and how many trout are landed from different zones. The information will be used at the Mohaka River Water Conservation Order appeal hearing to be held later this year. Individual answers will be confidential to staff, however.

Your name and address were among 600 chosen at random from angling licence holders in Hawkes Bay and Central North Island. We would like you to complete the attached questionnaire and send it back to us, even if you did no fishing in the Mohaka last season. This should take only 5 - 10 minutes.

PLEASE RESPOND BEFORE ²⁵~~14~~ FEBRUARY 1991 TO MEET THE SURVEY TIMETABLE.

Thank you for your cooperation. If you are not sure of what to do, please telephone (collect if necessary) one of the following numbers:

Bill Spooner (06) 8442291
 Gary King (06) 8353385

Yours faithfully



 G T KING - SECRETARY