Fish communities of Lake Whangape, Waikato -April 2000 survey

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l. Introduction

1.1 OBJECTIVES

Waikato Conservancy aims to carry out freshwater fish monitoring that will document the effect of removal of commercial fishing pressure on the eel and other fish (especially pest fish) populations of Lake Whangape. Hypotheses to be tested after commercial eel fishing ceases in Lake Whangape include;

1. The length frequency distribution of shortfinned and longfinned eel populations will change; presently predominantly small eels (sub-commercial size), and larger eels will become more common.

2. Over time, eel species proportions will change in favour of longfinned eels (percent composition by number and biomass).

3. Populations of other freshwater fish (especially pest fish) will be impacted (e.g., reduced abundance, change to size distributions) by greater numbers of piscivorous eels in the fish community.

The present investigation hopes to assess impacts of eel fishery closure on the fish population within Lake Whangape. Sampling gears and design outlined in the methods section are primarily intended for the initial baseline survey, and repeat surveys at 1, 3, 5, and 10 year intervals are recommended to follow this design. Where appropriate, additional techniques to be employed in the future surveys are also discussed.

1.2 STUDY SITE

Lake Whangape is situated 13 km north-west of Huntly (NZMS260 S13 26915 64125). It is the second largest of the LowerWaikato lakes and has 1130 ha of open water, about 600 ha of adjacent swamp, and a catchment of 310 km 2.

Maximum summer water depths are in the range of 2.5 m but these can rise by 1.7 m during winter. The main inflow is from the Awaroa Stream but several smaller streams and drains also enter the lake. The outlet channel runs for approx. 2 km before it enters the Waikato River. The water levels in Lake Whangape have been affected by lower river water levels due to drops in the bed of the Waikato River and excavation of the sill at the lake outlet. A rock weir was installed by the Waikato Regional Council to maintain summer water levels at 1.5 m asl.

The lake is highly fertile and supports abundant plant and animal life. Dense beds of the exotic macrophyte *(Egeria densa)* dominated the flora of the lake prior to 1990, but since then the exotic hornwort *(Ceratophyllum demersum)* has replaced *Egeria* as the dominant macrophyte, and emergent beds are common throughout the lake especially in sheltered and shallow areas. The only exception appears to be the southern or Waikokawai Stream

arm of the lake (Site 3, Figure 1) where turbid water appears to have prevented the establishment of macrophytes.

A large variety of native and exotic fish have been found in the Lake Whangape catchment (Table 1). Although there are fewer fish species recorded from the lake itself, many of the fish recorded elsewhere in the catchment have also been found in the lake during previous studies (Hayes 1989, Hayes & Rutledge 1991) but not entered into the database.

Lake Whangape has been one of several lowland Waikato lakes that contribute a substantial component to the Waikato commercial eel landings (Chisnall & Hayes 1991, Chisnall et al. In prep). Several fisheries investigations have been undertaken on the lake over the last 20 years, documenting species diversity and abundance (e.g., studies cited in Hayes et al. 1992; Hayes et al. 1990; Chisnall & Hayes 1991; Hayes & Rutledge 1991; Chisnall et al. In prep, Chisnall &West 1996; NIWA unpubl. data - Report to MFisheries 1998). The aim of the present investigation was to apply similar sampling methods to those used previously, in intensive surveys of the fish communities present throughout the lake. Results of the surveys will provide baseline information on fish communities prior to the cessation of commercial eel fishing in the Lake Whangape Wildlife Management Reserve.

2. Methods

2.1 SAMPLING

As discussed in the introduction, where practical, methods used were kept comparable to those used in previous sampling.

Ten large fine-meshed fyke nets (Chisnall & West 1996), small fine-meshed fyke nets, G-minnow traps and panel gillnets (3-4 10x2 m panels of -25,62, 87 and 112 mm stretched mesh) were set at 5 sites spread evenly around the Lake margins (Fig. 1). Sites were chosen to correspond to earlier sampling (Hayes 1989, Hayes & Rutledge 1991, Hayes et al. 1992), except site 4 which was moved further north to avoid the Awaroa Stream inflow. At each site one of each gear type was set at both the shore and -100 m from the shore. Due to possibility of losing G-minnow traps, both were set near the shore.

All nets were unbaited and set for approx. 24 hours. Site nets were picked up in order 1,2,5,4, then site 3 last.

In addition, sampling of three beach seines (5 mm mesh) of approx. 15 x 30 m was carried out at sites 2, 5 and at Northern Boat Ramp (Fig. 1) between 10.00 pm and 2.00 am on the night of 18 April.

2.2 CATCH PROCESSING

Catches of fish from individual nets/traps were kept separate. Eels were anaesthetised using benzocaine, while length and weight were measured using electronic measuring board and scales, then released alive back into the lake. Grey mullet were also measured using the electronic measuring board and scales.

Catches of the remaining smaller fish were killed in benzocaine then preserved in 5-10% formalin for later measurement. The majority of these samples have only been sorted into species and counted. However, samples of inanga have been measured for length/weight and in some cases, they have been sexed.

Results were analysed using SystatTm and SPSSTM statistical software packages.

3. Results

3.1 WATER QUALITY OBSERVATIONS

The following observations were made while moving around the lake by boat. The southern or Waikokawai Stream arm of the lake (Site 3, Figure 1) is still turbid as noted in earlier studies and its turbid water shows clearly as a line where it enters the main body of the lake. The lake waters were still warm (19-20°C, Table 2) and eel movement would have been unrestricted by cold water temperatures. Dissolved oxygen was high in all measurements. Beverlands arm was very shallow and turbid between beds of *Ceratophyllum*, although unconsolidated mud on the bottom still allowed passage by boat.

3.2 GEAR SELECTIVITY

Small and large fine-meshed fyke nets and panel gillnets caught a cross-section of those fish present (Table 3).

Koi and smaller goldfish were under-represented, given the abundance of koi seen from the boat and the numbers of small goldfish caught in night beach seines. Grey mullet and rudd were only caught in panel gillnets

Beach seines at night caught a large range of fish, especially smaller species and smaller individuals of larger species. Inanga and smelt were particularly well represented (Table 4).

3.3 SHORTFINNED EELS

To investigate if there were large differences in length and number of eels caught at different sites and net positions, catches were graphed separately.

No differences were obvious. Length/frequency and length/weight data are shown for all eels caught (Figures 2 and 3 respectively).

Lengths of shortfinned eels caught during previous sampling of the lake (Hayes 1989, Hayes et al. 1992, Chisnall unpublished) were compared to those caught in this sampling (Figure- 2). Trap nets were used in 1987 (Hayes 1989) and large fine-meshed fykes in the 1992 and 2000 samplings. These two nets have been shown to catch a comparable size range of eels to trap nets (Chisnall & West 1996). The size range of eels caught shows a trend towards higher numbers of small eels, and the weight of the majority of eels caught in 2000 is below the current commercial limit of 220 g which was increased from 150 g in 1986 (Figure 3).

3.4 INANGA

Almost all inanga were caught in night beach seines (Table 4, Figure 4). The majority of the inanga caught were mature adults (Table 5, Figure 4). No large differences in numbers caught were apparent between sites.

3.5 COMMON BULLY, GAMBUSIA AND OTHER SMALL FISH

No common bully, gambusia or other small fish have been measured, but lengths of preserved samples will be included in a subsequent report.

4. Discussion

The diversity of fish species caught in this study was similar to that in previous sampling.

While slightly fewer shortfinned eels were caught per large fine-meshed net than in previous studies, the numbers are comparable, given low catches/ fishing inefficiency in some of the offshore nets, and the full moon. Previous sampling was also during summer, when lower water levels and higher activity of eels may have increased catch rates.

No longfinned eel were caught in netting of the lake in 1986/1987 (Hayes 1989) and 1992 (B. Chisnall Unpubl.) but four were captured in this sampling. While the number is too low to suggest any real increase in longfinned eel numbers it may indicate some movement of longfinned eels into the lake during autumn.

Large numbers of inanga were caught in Lake Whangape by beach seining at night, and the lake appears to be well used by adult inanga. Fish access over the rock weir was difficult at the time of sampling due to water perculating through rather than over it. Rain subsequent to our sampling raised the wa-

ter level in the lake so that the weir was well overtopped and fish passage unimpeded.

Compared to numbers observed from the boat and caught by other fishermen, the numbers of koi caught in this sampling were very low and methods used appear ineffective for sampling larger koi.

5. Conclusions

Fine fykes are baited and set well away from superfykes to eliminate any reduction in catch in superfykes.

Due to lower catches in our April survey, possibly as a result of cooler weather (autumn) and full moon, it is recommended that future sampling be undertaken in February/summer and not during the full moon.

As there was little difference in catches of eels in fyke nets between near and off shore positions, future netting should be carried out at lake edge or shore positions only. This will also make setting nets easier and potentially increase fishing efficiency.

Five multi-panel gillnets could have been set (not 10), and alternative methods to assess koi carp should be used (such as trammel nets and large-meshed gill nets >100 mm, or recreational catches).

Seining using a 1-2' mesh gillnet on the lake margins during the day should be assessed for capturing koi and other carp species.

A total of 15 small (commercial net size) fine-meshed fyke nets should be used to sample eels as they are easier to set in shallow/shore positions and more readily available. They caught a similar size range of eels to large fine-meshed fykes and, although they caught fewer small species of fish (for example common bully, inanga and smelt), these species are best sampled by beach seining at night.

The setting of large fine-meshed fyke nets for the next summer sampling will be considered if they are available and time permits.

6. Acknowledgements

Joshua Smith (NIWA) stoically manned the measuring board while the rest of us collected nets. Grant Barnes (DOC) helped make picking up the nets entertaining. Lindsay Chadderton (DOC) gave up a night to wade around in the mud. Jared Millar (University of Waikato) processed inanga samples. Earl

(DOC volunteer) helped sort and count fish samples from beach seines. Avi Holzapfel's (DOC) help in improving the report was appreciated.

7. References

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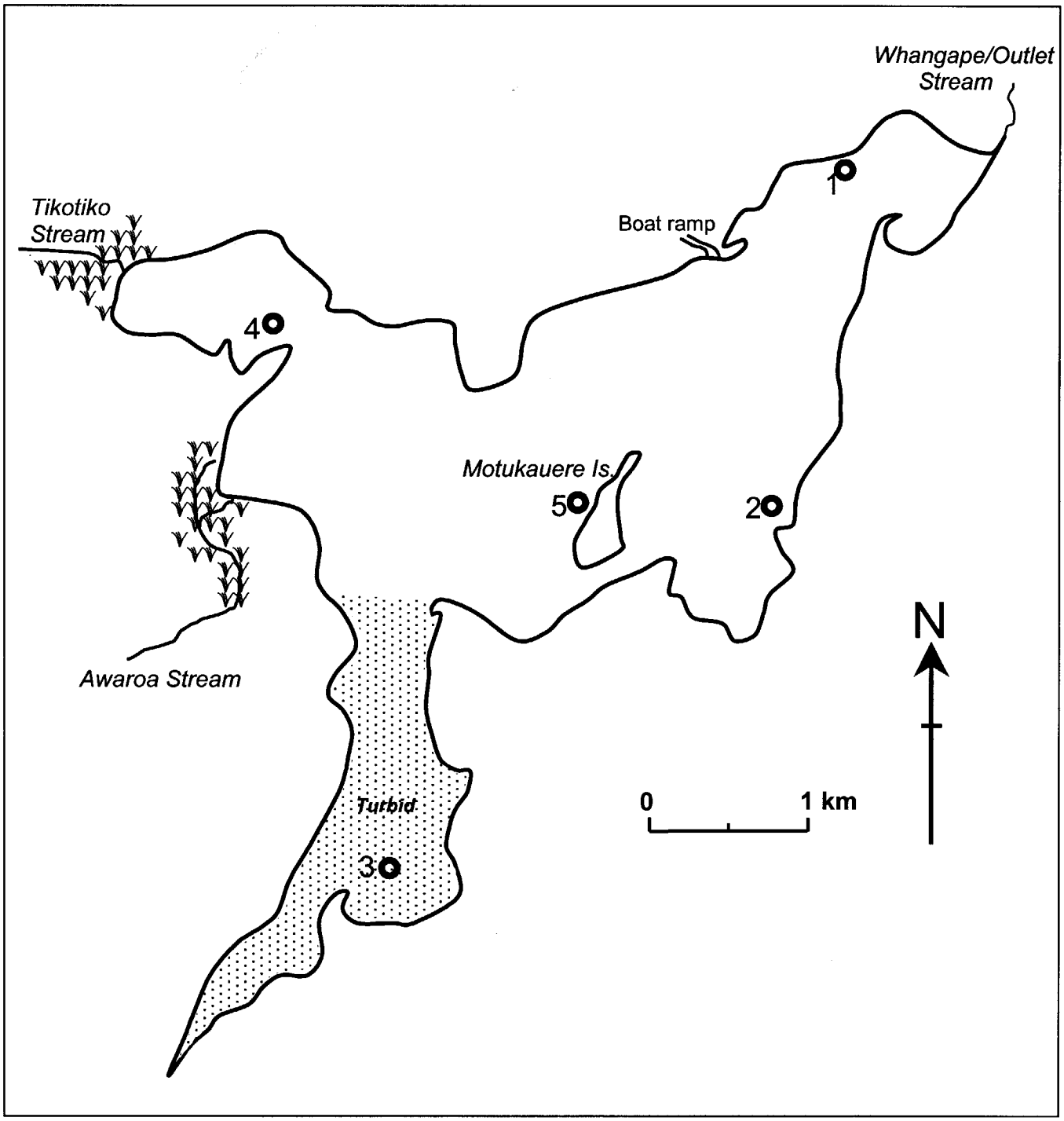

Figure 1. Lake Whangape with sampling sites marked as ⭘ 1-5, ⩔ Wetlands.

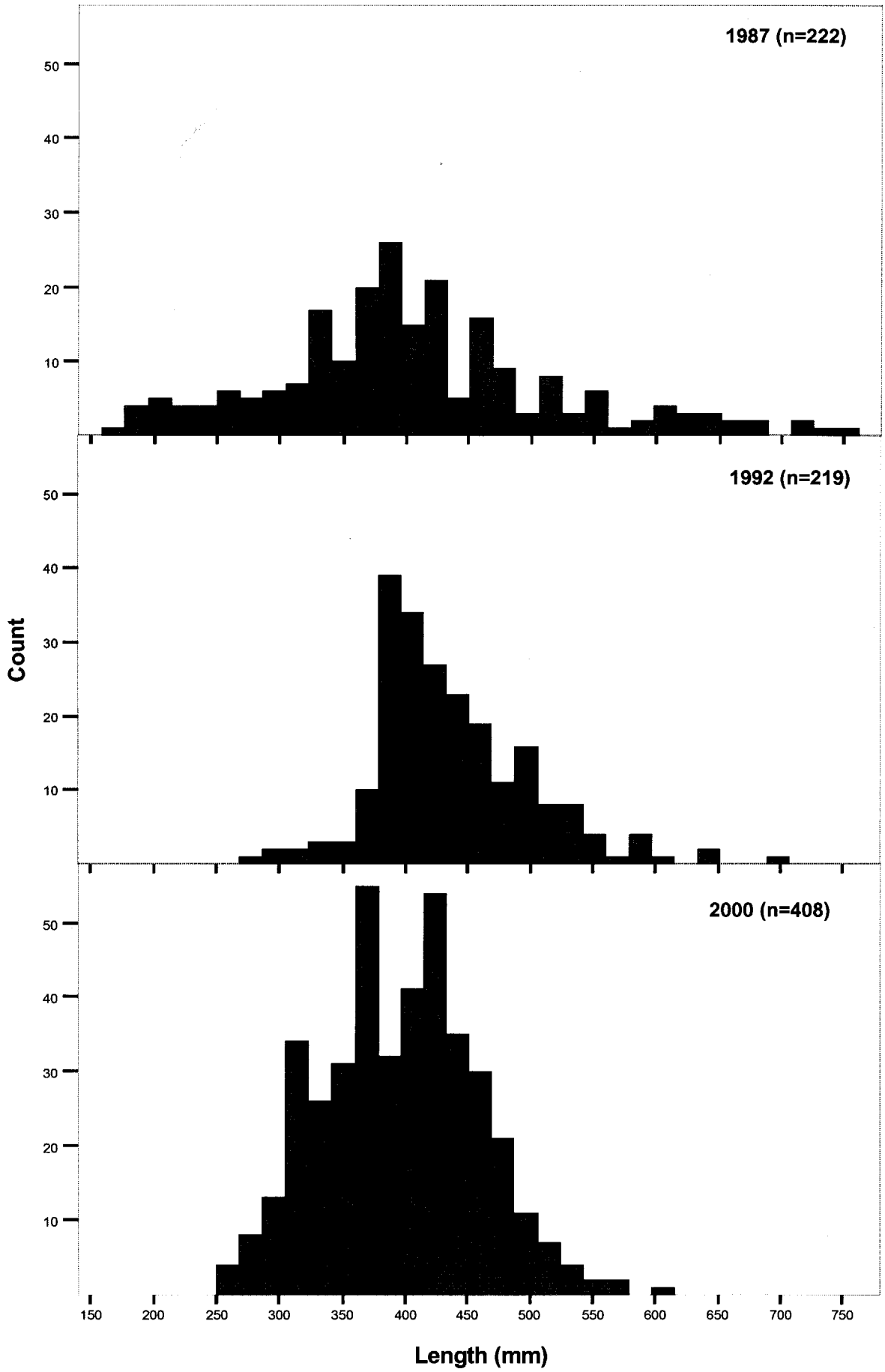

Figure 2. Comparison of Length frequency distribution of shortfinned eels caught from sampling in 1987, 1992 and 2000. Eels were caught using trap nets (Hayes 1989, 1987 data above), large fine-meshed fykes (Chisnall unpublished data, 1992 data above), and large and small fine--meshed fykes 2000.

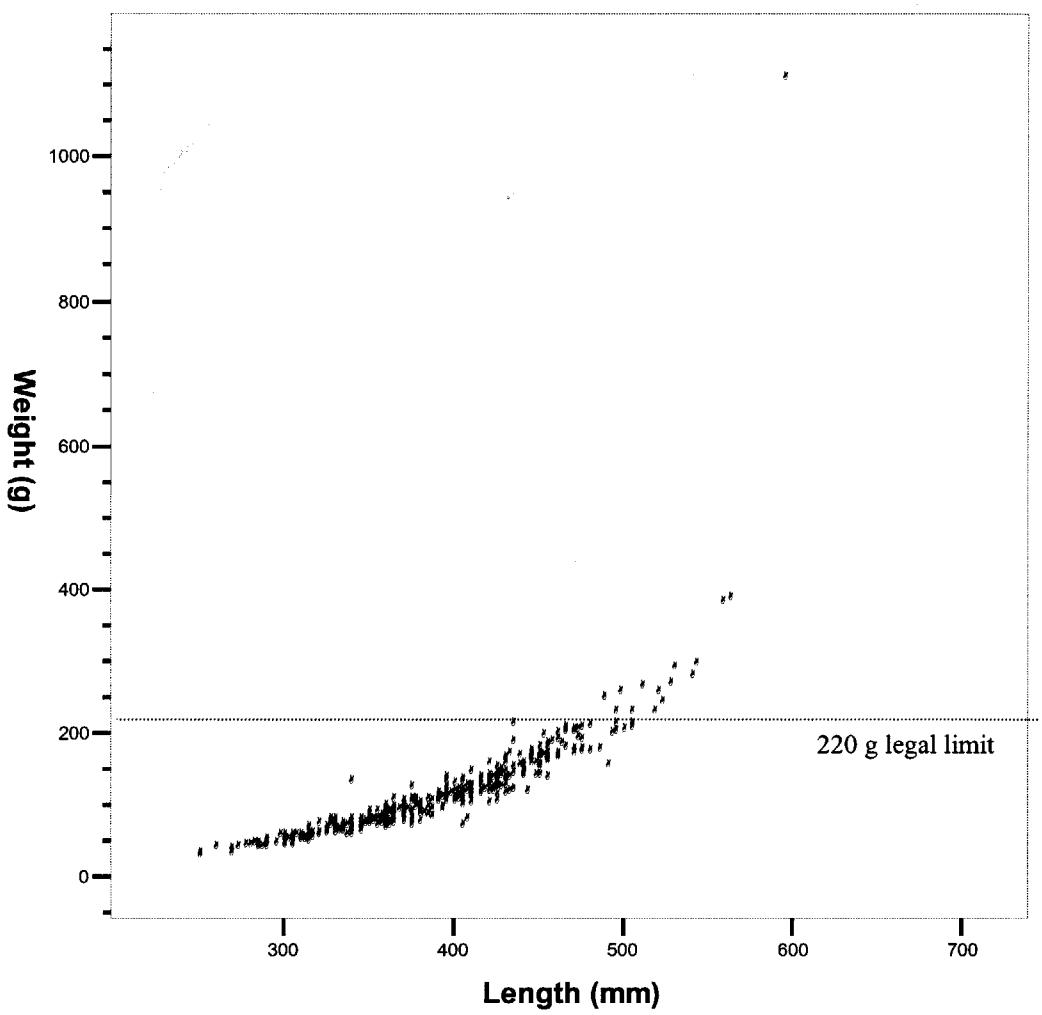

Figure 3. Length/weights of all shortfinned eels caught from large and small fine meshed fykes set in Lake Whangape 18-19 April 2000.

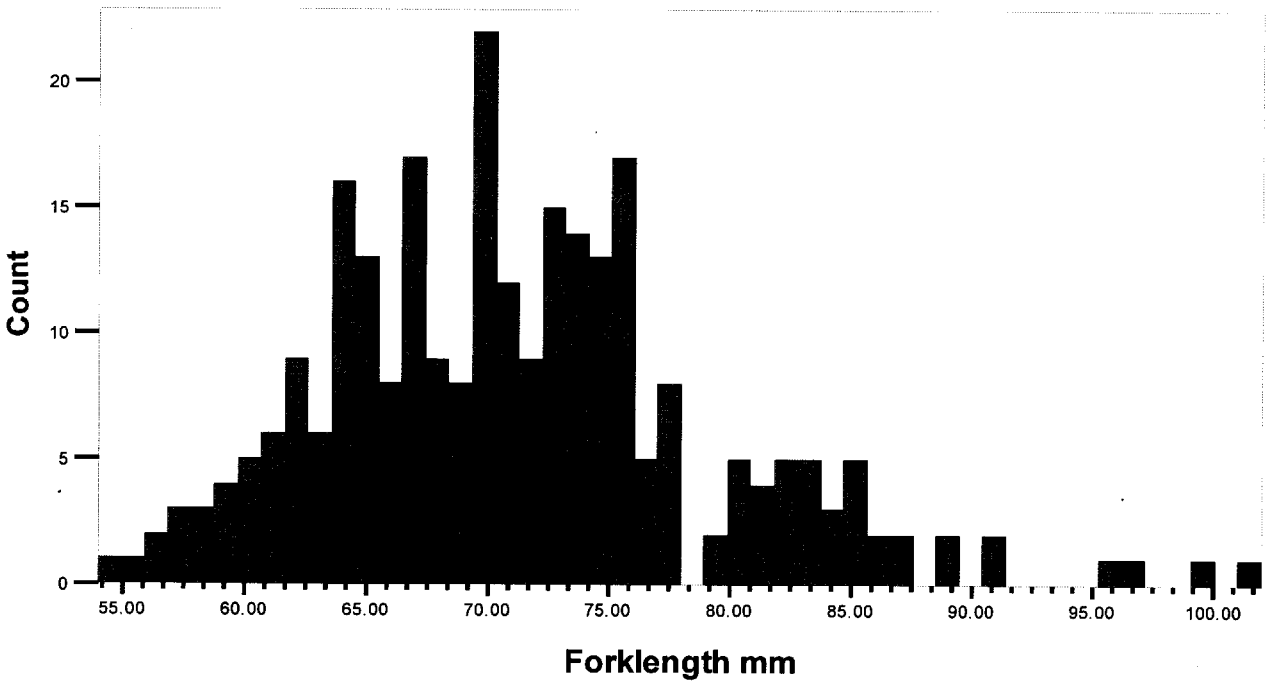

Figure 4. Length frequency distribution of all inanga caught from beach seines.

Table 1. Summary of New Zealand Freshwater Fish Database records from Lake Whangape Catchment

Site	CB	CrB	Bu	LF	SF	eel	S	In	GK	BK	BM	GM	BT	Ru	Koi	GF	CF	MF	K
Whangape Stm	3			1											1	c		a	
L. Whangape	c				18		O					70	1			34	61	c	
L. Whangape wetland	4					c		2										c	
Maire Stm tributary	a	c		2			1												O
Mangataru Stm	a					1	a	1											
Kouratahi Stm	3	1				4													
Awaroa Stm				8	39				r		1			4	2	5	18	1	
Tapp Stm			6	8	138	176			6	13									a
Renown Stm	r			1	7				3	1									O
Te Horo Stm				c	c														13

a = Abundant, c = Common and r = rare
CB = Common Bully, CrB = Cran's Bully, LF = Longfinned eel, SF = Shortfinned eel, S = smelt, In = inanga, GK = Giant kokopu, BK = Banded kokopu, BM = Black mudfish, GM = Grey mullet, BT = Brown Trout, Ru = Rudd, Koi = Koi carp, GF = Goldfish, CF = Catfish, MF = Gambusia, K = koura.

Table 2. Position and water quality for sites sampled for freshwater fish in Lake Whangape 18-19 April 2000.

Site No.	Name	NZMS260 (GPS except 5)	Water Temp °C	Do mg/l	Conductivity µS
1	Below wildlife hut	E93985 N14775	19.6	11.5	340
2	Beverlands	E93501 N 12612	19.5	11.3	300
3	Turbid arm	E91062 N10413	19.5	9.7	534
4	Tikotiko Stm.	E90215 N13960	20	12.4	397
5	Motukauere Is.	E925 N128	20	13.6	337

Table 3. Summary of lengths of fish caught in large and small fine-meshed fyke nets and gillnets (small fish from large fine-meshed fykes yet to be measured).

Fish species	Number	Length (mm)			
		Minimum	Maximum	Mean	Std Deviation
Catfish	3	243	260	253	9
Goldfish	1	93	93	.	.
Grey Mullet	184	185	450	293	43
Koi carp	1	245	245	.	.
Longfinned eel	4	413	710	503	140
Rudd	6	185	233	209	18
Shortfinned eel	408	255	600	396	62

Table 4. Total number of fish captured by beach seining at night at sites on shores of Lake Whangape. *Approximate weight of mysids includes some macrophyte fragments.

Site	Inanga	Smelt	CB	GF	SF	LF	Catfish	Koi	MF	Mysids (g)*
Boat ramp	58	22	45	16	4	2	1		23	0
Boat ramp	25	21	35	2		1			17	0
Boat ramp	34	24	13	7				1?	15	0
2	50	71	79	42	3		1		332	12
2	18	21	245	27	5		1	3	315	31
2	4	14	90	12	5				447	46
5	41	22	47	6	2				52	8
5	10	2	59	1	1				6	<5
5	27	13	75	4				2	17	<5
Average No./seine	29.7	23.3	76.4	13	2.2	0.3	0.3	0.6	136	~12

Table 5. Sex, number and length of inanga caught from beach seines (? = unable to sex due to lack of gonad development).

SEX	Number	Length (mm)			
		Maximum	Minimum	Mean	Std Deviation
?	88	86	54	66	6.35
♀	87	102	59	75	8.61
♂	92	87	55	72	6.68
All	267	54	102	71	8.1059

Appendix 1

Site 1

Located below the old wildlife hut. Dense *Ceratophyllum* beds with soft mud bottom out to 30 m offshore. Fyke and minnow traps set inshore of mai mai, with gillnets off snags nearby.
Nets set 10.20 am to 11.30 am, picked up 10.00 am onwards

Inshore catches: minnows #1 1xSF - 350mm, #2 2xgambusia, fine fyke (in clear patch in weed) zero, superfyke eels plus 1 inanga and 5-10 gambusia
100 m catches: Superfyke (set inshore off mai mai) very little, fine fyke (set on other side of mai mai) ++eels

Site 2

Located offshore of pines and patch of raupo, but by shore 100 m south. Dense *Ceratophyllum* beds with soft mud bottom out to 100 m offshore. Numerous large koi seen near water surface in this arm especially near end of island. 2-3 dead koi and goldfish seen floating on water surface no apparent signs of damage.
Nets set 12.30-1.30 pm, picked up 11.15 am onwards
Inshore catches: Minnows zero, fine fyke goldfish
No other catches recorded.

Site 3

Located on the eastern side of the arm below Castle style house. Water in arm very turbid, discernible as sharp line where it enters lake. No beds of macrophytes seen. Eastern shoreline grazed with exposed clay predominating wave zone (source of some of the turbidity?).
Nets set 3.00-4.00 pm, picked up 3.07 pin onwards

Inshore catches. Minnows #1 lxCB, #2 SF-220,260 mm., Fine fyke lxlarge LF +SFs, Superfyke low catch with -100g? mysids.
100 m catches. Fine fyke few eels, superfyke only 5 eels, l smelt and 3 CB not preserved.

Site 4

Located in the Tikotiko Stream arm by existing mai mai on southern side of arm. Shallow arm with bottom of thick layer of silt amongst *Ceratophyllum* beds. Large numbers of swan seen at entrance to arm.
Nets set 4.15-5.15 pm, picked up 2.00 pm onwards

Inshore catches. Minnows #1 0, #2 SF-300 mm., fine fyke +eels, superfyke ?
100 m catches. Fine fyke ?, superfyke cod open slightly, 0 catch,

Site 5

On the western shore of Motukauere 1. Shallow exposed clay and sand shore with *Ceratophyllum* beds occurring 20-30 m offshore.
Nets set 1.50-2.50 pin, picked up 12.30 pin onwards

Inshore catches. Minnows #1 1 inanga, #2 SF-330 mm 6 CB., fine fyke ?, superfyke + eels
100 m catches. No catches recorded,

Table 1a. Total number of fish captured by site, net type and position. Excludes small fish from fine meshed fykes preserved separately.

Site	Fish spp.	Large fine meshed fykes		Small meshed fykes		Multi-Panel Gillnets		G-minnow traps	
		Shore	100m	Shore	100m	Shore1	100m# 2	# 1	# 2
1	SF	27	1	0	17	0	0	1	0
	LF	0	0	0	1	0	0	0	0
	Mullet	0	0	0	0	10	3	0	0
	Rudd	0	0	0	0	0	1	0	0
	Gambusia	0	0	0	0	0	0	0	2
2	SF	14	3	0	19	0	0	0	0
	LF	0	0	0	1	0	0	0	0
	Mullet	0	0	0	0	7	0	0	0
3	SF	38	6	32	17	1	1	2	0
	LF	0	0	2	0	0	0	0	0
	Mullet	0	0	0	0	42	15	0	0
	Rudd	0	0	0	0	1	3	0	0
	Koi	0	0	0	0	0	1	0	0
	Catfish	0	0	0	0	1	1	0	0
	Com Bully	-	-	-	-	-	-	0	1
4	SF	92	0	26	33	1	2	0	1
	LF	0	0	0	0	0	0	0	0
	Mullet	0	0	0	0	20	46	0	0
	Goldfish	0	0	0	0	0	1	0	0
	Catfish	1	0	0	0	0	0	0	0
5	SF	49	9	13	5	0	3	1	0
	LF	0	0	0	0	0	0	0	0
	Mullet	0	0	0	0	35	5	0	0
	Rudd	0	0	0	0	0	1	0	0
	Catfish	0	0	0	0	1	0	0	0
	Com bully	-	-	-	-	-	-	6	0
	Inanga	-	-	-	-	-	-	0	1