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The New Zealand Freshwater Fish Survey: Guide to Input and Output

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KNOWLEDGE of New Zealand's freshwater fish fauna depends on published records which date back as far as the early explorations of this country by James Cook in the 1770s. However, in spite of intermittent studies since that time—and mostly since the 1930s—only limited data are available on past distributions of the species. Over the years much information on the fauna has been lost because it has not been systematically recorded or kept in a central data store.

To prevent further loss of such information Fisheries Research Division (FRD) has established a computer based system for storage and retrieval of field data on freshwater fish.

This leaflet outlines the reasons for establishing the data base and describes how information is put into and retrieved from the system. Access to this data base is available to anyone undertaking legitimate freshwater research.

Background

New Zealand has a small and rather sparsely distributed freshwater fish fauna, which comprises about 27 native species and some 16 introduced species. Only in the past 10–15 years has the fauna become well enough defined taxonomically to enable methodical and reliable recording of the distributions of species and data on their habitats. Old published material on our freshwater fish is quite plentiful, but many of the records are of doubtful use because the identity of the fish under discussion is uncertain.

There has probably been more collection and study of New Zealand's freshwater fishes in the past 20 years than in the previous 200 years; more than one-third of the publications discussing these fish have appeared since 1970 and more than half are post-1960.

There is little doubt that the most intensive field collection, particularly of indigenous fishes, has been by FRD staff, but other agencies, such as the Wildlife Service of the Department of Internal Affairs, various acclimatisation societies, some water managers (for example, Taranaki Catchment Commission, Waikato Valley Authority), and commercial organisations (Bioresearches Ltd., Cawthron Institute) have also undertaken similar work.

The recent high level of collecting activity has been made possible by the availability of sophisticated electric fishing equipment. New Zealand's freshwater fish tend to be small and cryptic, and to live in inaccessible habitats. Consequently, electric fishing equipment is virtually essential for catching them.

Interest in the fauna has been accelerated a little by the growth of ecology-consciousness and the environmental lobby in New Zealand. The establishment of the Commission for the Environment, the requirement for "Environmental Impact Reports", and an apparent broadening of the interests of the Nature Conservation Council have all led to the focusing of much more attention on our freshwater fish fauna, both native and introduced.

Need for a recording system

Owing to a lack of systematic recording, lack of interest in or ignorance of the native fishes, and difficulties in identifying them, much of the information on occurrence and distribution of our fishes has been lost. Thus, knowledge of the early distributions of freshwater fish species tends to be sketchy. These distributions have been modified substantially by habitat changes and, to some extent, by introduction of both native and introduced species into new waters. In many instances records of introductions are inadequate or lacking altogether.

Unless the mass of distributional and habitat information that is now being collected by field staff of various organisations is systematically recorded and stored, it is also in danger of being lost.

With increasing pressure being placed on New Zealand's aquatic environments from water abstraction, construction of dams, felling of forests, and discharge of domestic and industrial effluents, it is important that all possible information be recorded and centrally stored, both as a data resource for preparing environmental reports, and also as a set of baseline data for helping us to understand changes in the future.

For many years, staff at FRD have been accumulating data on the occurrence, habitats, and distribution of fishes in New Zealand river and lake systems. These data have usually been recorded in individual staff field notebooks, some have found their way on to the central "data card system", and some have undoubtedly been lost. To prevent this loss, and to standardise the recording of data, we decided to establish a computer based system which would allow for the storage of large volumes of distribution and habitat information and enable its rapid retrieval.

Setting up the system

Largely as a result of the meticulous maintenance of his personal field records by Mr K. F. Maynard (formerly on the staff of FRD), over a period of about 18 years, FRD has assembled a bank of data on fish distributions that was seen to be very valuable both for present use and for historical purposes.

To record in some systematic form old data already collected and to systematise future data acquisition, data recording cards were designed on which a wide range of information on distribution, habitat characteristics, and species captured could be documented.

At the outset we transferred all the data available from FRD records on to cards and then on to a computer file. Records and collections from the main provincial museums (Auckland, Canterbury, and Dunedin) and the National Museum (Wellington) were also searched, recorded, and entered.

Fish samples collected during field work have been either held in the FRD collection or, more usually, transferred to the larger collections of the National Museum in Wellington. Samples collected by Dr C. S. Woods are in the collections of the Canterbury Museum.

Various data sources sometimes overlapped. Records in field books were often related to collections deposited in museums, and some careful sorting was required to eliminate duplications.

The file that resulted from this work comprised the primary historical resource. After it was established, all FRD staff engaged in field work were instructed to fill out the printed data cards so that the information they collected could be incorporated into the central computer file.

Aims

The survey card system has been established primarily to ensure the systematic recording of information being collected. A second aim is to gain a better understanding of the distribution and abundance of the species in the fauna and possibly to monitor recent and future changes. (Until recently we did not know enough to be able to ascertain the conservation status of some species, and for others it is still not known.)

A third aim is to accumulate habitat data (on oxygen concentration, pH, temperature, conductivity, bottom types, stream types and size, vegetation, altitude, etc.) which will enable the eventual physical description of habitat types.

Recording cards

The data recording cards come in small books of 25 duplicate numbered cards so that by use of carbon paper, observers can retain 1 copy for their own records and send the other to FRD for storage. Those who have made a practice of using the cards routinely have found them useful for their own field records.

In addition to their use by FRD staff, we have sought to encourage other workers in the field to use the cards so that their data would be recorded in a useful form, and, above all, to facilitate the deposition of data in a central locality. Because the data cards are in duplicate, the hope has been that observers would submit 1 copy to FRD for computer storage.

Books of survey cards have been distributed to all acclimatisation societies and Wildlife Service conservancies, to other agencies engaged in fisheries investigations, and to various interested individuals. Those wishing to use the system can obtain books of cards from FRD.

The recording scheme has been operating since 1977 and at May 1983 contains about 4000 entries. Examination of a map of localities for which we have records (Fig. 1) indicates a broad national coverage, although significant gaps remain in Northland, the east coast of the North Island from Gisborne to Wairarapa, northern Taranaki, north-west Nelson, coastal Marlborough, North Canterbury, and central and west Otago. Stewart Island is virtually untouched. Even

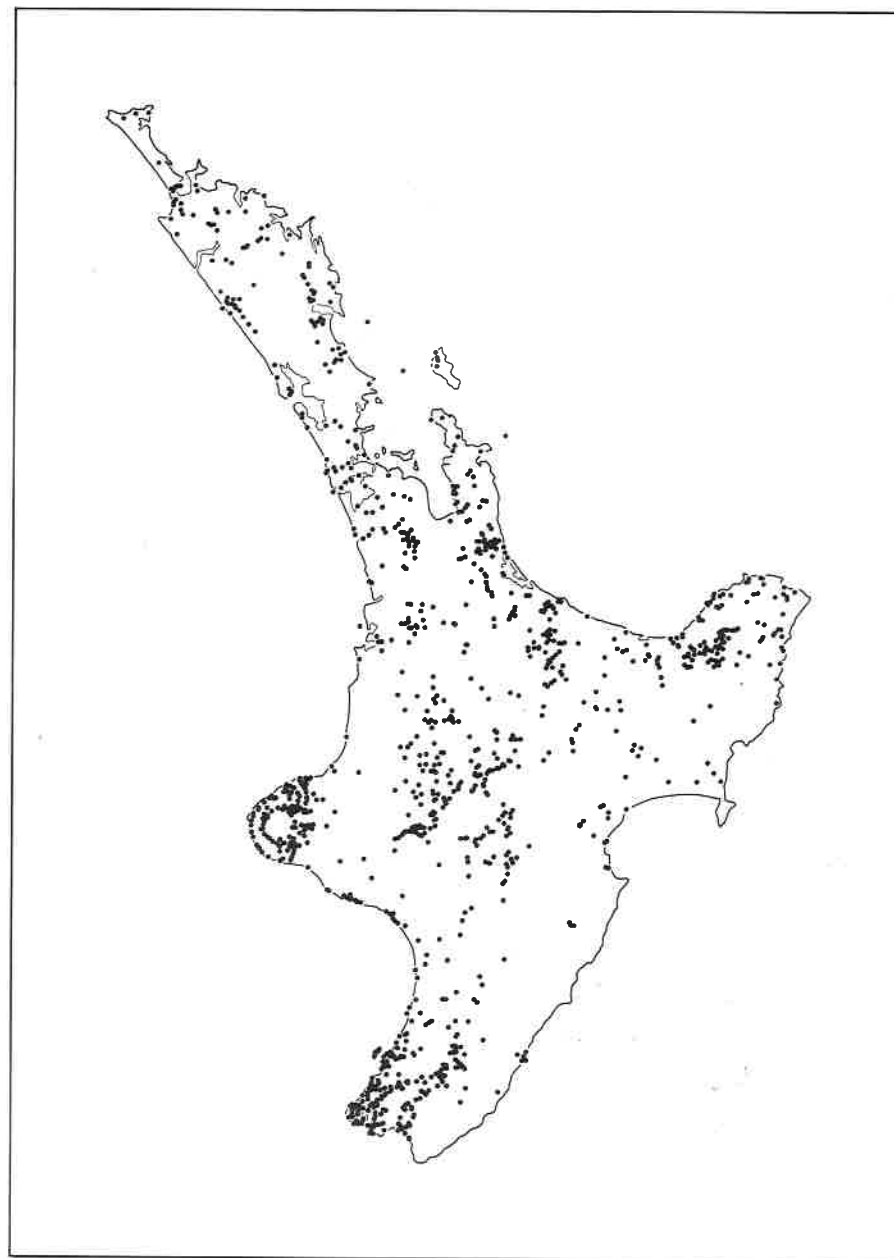


Fig. 1 (above and following page): Localities for which there are entries in the data base (excluding records from outlying islands).



Fig. 1: *continued.*

so, a broad overview of the distribution of freshwater fish in New Zealand is available and for some areas explicit information on the occurrence of species and the habitats they occupy is available.

Input of data

Instructions are given on the cover of each book to assist observers with filling out the cards. We suspect that the apparent complexity of the cards may be a little daunting and discourage people from using them, but it is important to note that there is **no** requirement for all of the data boxes to be filled in.

If observers are willing to fill in **only**:

- Date
- Locality
- Species collected

we will have the basic and most essential information. The sections on the cards that “must be filled in” are shaded in grey. The remaining sections can be regarded as “optional only”; they are included to make possible the recording of a wide range of information. A typical card, filled in by FRD staff, is shown in Fig. 2, and is the sort of result we are hoping for. However, even basic information on a single specimen is useful, and we are keen to receive such records.

Identification has been, and still is, a problem: there are now publications available to facilitate identification (McDowall 1978, 1980a, 1980b), but difficulties still occur even among experienced observers. Staff at FRD, Christchurch are willing to carry out identifications for anyone at any time.

Retrieval of information

Information on the data base can be retrieved in a variety of ways:

1. The computer can generate maps illustrating fish distributions. These are based on NZMS 1 map co-ordinates and replotted at a scale of about 36 kilometres to 1 centimetre (57 miles to 1 inch). The maps can show up to 3 different species distributions on the same printout. Data from the Chatham Islands and other outlying islands of New Zealand not covered by the NZMS 1 series are stored on a separate computer file. Information on these regions must be requested separately.

2. Listings can be produced of the species present in a nominated catchment.

FRESHWATER FISH SURVEY — PLEASE RETURN TO:		Fisheries Research Division, Ministry of Agriculture and Fisheries, P.O. Box 297, Wellington.		5266							
Catalogue Number	4/8/3	River/Lake System	Waihou River	Catchment Number	092280						
Date	4/8/81	Sampling Locality	Waiorongomai Stream								
Time	1205-1250	Access	Waiorongomai Loop Road								
Observer	R. TE RA	NZMS 1 Co-ordinates	248/747	NZMS 1 Map No.	#57						
Fishing Method	electric	Distance Surveyed	100m	Permanent Water	Yes/No						
				Tidal Water	Yes/No						
HABITAT DATA											
WATER	Colour	nil	Clarity	clear	Conduct.	75 μ n/cm	Temp.	-7.8°C	pH	7.11	
	Estimated Flow	3 cumec	Average Width	8m	Depth Range	10-100 cm			O ₂	12 mg/l	
Flow Type %	Still		Sluggish		Pool	10	Run		Riffle	30	
										Torrent	70
Bottom Type %	Bed Rock	10	Boulder	30	Gravel		Sand	5	Mud		
										Other	large
Cover in water — type and abundance						boulders, banks stones 55					
Aquatic vegetation — macrophytes						no algae — brown, little					
Type of river/stream/lake						steep mountain tributary, old gold mining stream					
Condition of river/stream/lake						normal flow, emerging from a gorge					
Notes on valley/vegetation						second growth bush, manuka, ponga, gorse					
Bottom fauna						very sparse					
General Comments						fished up and downstream of gauging staff. Silt between small boulders and stones in coarse sand					
FISH OBSERVED											
	SPECIES	ABUNDANCE		CONDITIONS WHERE CAUGHT		COMMENTS*				†	
1	<i>S. gairdnerii</i>	2 large + 7 yearlings				see below				2	
2	<i>C. fosteri</i>	1		fast water							
3	<i>G. basalis</i>	2									
4											
5											
6											
7											
8											
9											
10											
11											
12											
NOTES— <i>S. gairdnerii</i>											
no. 1003 440g x 330 mm ♀ not spawned											
no. 1004 630g x 370 mm ♂ not spawned											
photos film 119-21.											
Size, Peculiarities, Spawning, Juveniles, etc.											
† Specimens Retained.											
						These sections must be filled in; other sections optional but desirable.					

Fig. 2: Sample survey data card showing extensive use of data categories available.

Retrieval is based on catchment numbers as listed in "Catchments of New Zealand", published in 1956 by the Soil Conservation and Rivers Control Council. This publication assigns 6-figure numbers to all significant catchments in New Zealand, with separate numbers for tributaries, etc.

The first 3 digits of a catchment number denote a river or stream that discharges into the sea. The next 2 digits refer to a tributary of that main stream, numbered from the mouth and proceeding up stream on either bank, and the last digit in the 6-figure number refers to a subtributary flowing into a main tributary. For example, 664000 refers to the Waimakariri River and any number beginning with 664 refers to parts of that river system; 664130 refers to Broken River in the upper Waimakariri catchment and 664132 to Winding Creek, which flows into Broken River. Winding Creek drains Lake Pearson, which has no separate code and would therefore be listed under 664132.

3. Retrieval can be based on a geographical area by nominating either:
 (a) latitudinal and longitudinal co-ordinates. These are nominated to specify the boundaries within which species occurrence is sought, or
 (b) NZMS 1 map co-ordinates. These are listed for all entries. Although the NZMS 1 Topographical Map series is being replaced by the NZMS 262 metric series, data are, at present, all coded for the older NZMS 1 series. Data are coded by map number and an 8-figure digit that relates to east-west co-ordinates (the first 4 digits) and north-south co-ordinates (the last 4). Co-ordinates are printed on the margins of the topographical maps. The occurrence of species recorded within areas specified by these co-ordinates can be listed.

4. Retrieval can be based on 1 or more nominated fish species.

Printout, regardless of the way retrieval is generated, is always in the standard form shown in Fig. 3. The entry number (<NC>) is the number of the survey card from which the data are derived. These cards are filed in numerical order at FRD, Wellington and access to them can be obtained if additional data, not listed in the printout, are required. The category <EP> contains data on habitats and other environmental variables. Few records have these data, but where available they are listed. The species present (<SP>) are listed by species name only, as follows:

Code	Scientific name	Common name
Native freshwater species		
australis 1	<i>Geotria australis</i>	lamprey
australis 2	<i>Anguilla australis</i>	short-finned eel
dieffenbachii	<i>Anguilla dieffenbachii</i>	long-finned eel
retropinna	<i>Retropinna retropinna</i>	common smelt
anisodon	<i>Stokellia anisodon</i>	Stokell's smelt

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FISH DISTRIBUTION DATA BASE SEARCH

14 - 05 - 83

CODES

<CRN>River or Lake Name
 <CNC>Entry No. Catchment No.
 <DT>Date Time(NZST)
 <EP>Temp(oC) pH Oxygen(mg/l) Water colour
 <SP>Species present
 <MR>Map co-ordinates NZMS 1 Sheet No.

CATCHMENT NO: 092 RIVER NAME: WAIHOU RIVER, TRIBUTARIES 092200-092330

<CRN>TUI STREAM
 <CNC>1754 092.242
 <DT>04/08/81 1500
 <EP>9.6 5.9 11.2 ORANGE
 <SP>XXX
 <MR>3197/3794 N57

<CRN>WAIORONGOMAI STREAM
 <CNC>270 092.280
 <DT>10/12/80 0855
 <EP>12 - - CLEAR
 <SP>GAIRDNERII DIEFFENBACHII
 <MR>3249/3748 N57

<CRN>WAIORONGOMAI STREAM
 <CNC>5252 092.280
 <DT>04/08/81 1205
 <EP>7.8 7.11 12 CLEAR
 <SP>GAIRDNERII FOSTERI BASALIS
 <MR>3248/3747 N57

<CRN>WAIRAKAU STREAM
 <CNC>3252 092.300
 <DT>27/11/78 1500
 <EP>18.5 8 14 CLEAR
 <SP>GAIRDNERII BREVICEPS?
 <MR>3276/3713 N57

<CRN>WAIUPU STREAM
 <CNC>1751 092.301
 <DT>04/08/81 1020
 <EP>8.5 6.41 11.9 CLEAR
 <SP>FOSTERI DIEFFENBACHII GAIRDNERII BASALIS AUSTRALIS2
 <MR>3282/3701 N57

<CRN>WAHINE STREAM
 <CNC>3259 092.302
 <DT>27/11/78 - - - CLEAR
 <EP>- 7 14.5
 <SP>HUTTONI COTIDIANUS GAIRDNERII
 <MR>3278/3711 N57

<CRN>MACILL STREAM
 <CNC>3257 092.330
 <DT>27/11/78 - - - CLEAR
 <EP>- - -
 <SP>COTIDIANUS DIEFFENBACHII GAIRDNERII MACULATUS HUTTONI
 <MR>3282/3650 N57

Fig. 3: Sample printout from data base. (Some entries have been altered to include features which may appear on a genuine printout.)

Code	Scientific name	Common name
Native freshwater species (continued)		
oxyrhynchus	<i>Prototroctes oxyrhynchus</i>	grayling
argenteus	<i>Galaxias argenteus</i>	giant kokopu
fasciatus	<i>Galaxias fasciatus</i>	banded kokopu
postvectis	<i>Galaxias postvectis</i>	short-jawed kokopu
brevipinnis	<i>Galaxias brevipinnis</i>	koaro
maculatus	<i>Galaxias maculatus</i>	inanga
vulgaris	<i>Galaxias vulgaris</i>	common river galaxias
gracilis	<i>Galaxias gracilis</i>	dwarf inanga
divergens	<i>Galaxias divergens</i>	dwarf galaxias
prognathus	<i>Galaxias prognathus</i>	long-jawed galaxias
paucispondylus	<i>Galaxias paucispondylus</i>	alpine galaxias
apoda	<i>Neochanna apoda</i>	brown mudfish
burrowsius	<i>Neochanna burrowsius</i>	Canterbury mudfish
diversus	<i>Neochanna diversus</i>	black mudfish
fosteri	<i>Cheimarrichthys fosteri</i>	torrentfish
huttoni	<i>Gobiomorphus huttoni</i>	red-finned bully
gobioides	<i>Gobiomorphus gobioides</i>	giant bully
cotidianus	<i>Gobiomorphus cotidianus</i>	common bully
hubbsi	<i>Gobiomorphus hubbsi</i>	blue-gilled bully
breviceps	<i>Gobiomorphus breviceps</i>	upland bully
basalis	<i>Gobiomorphus basalis</i>	Cran's bully
retiaria	<i>Rhombosolea retiaria</i>	black flounder
paranephrops	<i>Paranephrops</i> spp.	koura
Introduced freshwater species		
trutta 1	<i>Salmo trutta</i>	brown trout
gairdnerii	<i>Salmo gairdnerii</i>	rainbow trout
salar	<i>Salmo salar</i>	Atlantic salmon
tshawytscha	<i>Oncorhynchus tshawytscha</i>	quinnat salmon
nerka	<i>Oncorhynchus nerka</i>	sockeye salmon
fontinalis	<i>Salvelinus fontinalis</i>	brook char
namaycush	<i>Salvelinus namaycush</i>	mackinaw
nebulosus	<i>Ictalurus nebulosus</i>	catfish
tinca	<i>Tinca tinca</i>	tench
auratus	<i>Carassius auratus</i>	goldfish
erythrophthalmus	<i>Scardinius erythrophthalmus</i>	rudd
affinis	<i>Gambusia affinis</i>	mosquitofish
latipinna	<i>Poecilia latipinna</i>	sailfin molly
reticulata	<i>Poecilia reticulata</i>	guppy
fluviatilis	<i>Perca fluviatilis</i>	perch
carpio	<i>Cyprinus carpio</i>	koi carp
idella	<i>Ctenopharyngodon idella</i>	grass carp

Code	Scientific name	Common name
Primarily marine species entering fresh water		
trutta 2	<i>Arripis trutta</i>	kahawai
cephalus	<i>Mugil cephalus</i>	grey mullet
forsteri	<i>Aldrichetta forsteri</i>	yellow-eyed mullet
macropygus	<i>Leptoscopus macropygus</i>	stargazer
nigripenne	<i>Tripterygion nigripenne</i>	cockabully

In instances where no fish were seen or captured the entry appears as XXX. Where fish were not identified to species, the generic name only has been entered, for example, *Anguilla* for all eels. Where a species record appears to be doubtful, the entry is followed by a question mark.

The category <MR> refers to the NZMS 1 map co-ordinates followed by the NZMS 1 sheet number. Sheet numbers are prefixed with N for the North Island series and S for the South Island series.

Users should remember that the data are fallible. Errors can emerge at any level from identification of fish at capture to data coding, input, and even print-out. This is particularly likely with some of the older records and those which are based on museum collections and the like. The identification of errors is a problem. We hope that some, perhaps many, will be made obvious by peculiar distributions discordant with known or published data on distribution. As an initial check, the opinion of experienced observers can serve as a guide to accuracy. Otherwise the data can be traced back, through the survey card, to the original observer, who may or may not be available for consultation. Obviously discretion is needed by all users of the data, who must be responsible for any use they make of the records.

Data availability

Survey data are available to anyone with a demonstrable, legitimate need for the information. To avoid frivolous requests, all users seeking information should indicate their credentials, as well as the purpose for which the data are sought. In general there should be few problems associated with release of information, though it is possible that problems related to departmental jurisdiction could occur. Requests for printout should be addressed to the Director, Fisheries Research Division, Ministry of Agriculture and Fisheries, P.O. Box 297, Wellington.

References

The following publications provide background information on New Zealand's freshwater fish and facilitate their identification:

MCDOWALL, R. M. 1978: "New Zealand Freshwater Fishes—a Guide and Natural History." Heinemann Educational Books, Auckland. 230 p.

MCDOWALL, R. M. 1980a: A synoptic check-list of the freshwater fishes of New Zealand. *Fisheries Research Division Occasional Publication, N.Z. Ministry of Agriculture and Fisheries, No. 16.* 67 p.

MCDOWALL, R. M. 1980b: "The Mobil New Zealand Nature Series—Freshwater Fish in New Zealand." A. H. & A. W. Reed Ltd., Wellington. 80 p.

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