FRESHWATER FISH
IN
FIORDLAND NATIONAL PARK

Report on a survey of Dusky Sound
January-February 1981,
with a review of previous fresh water
fish records in the park

BY
R.M. McDOWALL

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1. INTRODUCTION

Because of its remoteness and difficulty of access, Fiordland is by far the least explored area of New Zealand as regards its native freshwater fishes. Yet, interestingly, the first freshwater fish reported caught by Europeans in New Zealand was taken from Lake Forster, which drains via Cook Stream into Pickersgill Harbour near the mouth of Dusky Sound. As the locality names indicate, the fish was collected by naturalists with James Cook when he visited New Zealand in the Resolution in 1773 (Forster 1777). The fish was described by J.R. and G. Forster (father and son), naturalists on board the Resolution, in manuscripts that remained unpublished for many years (Forster 1844), but was first formally described by the German, Gmelin (1789). It was redescribed by two further Germans (Bloch and Schneider 1801) using the Forster name *alepidotus*. Using the current generic name, the fish is correctly known as *Galaxias argenteus* (Gmelin).

Fiordland also features as the area from which the smelt *Retropinna osmeroides* was first described by Sir James Hector - from the lower Hollyford (Hector 1871). More recently, at the fringes of the present National Park, Stokell (1941) described another smelt as *Retropinna obtusirostris* (from Lake Henry, near Te Anau township). Both *R. osmerioides* and *R. obtusirostris* are now regarded as synonyms of *R. retropinna* (Richardson), the common smelt, the Lake Henry stock being landlocked (McDowall 1979).

Past records of freshwater fish from the Park have been very sparse and sporadic. There are a few notes from Richard Henry, former curator of Resolution Island (Henry n.d., 1885); a note from Thomas McKenzie, a West Coast explorer; vague and general notes published by Herris Beattie (1945); and sparse comments in historical accounts of the Hollyford-Big Bay area (McKenzie 1961; Houghton 1974). Freshwater fish feature in notes of more recent explorations of Fiordland by climbers (Cookson 1956), and reports on scientific expeditions to Lake Monk (Riney et al. 1959) and George and Caswell Sounds

(Cunningham 1951), make brief mention of fish.

It was not until staff of the Fiordland National Park Board developed an interest in freshwater fish that some real progress was made. They began to take notes on fish distributions and habitats and contacted Fisheries Research Division in the mid-1970's. This contact resulted in a brief collaborative survey of Dusky Sound in the summer of 1981, when more than 40 stations were sampled. The Fiordland National Park Board vessel M.V. Renown was used for the survey. The data available are still sparse. Major Sounds like Doubtful and the Chalky-Preservation complex remain largely unexplored, most of the smaller Sounds, even Milford, are almost untouched, and the complex of rivers and lakes on the southern boundary of the Park - Hauroko, Poteriteri etc. - are also unstudied.

In spite of the incomplete and erratic coverage of waters in the Park, enough is probably now known to enable a preliminary description of the fauna to be prepared. Such a description follows.

2. FIORDLAND NATIONAL PARK AND ITS FRESH WATERS

Fiordland National Park (Fig. 1) comprises the southwestern corner of the South Island, an area of rugged high mountains intensely dissected by deep glacial valleys. In the west these are now extensively drowned by marine invasion, establishing a series of about 15 sounds or fiords up to 40 kms deep. The Park is clearly bounded in the east by two river systems, the Hollyford in the northern area and the Eglinton-Lake Te Anau-Waiau system to the south. These run nearly north-south and are almost parallel to the western seaward boundary of the Park. The area is an elongated triangle.

Numerous rivers and small creeks flow into the fiords in the west and into the Hollyford, or Eglinton-Te Anau-Waiau systems in the east. Rainfall is extremely high throughout the area and this, combined with the precipitous topography of much of the country results in very swiftly-flowing, bouldery

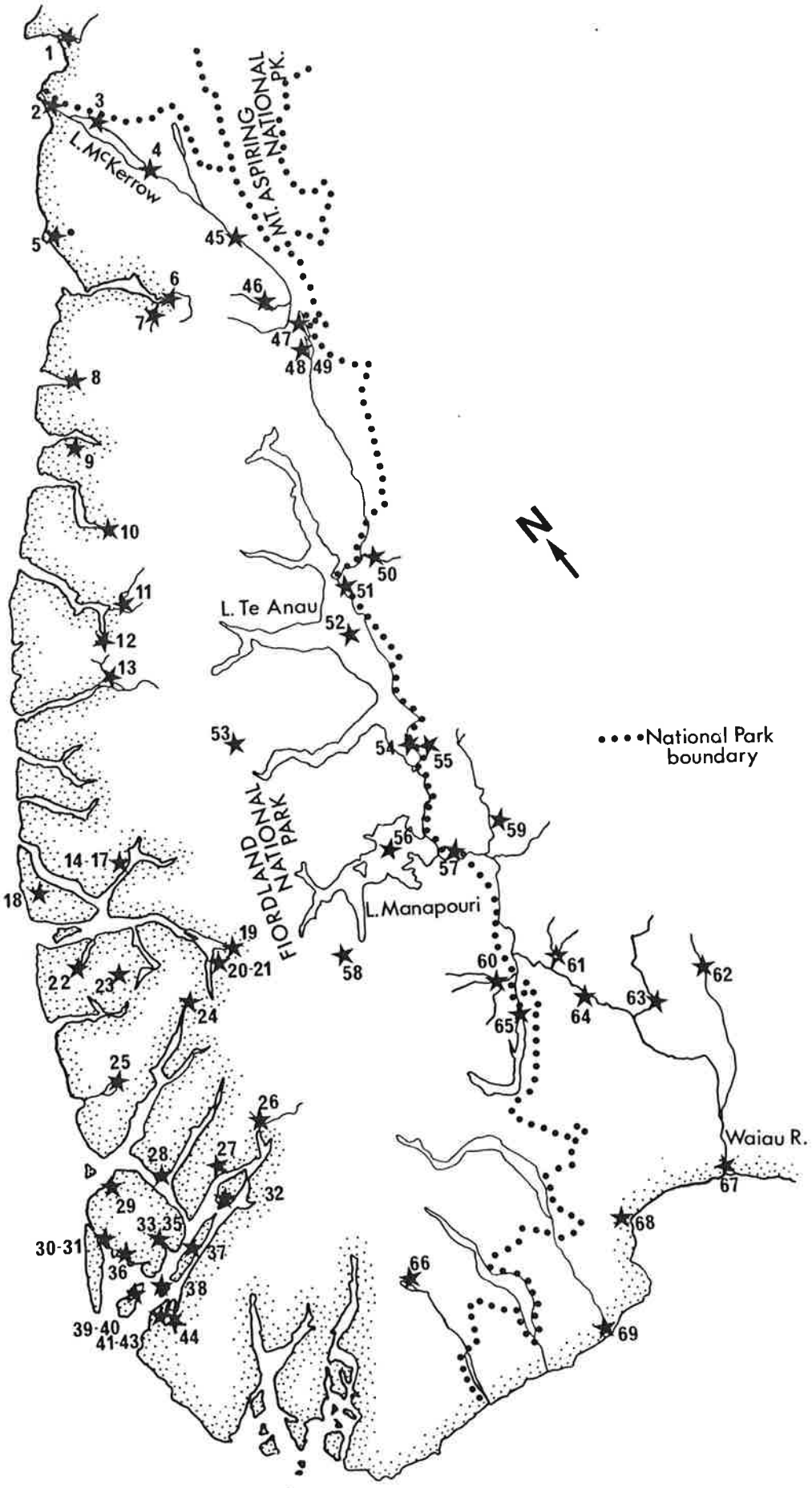


FIGURE 1. Known distribution of native freshwater fishes in Fiordland National Park. (Numbers refer to localities listed in Appendices I and II.)

streams and rivers that flood rapidly and fall to normal levels equally swiftly. It is probable that many of the smaller streams are ephemeral. Lakes are also numerous, varying from large like Te Anau - the largest lake in the South Island - to tiny mountain tarns. Irwin (1975) listed in excess of 150 lakes within the park. Habitats available to freshwater fish are thus both extensive in area and diverse in character.

3. NATIVE FISH IN THE PARK

New Zealand has 27 native species of freshwater fish (McDowall 1978, 1980). On the basis of general geographical distribution, it is predictable that 16 of these would occur in Park waters that flow directly to sea along the western boundary, and rather fewer, perhaps less than 10 in the waters of the upper Eglinton-Te Anau systems. Historical data (what few exist), and recent collection records show that the actual number of species present is significantly lower than that predicted (Appendix I).

The "core" fauna of the main fiords comprises the following species:

longfinned eel - *Anguilla dieffenbachii* Gray
giant kokopu - *Galaxias argenteus* (Gmelin)
banded kokopu - *G. fasciatus* Gray
koaro - *G. brevipinnis* Günther
inanga - *G. maculatus* (Jenyns)
redfinned bully - *Gobiomorphus huttoni* (Ogilby).

These six species seem to be widely and generally present.

In addition, the now extinct grayling (*Prototroctes oxyrhynchus* Günther) was once present, at least in some of the larger rivers. The lamprey (*Geotria australis* Gray) has been recorded from a few localities and is probably generally distributed but seldom seen, owing to its seasonal occurrence and nocturnal habits. The shortfinned eel (*Anguilla australis* Richardson) was found

occasionally; its wider occurrence is likely to be limited by shortage of suitable habitat.

Species that we anticipated finding but which were not collected included the following:

common smelt	-	*Retropinna retropinna* (Richardson)
shortjawed kokopu	-	*Galaxias postvectis* Clark
torrentfish	-	*Cheimarrichthys fosteri* Haast
giant bully	-	*Gobiomorphus gobioides* (Valenciennes)
common bully	-	*G. cotidianus* McDowall
bluegilled bully	-	*G. hubbsi* (Stokell)
black flounder	-	*Rhombosolea retiaria* Hutton.

The absence of these seven predicted species from the waters of the Park is not understood, but there are three possible explanations. First, is the absence of suitable habitats. Several of these species are found primarily in gently flowing lowland reaches of rivers. However, this is also a characteristic of inanga habitat - and this species is present in a variety of Dusky Sound rivers. Second, the rapidly fluctuating and swiftly flowing nature of many of the rivers may be a factor. However torrentfish and bluegilled bullies are typically found in the swiftest flowing sections of rivers elsewhere in New Zealand. A third possibility is that some of the species may enter rivers primarily on open coasts. From its distribution elsewhere in New Zealand this may be true of the common smelt. Thus, the semi-enclosed fiords of the National Park may limit the occurrence of some species.

Certainly all the species predicted to occur in Fiordland waters but not found so far, are present in the rivers of south Westland and most also occur in Southland rivers. So in terms of general geographical distribution there is no reason why they should not be present in Fiordland.

Large examples of most species were uncommon. This too, is probably a function of the serious flood prone character of the Fiordland rivers.

On the eastern side of the Park, river systems comprise the Hollyford - Lake McKerrow system in the north and the Eglinton-Te Anau-Manapouri system flowing out of the Park as the Waiau River in the south. Rivers like the Borland and Monowai flow east from the Park to join the Waiau as it flows south.

Fish species present in the Hollyford below Lake McKerrow comprise the coastal component of the fauna of the Sounds further south, e.g. inanga, koaro, but also include common smelt not found in Dusky Sound and not reported from other coastal rivers in the Park (Appendix II).

Above Lake McKerrow, and in the rivers and lakes of the upper Waiau, the following species are known:

longfinned eel	- *Anguilla dieffenbachii*
common smelt	- *Retropinna retropinna*
giant kokopu	- *Galaxias argenteus*
koaro	- *G. brevipinnis*
common river galaxias	- *G. vulgaris*
torrentfish	- *Cheimarrichthys fosteri*
common bully	- *Gobiomorphus cotidianus*
upland bully	- *G. breviceps*.

Whereas the species in streams running west into the Sounds are all diadromous (i.e. spend a part of their lives in the sea), this is not true of all those in the east.

The longfinned eel, present in the upper Hollyford and probably throughout the lakes of the upper Waiau, must go to sea to spawn. It is probable that the populations of giant kokopu and torrentfish known in the upper Monowai River are also diadromous. However, although the common smelt, koaro and common bully do exist as diadromous forms elsewhere in New Zealand, those found in rivers of the eastern National Park are in most, if not all, instances landlocked. Common smelt present in Lakes Te Anau, Monowai and Henry are undoubtedly landlocked, as are populations of koaro throughout the eastern park, in both

high alpine and lower elevation main lakes. Even a population in a low elevation lake on Anchor Island (near the entrance to Dusky Sound) is probably landlocked. The common bully, known from a few lakes (Te Anau, Gunn) and rivers is also probably widespread in the National Park as landlocked populations.

A distinctive element in the fauna of the Park is the common river galaxias, a species always restricted to fresh water and without a marine life history stage. It is abundant in inland and sub-alpine rivers from Canterbury southwards, and including tributaries of the Waiau to the east of Te Anau - Excelsior Creek and other streams draining the Takitimu Mountains. The occurrence of common river galaxias in west flowing tributaries of the Waiau is predictable, and James (1967) reported the fish from the lower Borland River.

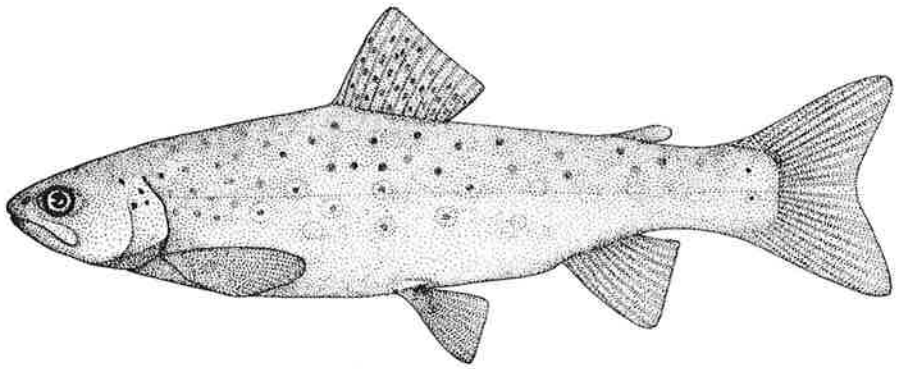
The upland bully is also confined to freshwater, has a similar general distribution to the common river galaxias and was found by James (1967) in the Borland River.

Clearly, with the relatively limited number of stations yet sampled within the National Park, it is likely that additional species may remain undiscovered. However, the recent fairly intensive sampling of Dusky Sound, plus the intermittent records from diverse localities in the Park over the past 100 years, are likely to have revealed the principal native fish species in Fiordland National Park.

4. INTRODUCED FISH SPECIES

Introductions of exotic fish species into waters now within Fiordland National Park date back probably more than a century.

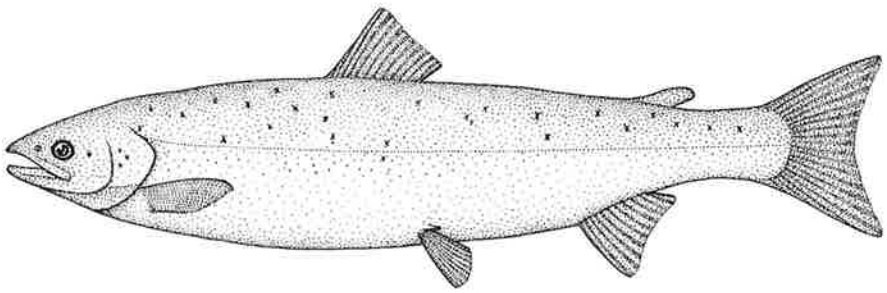
It is not clear when brown trout (*Salmo trutta*) were first released, but it seems likely to have been as early as the 1870-80's. The Waiau River and Lakes Te Anau and Manapouri were bound to be early candidates for releases. Reports of releases of brown trout into the remote lower Hollyford River before 1884 are somewhat surprising (Anon 1884).



Brown trout (*Salmo trutta*), female, 225 mm.

Today brown trout are abundant in Waiau-Manapouri-Te Anau waters and upstream through Lakes Gunn and Fergus. They are also present in the Hollyford River and Lake McKerrow. There are reports of trout in Wild Natives River at the head of Bligh Sound (J. Parkes, pers. comm.). However, only one was taken during the survey in Dusky Sound, a small yearling from the lower Seaforth River. There are several unconfirmed reports of sea-run brown trout entering rivers in various of the Sounds, often reputedly chasing migrating whitebait as they leave the sea.

Atlantic salmon (*Salmo salar*) were first liberated into Lake Ada, Milford Sound in 1889, when 2,000 were released. The following year 2,000 more were placed there, and in 1891, 3,000 (N.Z. Marine Department Annual Report; Thompson 1922).



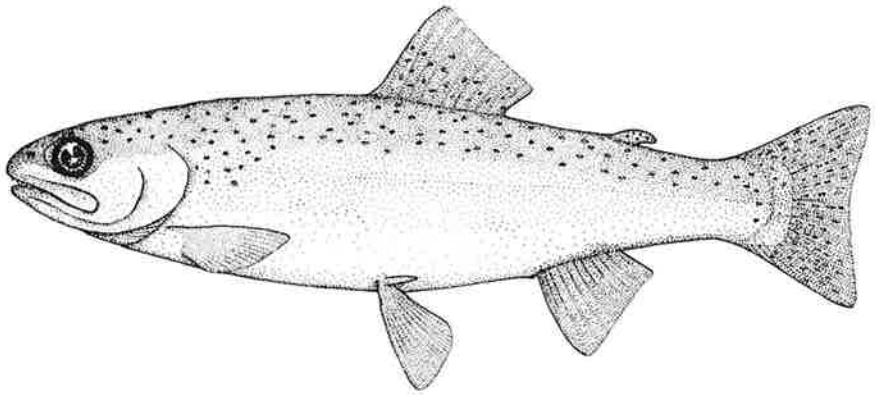
Atlantic salmon (*Salmo salar*), 495 mm.

There is no report of their success, but in 1908 the Government became involved in efforts to establish the species, and between this date and 1911 approaching

2 million salmon were released from a hatchery on the Upukerora River on Lake Te Anau. These came from England, Wales, Ireland and Germany, all being from sea-migratory stock, but Stokell (1955) suggested that on at least two occasions fish were also obtained from landlocked Canadian salmon populations and released into the Te Anau-Waiau system. Whether the existing landlocked Te Anau salmon population derives from these Canadian stocks or from sea-going salmon from Europe is unknown, although Stokell (1959) concluded (on somewhat tenuous grounds), that they are not descended from Canadian landlocked stocks.

Salmon were recognised as having become established in Lake Te Anau in the early 1920's (Hutchinson 1975) and began to appear in anglers' catches (Godby 1925; Hefford 1927). However, a decline in abundance took place from the 1940's onwards, owing possibly to extensive trapping of the spawning runs for the taking of ova, possibly to the extensive liberation of rainbow trout in the lakes. Although trapping operations for salmon ceased in the 1940's and salmon persisted in the lakes into the 1950's and 60's, the decline in abundance continued until, in the late 1960's, the Wildlife Service found that there was no longer a spawning run of salmon in the Upukerora River, the origin of most Atlantic salmon in the system. As a result of a restoration programme by the Wildlife Service, Atlantic salmon have since been discovered in Lakes Gunn and Fergus and releases of hatchery reared fish are being made into these lakes. Small Atlantic salmon, both hatchery releases and wild reared fish, are being caught by anglers at these two lakes.

Rainbow trout (*Salmo gairdnerii*) are reported to have been released into the Te Anau system in the mid-1920's (Hutchinson 1975), where they are widespread and successful. They seem to be confined primarily to the main lake-river system, although an illicit liberation of rainbows was reportedly made into Lake Orbell in the special "Takahe area" in the Murchison Mountains (R. Peacock, pers. comm.). Rainbows have also appeared in the tailrace of the Manapouri Power Scheme in Deep Cove, Doubtful Sound since the construction of that scheme in 1967 and have spread from there into the Lydia River nearby



Rainbow trout (*Salmo gairdnerii*), female, 560 mm.

(K. Morrison, pers. comm.). The fish have apparently been able to survive passage through the Manapouri power scheme at some stage.

Quinnat salmon were apparently released into National Park Waters only once. The Marine Department Annual Report for 1912 states that 3,000 salmon fry were released into the Seaforth-McKenzie River at the head of Dusky Sound in 1911. Nothing further was done until a brief visit was made to the river by Fisheries Research Division staff in 1971 (Goode 1972). Salmon carcasses had been reported from the area over several years by a deer shooter, and by a Marine Department Fisheries Officer in 1971. Six Fisheries Research Division staff attempted an examination of the lower Seaforth on 15 March 1972, but serious flooding in the river made the effort worthless. Nothing has been done since.

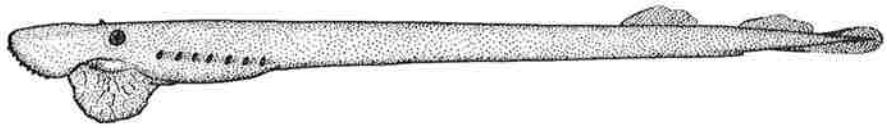
The likelihood of a run of quinnat salmon in this isolated Fiordland river, based on a single small liberation 70 years ago, seems remote to this writer. Further investigations should occur only if new evidence points to the presence of salmon in the river.

5. LIFE HISTORY PATTERNS AND HABITATS OCCUPIED BY NATIVE FISH SPECIES

To facilitate the maintenance of existing native fish populations in Fiordland National Park some comment on habitat occupied by the species is appropriate. These matters are discussed in greater detail in McDowall (1978).

(i) Lamprey (*Geotria australis*)

Larval ammocoetes live in sandy-mud in quiet flowing, marginal waters, usually in small streams. After a metamorphosis the juvenile "macrophthalmia"

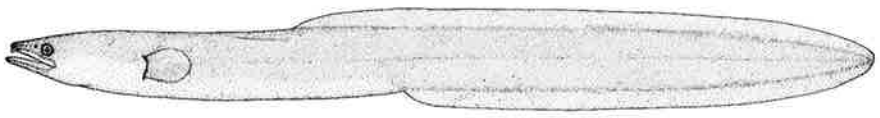


Lamprey (*Geotria australis*), pouched male, 465 mm.

migrates to sea and, until the adult returns to freshwater to spawn several years later, life is marine. Spawning sites are undiscovered but are possibly in upland streams in bush. Adult lampreys are relatively adept at climbing low falls and swift rapids and may penetrate considerable distances upstream.

(ii) Longfinned eel (*Anguilla dieffenbachii*)

Longfinned eels enter freshwater from the sea in the spring as small glass elvers. They settle in the lower rivers and streams for some months before undertaking an upstream migration. Small eels are found under rocks in both pools and rapids. As they grow larger they increasingly inhabit pools, living beneath logs, bank overhangs etc. Although not typically a lake species, numbers of longfins were taken in Lake Forster and the lake on Anchor Island and are present in the lakes of the Waiau system.



Long-finned eel (*Anguilla dieffenbachii*), adult female, 1450 mm.

Adult eels leave freshwater to spawn in the distant sub-tropical seas and do not return. Longfinned eels are aggressive upstream migrants and only

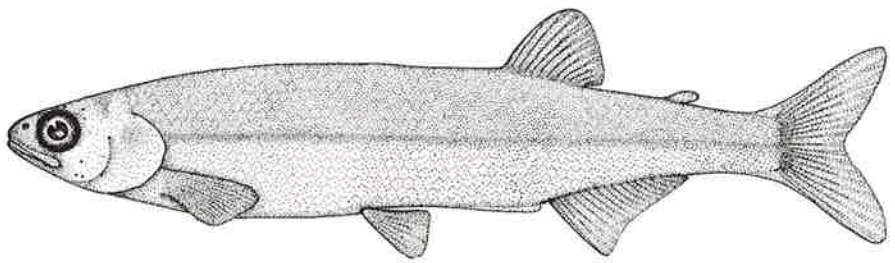
the most difficult barriers stop them. High vertical falls are climbed by juvenile eels.

(iii) Shortfinned eel (*Anguilla australis*)

Shortfinned eels were infrequent in National Park waters. It is a species characteristic of lowland and estuarine swampy lakes, a habitat uncommon in Fiordland. Its life history pattern is essentially similar to that of the longfin.

(iv) Common smelt (*Retropinna retropinna*)

Common smelt spend most of their lives in the sea. They move into lowland rivers in large shoals during the spring as almost mature adults and spend the summer there, where they reach full maturity. They spawn in sandy pools, the adults dying and the larvae going out to sea upon hatching. Inland penetration is usually not extensive except in rivers with a low gradient.

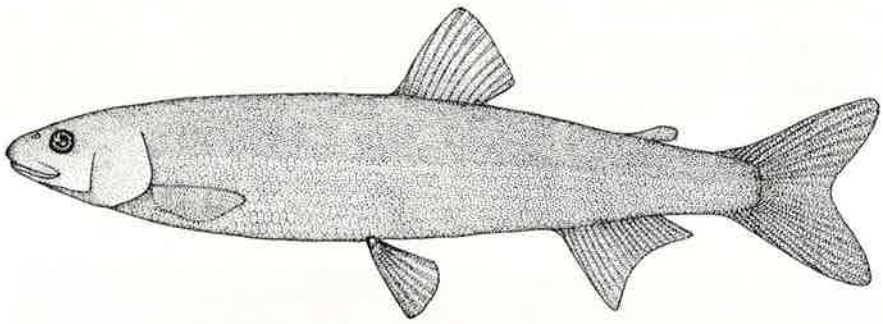


Common smelt (*Retropinna retropinna*), female, 93 mm.

Landlocked populations of common smelt are present in Lakes Te Anau and Manapouri. Lake Henry, on the Park fringes, also contains this species. Larval stages of landlocked populations are likely to be found in the surface waters of the open lake and spawning is probably in the sandy estuaries of streams entering the lakes.

(v) Grayling (*Prototroctes oxyrhynchus*)

Although it is believed that the grayling is extinct and although there are no properly authenticated records of the fish from Fiordland, this area

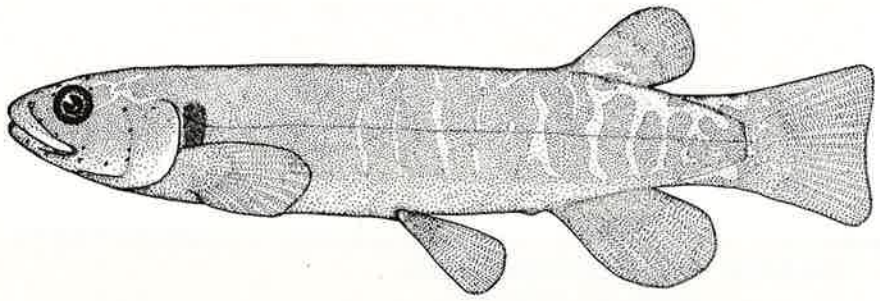


Grayling (*Prototroctes oxyrhynchus*), 220 mm.

remains that most likely to have any remnant populations of grayling. Little is known about this fish, but it was probably a migrant species moving upstream into fresh water from the sea, and was apparently a shoaling, pool-living species.

(vi) Banded kokopu (*Galaxias fasciatus*)

Banded kokopu begin life in freshwater as freshly-hatched larvae, which go immediately to sea, returning in about 6 months - during the spring - as whitebait juveniles. These penetrate considerable distances upstream, including passage past substantial falls. The usual freshwater habitat is pools in bush creeks, typically tiny creeks comprising small rapids or cascades, alternating with small pools surrounded by marginal ferns and other bushy growth - often with logs, fallen trees and boulder piles offering concealment.

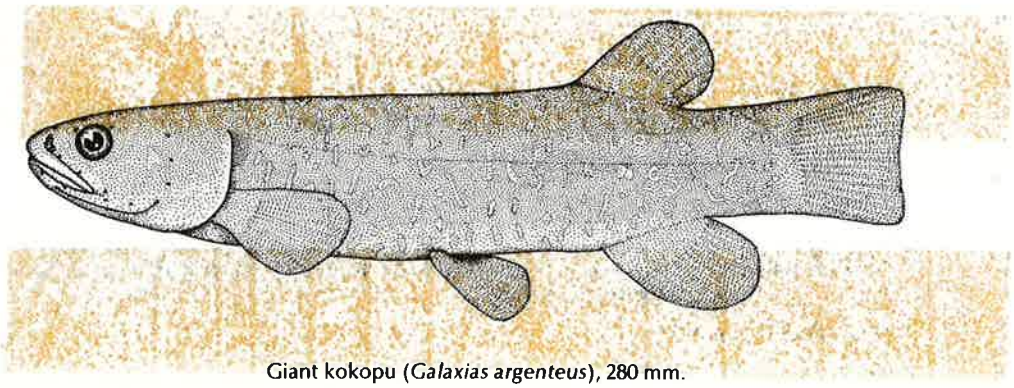


Banded kokopu (*Galaxias fasciatus*), 155 mm.

The water is usually cool to cold and often moderately brown stained. This species is usually active at night and can easily be found by exploring streams with a flashlight.

(vii) Giant kokopu (*Galaxias argenteus*)

Giant kokopu habitats are commonly moderately-sized, often brown-stained bush streams that typically have deep holes, heavily overhung banks or generous

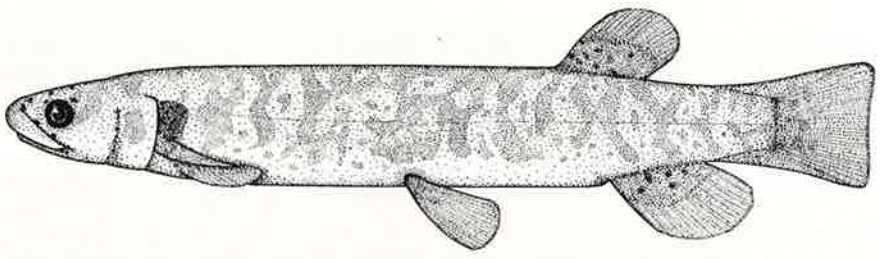


Giant kokopu (*Galaxias argenteus*), 280 mm.

supplies of logs and other potential cover. This species is also widely present in low elevation lakes and lagoons, particularly where there is extensive marginal growth of raupo or flax. Its life cycle is comparable with that of the banded kokopu, although its ability to migrate upstream past difficult barriers is not as great. Giant kokopu rarely penetrate far inland or reach even moderate altitudes - their distribution is largely low elevation and coastal. They are generally secretive fish, but emerge at night to feed and can be located by torchlight.

(viii) Koaro (*Galaxias brevipinnis*)

Koaro customarily live in the swifter bouldery rapids of small bush streams, usually where the water is tumbling to broken. Smaller numbers, and usually smaller fish, may also be found in the rapids of larger rivers,



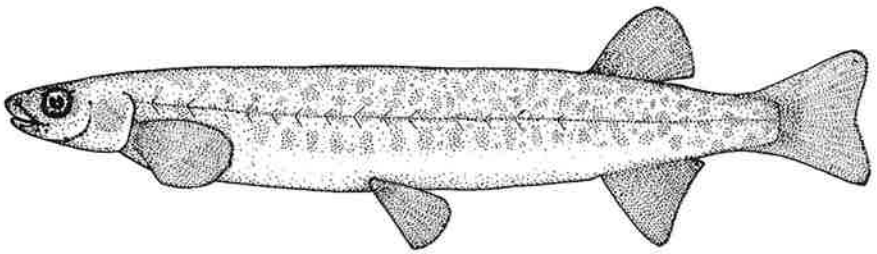
Koaro (*Galaxias brevipinnis*), 185 mm.

some of these being post-migrant whitebait that have become pigmented and which are still moving upstream into the more usual tributary stream. The life history of the koaro resembles that of the banded kokopu - autumn spawning in fresh water, larvae going to sea and returning as whitebait in spring. Like the banded kokopu, koaro emerge from cover at night and can be located with torchlight. The koaro is adept at establishing landlocked populations and many

of the inland lakes of the National Park have such populations. Where the lakes have tributaries the adults tend to be found in these with the juveniles lacustrine, but in lakes that have no tributaries adults are present on the lake bed amongst boulders. Koaro are very agressive upstream migrants and, like eels, may be found upstream of high and precipitous falls.

(ix) Inanga (*Galaxias maculatus*)

Inanga are characteristic of lowland rivers that are gently flowing. They inhabit pools and backwaters and make their way into easily accessible swamps and lagoons. Even moderate falls or long swift rapids will prevent upstream

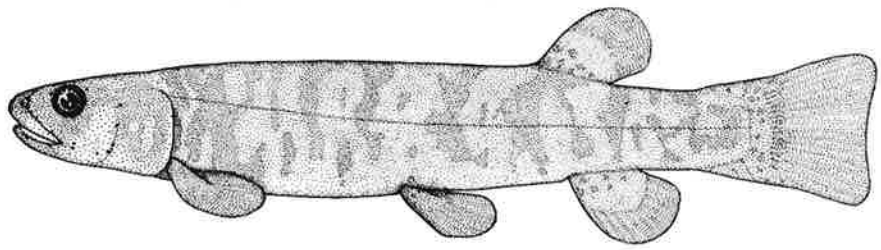


Inanga (*Galaxias maculatus*), 94 mm.

movement. Spawning is estuarine and larval life marine, with the juvenile whitebait returning to freshwater in the spring. This species is the chief component of the whitebait catch. The spawning habitat is highly specialised, comprising marginal estuarine vegetation that is flooded normally only at the high spring tides.

(x) Common river galaxias (*Galaxias vulgaris*)

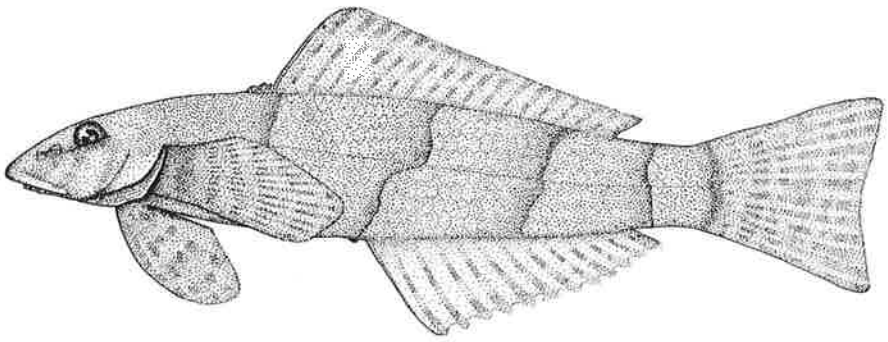
The common river galaxias has a wholly freshwater life cycle, the adults inhabiting a broad range of stream habitats, chiefly bouldery rapids and runs. The young are found along gently flowing stream margins in the spring. This galaxiid occurs at a wide range of altitudes.



Common river galaxias (*Galaxias vulgaris*), 100 mm.

(xi) Torrentfish (*Cheimarrichthys fosteri*)

As its name implies, the torrentfish is found in very swiftly flowing waters - typically the broken "white" water of rapids - where it is found in the substrate amongst the boulders. Larval life is marine, the small juveniles

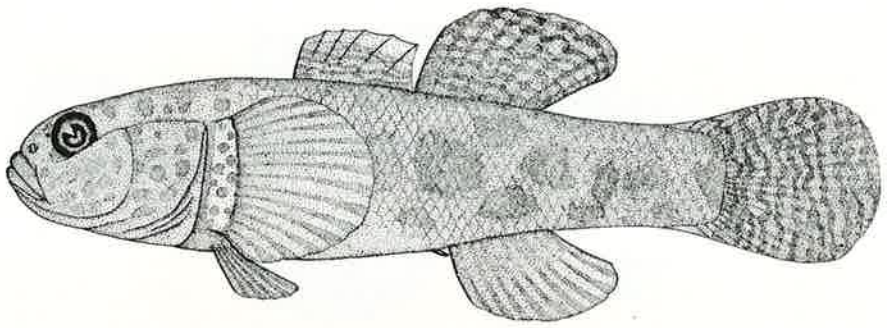


Torrentfish (*Cheimarrichthys fosteri*), 105 mm.

making their way upstream from the sea in spring. Inland penetration is only moderate unless river gradients are slight.

(xii) Upland bully (*Gobiomorphus breviceps*)

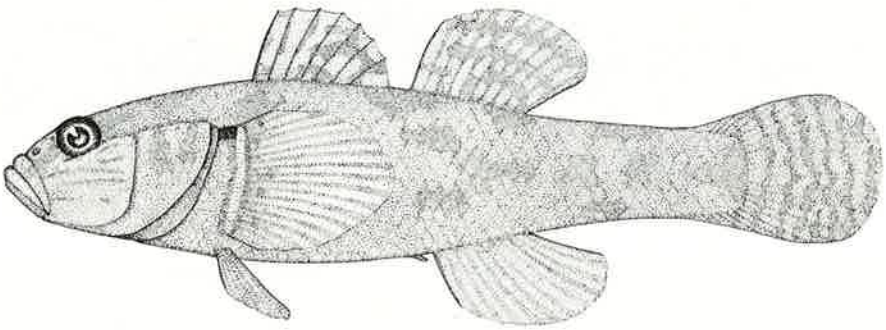
Upland bullies usually occupy still and gently flowing waters, habitats varying from weedy lake margins to rocky streams. Because there are no significant migrations and as the life cycle is wholly in fresh water, this species tends to be found at a wider range of altitudes and at greater distances from the sea than other bullies.



Upland bully (*Gobiomorphus breviceps*), male, 83 mm.

(xiii) Common bully (*Gobiomorphus cotidianus*)

Only landlocked populations of common bullies have so far been reported from National Park. The habitat occupied is usually lake margins, amongst

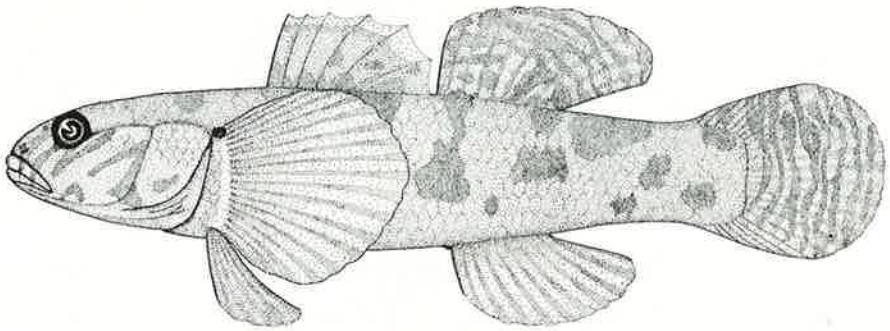


Common bully (*Gobiomorphus cotidianus*), female, 100 mm.

rocks but with slight penetration of lake tributaries. Larval life is spent in the lake surface waters.

(xiv) Redfinned bully (*Gobiomorphus huttoni*)

The redfinned bully is characteristic of bouldery streams, being found in the shallower, moderately swift water towards the downstream end of pools.



Red-finned bully (*Gobiomorphus huttoni*), male, 105 mm.

It is common in both small streams and larger rivers, and both within and outside forested catchments. Spawning is in late winter and spring. The larvae are marine, returning at a length of about 15 mm and spending the remainder of their life in fresh water. Inland penetration is moderate, with low falls and swift rapids being passable.

Habitats of additional species that seem likely to be found in the National Park include the following:

shortjawed kokopu (*Galaxias postvectis*) - in the pools of small bush streams.

bluegilled bully (*Gobiomorphus hubbsi*) - swiftly flowing rapids.

giant bully (*Gobiomorphus gobioides*) - lowland rivers just above the estuaries.

common bully (*Gobiomorphus cotidianus*) - sea-going populations in the lower reaches of the rivers, in pools and quiet water.

black flounder (*Rhombosolea retiaria*) - estuaries and sandy pools, mostly at low elevations.

6. CONSERVATION

Apart from the grayling, already probably extinct, none of the native freshwater fish species in the National Park can be regarded as under serious threat. Giant kokopu habitats are threatened in many parts of New Zealand owing to the drainage of swamps and the channelisation and dredging of creeks. However the species remains widespread and locally abundant, particularly in Southland and eastern Otago. Thus there are no particular conservation problems related to the occurrence of fish species in Fiordland National Park - unless, of course, grayling turn up somewhere!

The role of the National Park is primarily the preservation of prime habitats for the range of native fish species that is naturally present. The preservation of these habitats is important in itself, but in addition it has wider implications for species that spend a portion of their life at sea - in this instance most of the species present.

Eels are heavily exploited in New Zealand rivers and lakes and the protection of populations by the prohibition of commercial eeling in the waters of the National Park is a buffer against over-exploitation of the resource. Reports that there has been some illicit eel fishing in National Park waters should be regarded with serious concern.

This is equally true of the whitebait fishery, with at least four of the five species contributing to the fishery occurring in Fiordland waters.

Few conservation strategies can be implemented relevant to fishes in National Park freshwaters. Given that the area will be protected from exploitation, the protection of the land and its forest cover will protect the river catchments and thereby the fish that live in them. The presence of forest cover seems to be important not only to river stability but also to maintenance of populations of species such as banded kokopu and koaro.

Attention is drawn to the large proportion of species that is migratory and to the fact that the placement of impoundments in the rivers may prevent the up- and downstream movement of fish. Reports that large numbers of adult lampreys sometimes migrate up the Deep Cove tailrace to the base of the Manapouri power generation plant is a cause for some concern, since it is likely that these lampreys are unable to locate suitable spawning grounds and presumably perish without spawning successfully.

The presence in National Park waters of introduced fish species and indeed the continued liberations of such species into Park waters is scarcely consistent with the policy of National Parks towards introduced species.

The impact of the introduced salmonids on the native biota is not documented. It is evident in some lakes in New Zealand, particularly Lake Taupo, that populations of koaro have declined drastically since trout were introduced. This is not known to have occurred in Lakes Te Anau and Manapouri, but the status of the native fishes in the lakes does need to be watched.

In view of the fragile nature of Atlantic salmon populations in the Waiau system, the fact that this is the only area in New Zealand where the species is present, and the very low possiblity that it would be re-introduced into New Zealand if the populations died out, the present policy of permitting releases of Atlantic salmon into Lakes Gunn and Fergus can probably be justified - in spite of the fact that it is contrary to the usual approach to the presence of exotic biota in National Parks.

7. ACKNOWLEDGEMENTS

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APPENDIX I. Native fish distribution along the western slopes of Fiordland National Park

	Coll. No.	NZMS 1 Map Co-ordinates			REF*	*Geotria australis*	*Anguilla australis*	*Anguilla dieffenbachii*	*Retropinna retropinna*	*Prototroctes oxyrhynchus*	*Galaxias maculatus*	*Galaxias fasciatus*	*Galaxias argenteus*	*Galaxias brevipinnis*	*Cheimarrichthys fosteri*	*Gobiomorphus huttoni*	*Gobiomorphus cotidianus*	*Gobiomorphus hubbsi*
Awarua River lower reaches	1	S105	050	575	FRD		X	X	X		X	X	X	X	X	X	X	X
Hollyford River and tributaries below Lake McKerrow	2	S105	963	480	FRD				X		X							
L. McKerrow - tributaries near Jamestown	3	S105	997	440	FRD						X			X		X		
Lake McKerrow at head	4	S113	020	315	FNP	X												
Stream at Yates Point (unnamed)	5	S112	805	323	FNP									X				
Cleddau River, tributary Milford Sound	6	S113	907	109	FNP											X		
Arthur River, Milford Sd	7	S113	887	107	FWH								X					
Stream, Poison Bay	8	S120 /1	672	081	FNP								X					
Stream, Sutherland Sound	9	S120 /1	624	006	FNP									X				
Wild Natives River, Bligh Sound	10	S120 /1	572	845	JP						?	?	?	?				
Lake Alice and Edith River, George Sound	11	S130	530	730	FRD									X				
Lake Katherine and River, George Sound	12	S130	510	695	BTC				X					X				

APPENDIX I. (Cont'd)

	Coll. No.	NZMS 1 Map Co-ordinates			REF*	*Geotria australis*	*Anguilla australis*	*Anguilla dieffenbachii*	*Retropinna retropinna*	*Prototroctes oxyrhynchus*	*Galaxias maculatus*	*Galaxias fasciatus*	*Galaxias argenteus*	*Galaxias brevipinnis*	*Cheimarrichthys fosteri*	*Gobiomorphus huttoni*	*Gobiomorphus cotidianus*	*Gobiomorphus hubbsi*
Stillwater R. and tribs., Caswell Sound	13	S130	395	620	BTC	X		X					X	X		X		
Stream at Precipice Cove, Bradshaw Sound	14	S139	273	372	FRD							X		X		X		
Stream just off Precipice Cove, Bradshaw Sound	15	S139	252	363	FRD		X				X	X		X		X		
Rum River, tributary on left bank near mouth	16	S139	240	363	FRD		X				X	X		X		X		
Rum River, lower reaches, Bradshaw Sound	17	S139	240	363	FRD									X		X		
Stream, Secretary Is.	18	S138 /9	103	314	FNP							X				X		
Deep Cove - tailrace of power scheme, Doubtful Sound	19	S148	297	106	FNP	X												
Wanganella Stream, Doubtful Sound	20	S148	282	116	FNP		X					X		X				
Creek below Helena Falls, Doubtful Sound	21	S148	293	118	FNP									X				
Stream at head of First Arm, Doubtful Sound	22	S139	058	252	AMC								?					
Four small lakes draining into Doubtful Sound	23	S148	280	030	FNP			?										

APPENDIX I (Cont'd)

	Coll. No.	NZMS 1 Map Co-ordinates			REF*	*Geotria australis*	*Anguilla australis*	*Anguilla dieffenbachii*	*Retropinna retropinna*	*Prototroctes oxyrhynchus*	*Galaxias maculatus*	*Galaxias fasciatus*	*Galaxias argenteus*	*Galaxias brevipinnis*	*Cheimarrichthys fosteri*	*Gobiomorphus huttoni*	*Gobiomorphus cotidianus*	*Gobiomorphus hubbsi*
Stream at head of Breaksea Sound	24	S148	165	085	TM					?								
Lake Beattie	25	S148	956	049	FNP		X											
Seaforth River and tributaries at mouth of Dusky Sound	26	S157	137	827	FRD			X		X +	X	X		X		X		
Streams entering Dusky Sound near Docherty's Camp	27	S157	025-7	808	FRD						X	X		X		X		
Stream at Stick Cove, Wet Jacket Arm	28	S156	942	862	FRD			X						X		X		
Stream at Disappointment Cove, Resolution Island	29	S147	882	921	FNP								X					
Shag River and tribs., Dusky Sound	30	S156	785 -94	830 -2	FRD		X	X			X	X	X	X		X		
Creek at Cormorant Cove, Dusky Sound	31	S156	784	828	FRD							X						
Creeks at Sportsmans Cove, Coopers Island, Dusky Sound	32	S157	006	764	FRD									X		X		
Watering Ck, Duck Cove, Dusky Sound	33	S156	870	770	FRD									X				
Stream near Nook Cove, Duck Cove, Dusky Sound	34	S156	867	762	FRD			X					X					

APPENDIX I (Cont'd)

	Coll. No.	NZMS 1 Map Co-ordinates			REF*	*Geotria australis*	*Anguilla australis*	*Anguilla dieffenbachii*	*Retropinna retropinna*	*Prototroctes oxyrhynchus*	*Galaxias maculatus*	*Galaxias fasciatus*	*Galaxias argenteus*	*Galaxias brevipinnis*	*Cheimarrichthys fosteri*	*Gobiomorphus huttoni*	*Gobiomorphus cotidianus*	*Gobiomorphus hubbsi*
Stream at Nook Cove, Dusky Sound	35	S156	804	762	FRD									X				
Streams at Earshell Cove, Dusky Sound	36	S156	819 -22	772 -6	FRD			X				X	X	X		X		
Streams at Deception Cove, Long Island, Dusky Sound	37	S156	894	731	FRD							X		X		X		
Stream, Indian Island, Dusky Sound	38	S156	827	714	FRD		X	X			X			X				
Lake, Anchor Island, Dusky Sound	39	S156	772	739	FRD									X				
Stream, Anchor Island	40	S156	765	736	FRD							X						
Cook Stream, Pickersgill Harbour, Dusky Sound	41	S156	812	686	FRD			X			X	X	X	X		X		
Stream east of Pickersgill Harbour, Dusky Sd.	42	S156	816	685	FRD			X				X	X	X				
Lake Forster, Dusky Sd.	43	S156	806	697	FRD								X					
Stream, Cascade Cove, Dusky Sound	44	S156	807 -12	662 -72	FRD						X	X	X	X		X		

+ See Henry (n.d.) in Literature Cited

* See Appendix III

APPENDIX II. Native-fish distribution along the eastern slopes of Fiordland National Park and associated systems.

	Coll. No.	NZMS Map Co-ordinates			REF*	*Geotria australis*	*Anguilla australis*	*Anguilla dieffenbachii*	*Retropinna retropinna*	*Prototroctes oxyrhynchus*	*Galaxias maculatus*	*Galaxias fasciatus*	*Galaxias argenteus*	*Galaxias brevipinnis*	*Galaxias vulgaris*	*Cheimarrichthys fosteri*	*Gobiomorphus huttoni*	*Gobiomorphus cotidianus*	*Gobiomorphus hubbsi*	*Gobiomorphus breviceps*
Humboldt Ck. and other tributaries, upper Hollyford	45	S122	075	095	FRD			X						X						
Lake Marion, upper Hollyford River	46	S122	037	980	FNP									X						
Lake Fergus, upper Eglinton River	47	S122	070	910	FRD									X						
Lake Gunn, upper Eglinton River	48	S122	055	873	FRD			X						X				X		
Cascade Ck, upper Eglinton River	49	S122	047	847	FRD										?					
Dunton Creek, Eglinton River	50	S131	520	900	FRD													X		
Tributary of Lake Te Anau near Te Anau Downs	51	S140	842	485	FRD													X		
Lake Te Anau	52	S149	080	040+	FRD			X	X					X				X		
Lake Te Anau	53	S140	380	465	FNP									X						
Trib. of Lake Te Anau at FNP HQ's.	54	S149	760	197	FRD													X		
Lake Henry	55	S149	763	183	FRD				X					?						

APPENDIX II. (Cont'd)

	Coll. No.	NZMS 1 Map Co-ordinates			REF*	*Geotria australis*	*Anguilla australis*	*Anguilla dieffenbachii*	*Retropinna retropinna*	*Prototroctes oxyrhynchus*	*Galaxias maculatus*	*Galaxias fasciatus*	*Galaxias argenteus*	*Galaxias brevipinnis*	*Galaxias vulgaris*	*Cheimarrichthys fosteri*	*Gobiomorphus huttoni*	*Gobiomorphus cotidianus*	*Gobiomorphus hubbsi*	*Gobiomorphus breviceps*
Lake Manapouri	56	S149	610	070+	FRD			X	X					X				X		
Home Creek, Lake Manapouri	57	S149	700	020+	RH					X										
Trib. of Grebe R. at Percy Pass, Lake Manapouri	58	S149	417	100	FNP									X						
Whitestone R., trib. of Waiau River	59	S149	820	110+	FRD														X	
Borland R, trib. of Waiau River	60	S158	900	760+	GDJ									X						
Ligar Creek, trib. of Waiau River	61	S158	760	790+	GDJ										X					
Orawea River, trib. of Waiau River	62	S159	955	625	FRD										X					
Excelsior Creek, trib. of Waiau R.	63	S149	808	950	FRD										X					
Waiau River at Blackmount	64	S158	730	710+	FRD											X				
Lake Monowai-Monowai River	65	S158	618	116	FRD /IAM			X	X				X			X				
Lake Monk	66	S166	170	420	FRD									X						

APPENDIX II (Cont'd)

	Coll. No.	NZMS 1 Map Co-ordinates			REF*	*Geotria australis*	*Anguilla australis*	*Anguilla dieffenbachii*	*Retropinna retropinna*	*Prototroctes oxyrhynchus*	*Galaxias maculatus*	*Galaxias fasciatus*	*Galaxias argenteus*	*Galaxias brevipinnis*	*Galaxias vulgaris*	*Cheimarrichthys fosteri*	*Gobiomorphus huttoni*	*Gobiomorphus cotidianus*	*Gobiomorphus hubbsi*	*Gobiomorphus breviceps*
Waiau R. at mouth	67	S175	735	260+	FRD				X		X									
Track Burn, near mouth	68	S175	535	285+	FRD		X	X	X		X					X	X		X	
Wairaurahiri R. near mouth	69	S173 /4	390	160	FRD		X	X			X						X			

* See Appendix III

\+ Co-ordinates only approximate

APPENDIX III. Identity of items in REF column in Appendices I and II.

AMC - see Cookson, A.M. 1956 in Literature cited.

BTC - see Cunningham, B.T. 1951 in Literature cited.

FNP - Fiordland National Park Board records.

FRD - Fisheries Research Division records (including 1981 Dusky Sound data).

FWH - see Hutton, F.W. 1896 in Literature cited.

GDS - see James, G.D. 1967 in Literature cited.

IAM - I.A. Mathieson, pers. comm.

JP - J. Parkes, pers. comm.

RH - see Henry, R. 1884 in Literature cited.

TM - see McKenzie, T. 1896 in Literature cited.