



New Zealand large galaxiid  
recovery plan, 2003-13

Shortjaw kokopu, giant kokopu,  
banded kokopu, and koaro

THREATENED SPECIES RECOVERY PLAN 55



Department of Conservation  
*Te Papa Atawhai*



**Frontispiece. Top**—Banded kokopu (*Galaxias fasciatus*). Close up of head and pectoral fins of large adult from the side. Maori: kokopu.

**Mid left**—Shortjaw kokopu (*Galaxias postvectis*). Side view of head and pectoral fins showing undershot lower jaw. Maori: kokopu.

**Mid right**—Giant kokopu (*Galaxias argenteus*). Close-up of head, mouth, eye and sensory pores. Maori: kokopu.

**Bottom**—Giant kokopu (*Galaxias argenteus*). Side view of an adult. Maori: kokopu.

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Cover: Koaro (*Galaxias brevipinnis*). Close-up side view of the head of a large adult.  
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# Recovery plans

This is one of a series of recovery plans produced by the Department of Conservation. Recovery plans are statements of the Department's intentions for the conservation of particular plants and animals for a defined period. In focusing on goals and objectives for management, recovery plans serve to guide the Department in its allocation of resources and to promote discussion amongst a wider section of the interested public.

After preparing a technical report which was refined by scientists and managers both within and outside the Department, a draft of this plan was sent to the New Zealand Conservation Authority and relevant Conservation Boards for comment. After further refinement, this plan was formally approved by the Regional General Manager (Northern) in November 2004. A review of this plan is due after 10 years (2013), or sooner if new information leads to proposals for a significant change in direction. This plan will remain operative until a reviewed plan is in place.

The Department acknowledges the need to take account of the views of the tangata whenua and the application of their values in the conservation of natural resources. While the expression of these values may vary, the recovery planning process provides opportunities for consultation between the Department and the tangata whenua. Departmental Conservancy Kaupapa Atawhai Managers are available to facilitate this dialogue.

A recovery group consisting of people with knowledge of large galaxiids, and with an interest in their conservation has been established. The purpose of the large galaxiid recovery group is to review progress in the implementation of this plan and to recommend to the Department any changes which may be required as management proceeds. Comments and suggestions relating to the conservation of large galaxiids are welcome and should be directed to the recovery group via any office of the Department or to the Terrestrial Conservation Unit.

# New Zealand large galaxiid recovery plan, 2003–13

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and koaro

## ABSTRACT

Recovery planning at a national level provides a framework for targeting management actions and research requirements that contribute to the improved security, and thus persistence of, threatened species. Here, the biology and threats to the persistence, on a national scale, of four native freshwater fish species, known collectively as 'the large galaxiids', are discussed. These include the threatened shortjaw kokopu (*Galaxias postvectis*) and giant kokopu (*Galaxias argenteus*), and the non-threatened koaro (*Galaxias brevipinnis*) and banded kokopu (*Galaxias fasciatus*). Degradation of habitat, barriers to recruitment and competition with introduced species are revealed as the main threats to persistence. Descriptions of time-bound management actions and research needs to counteract these factors and improve the security of the large galaxiids are therefore needed to support long-term recovery goals.

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# 1. Introduction

This recovery plan incorporates four large (up to 240 mm in total length) native migratory galaxiid species: shortjaw kokopu (*Galaxias postvectis*), giant kokopu (*Galaxias argenteus*), banded kokopu (*Galaxias fasciatus*) and koaro (*Galaxias brevipinnis*). Each species is distributed throughout New Zealand in what is currently considered to be one national population (other than land-locked sub-populations). Current and historic landuse change and intensification in New Zealand has resulted in incremental habitat loss for these species, and they are now essentially absent from most of New Zealand's intensively utilised lowland plains (Hanchet 1990; Rowe et al. 2000).

These fish species are descendants of tangaroa (nga uri o tangaroa) and as such are 'nga taonga tuku iho o nga tupuna matua' ('treasures handed down to us from our ancestors'). The Ngai Tahu Claims Settlement Act 1998 requires the Department of Conservation (DOC) to consult and have particular regard to the views of Ngai Tahu when making decisions regarding the management of taonga species, such as giant kokopu.

Under the New Zealand 'threat of extinction' classification system (Hitchmough 2002; Molloy et al. 2002) the shortjaw and giant kokopu are ranked as in Gradual Decline and banded kokopu and koaro are ranked as Not Threatened. A Data Poor (DP) qualifier applies to banded and giant kokopu listings, as confidence in these is low, based on the data available for assessment.

The intention of this recovery plan is to provide strategic guidance to DOC freshwater fish conservation management in order to achieve greater co-ordination nationally and to ensure that the highest priority recovery work is undertaken. This recovery plan is intended to sit alongside Conservancy Conservation Management Strategies as a means to assist with Conservancy and Area business planning. This plan sets out the recovery programme for four large galaxiids over the next 10 years (2003-13). It has been produced in tandem with a New Zealand mudfish recovery plan (DOC 2003a), and a New Zealand non-migratory galaxiid recovery plan (DOC 2004), with the aim of guiding the conservation management of New Zealand's threatened freshwater fish species over the next 10 years. These plans have been produced under the overarching guidance of the DOC Statement of Intent (DOC 2003b), and will be linked to the strategic action plan for freshwater (FreshSAP) currently being produced. While all four species are harvested in their juvenile form as whitebait (McDowall 1965), the scope of this document does not address whitebait fishery management issues.



## 2. Past and present distribution and population size

### 2.1 SHORTJAW KOKOPU

Distributed throughout the North and South Islands of New Zealand, this species is known from only a few sites in many regions, and is essentially absent from the East Coast of New Zealand (McDowall et al. 1996) (Figs 1A and 1B). To date, land-locked populations of this species have not been documented. Although the species is one of the five galaxiids contributing to New Zealand's whitebait fishery, it is one of the least known freshwater fish in New Zealand. Until recently, this species had been found at only 2% of sites registered in the New Zealand freshwater fish database. Recent targeted survey work and improved survey technique in the Nelson/Marlborough, Taranaki and West Coast regions has led to the discovery of many new species' locations, with populations being far more abundant than indicated by the national population records (Caskey 1998; Studholme et al. 1999; Jack & Barrier 2000; Eastwood 2001; Jack et al. 2001). Whether this holds true for the rest of New Zealand remains to be verified.

### 2.2 GIANT KOKOPU

This species is widely distributed throughout much of the North and South Islands of New Zealand, and on Stewart Island, Great and Little Barrier Islands and the Chatham Islands. Land-locked populations exist within several New Zealand lakes. Distribution within this range is variable, with most current records occurring from Westland, Southland, Nelson/Marlborough and Taranaki. The present distribution has decreased significantly compared with that in historical records (Bonnott 2000) (Figs 2A and 2B).

### 2.3 BANDED KOKOPU

This species is found throughout New Zealand and its offshore islands, and is most abundant at low elevations close to the sea (McDowall 1990; McCullough 1998). As with giant kokopu, land-locked populations occur in some New Zealand lakes. Banded kokopu represent a significant component of the national whitebait catch on the West Coast. While the species remains widespread, it has declined substantially in range and abundance, particularly in intensively developed areas such as the Manawatu and Canterbury plains (McDowall 2000) (Figs 3A and 3B).

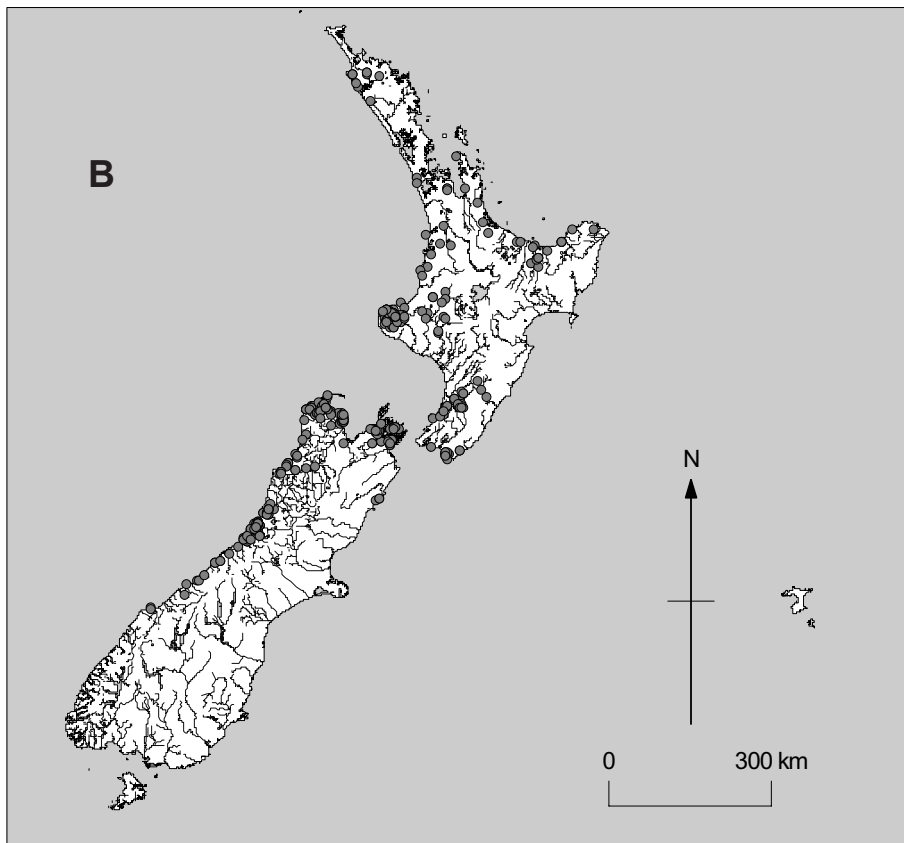
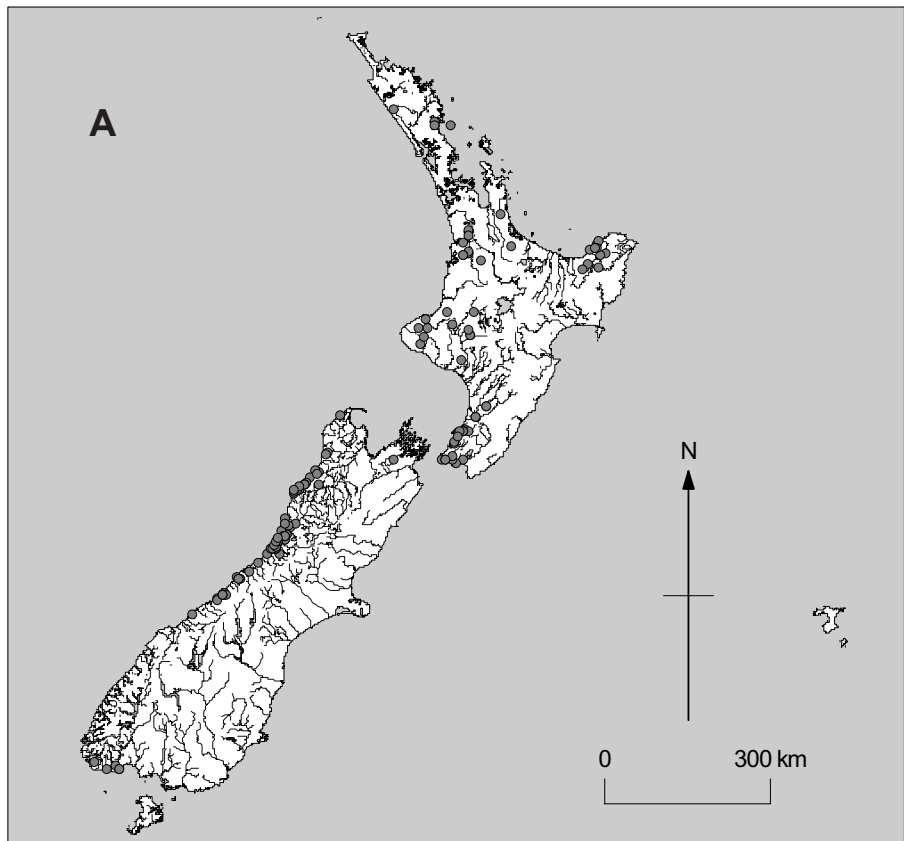


Figure 1. Shortjaw kokopu records in New Zealand: **A.** Prior to 1991; **B.** 1991 to the present.

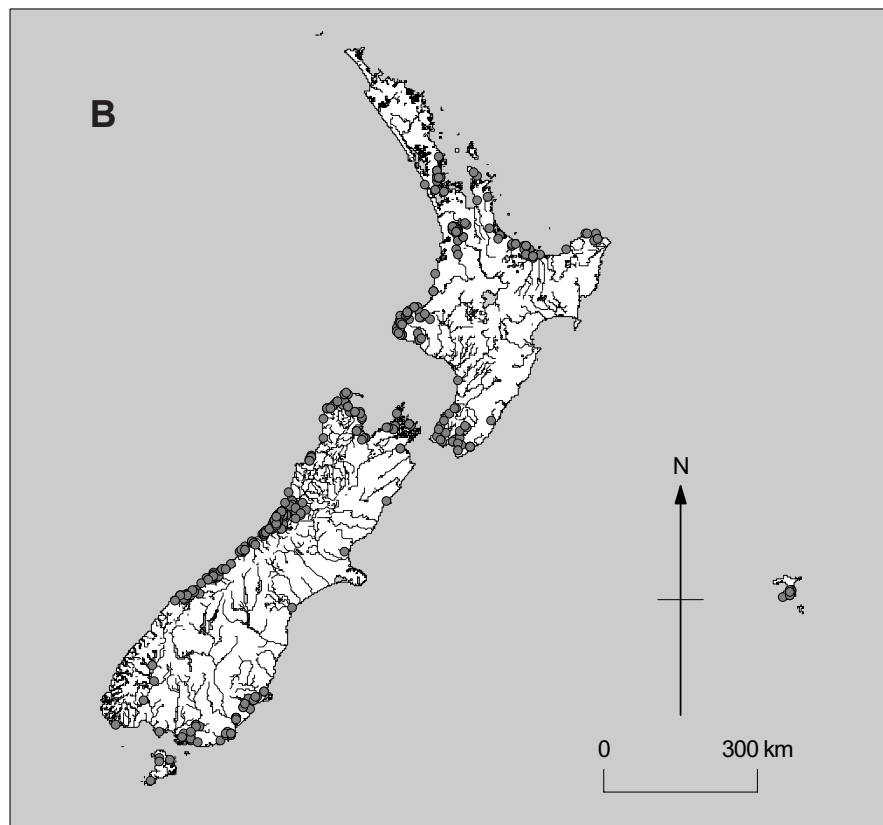
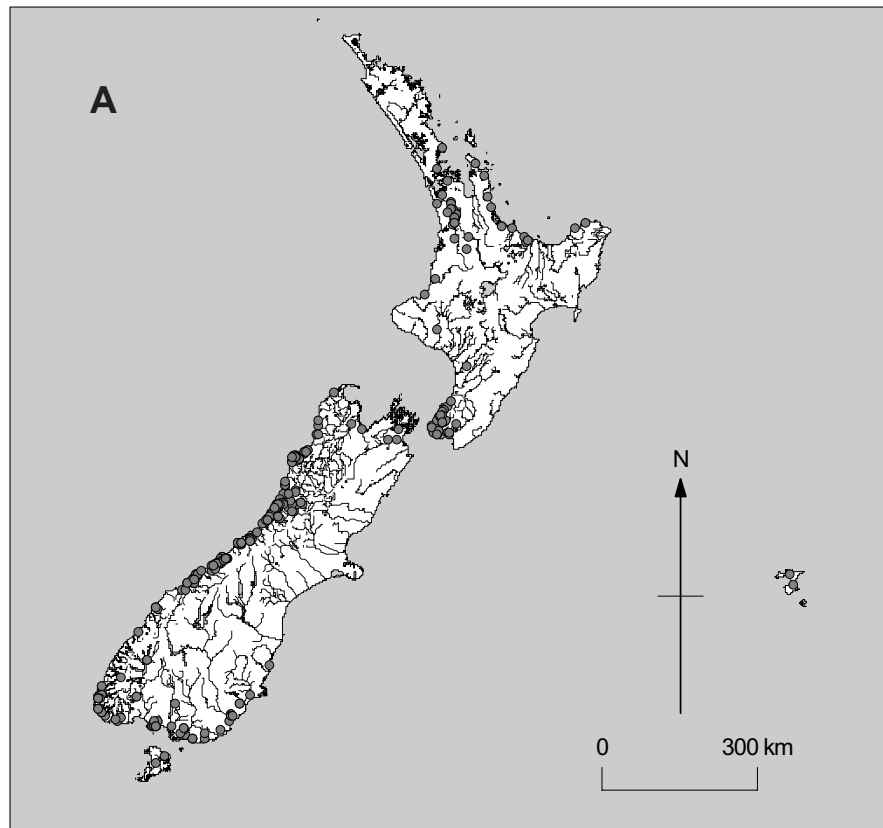


Figure 2. Giant kokopu records in New Zealand: **A.** Prior to 1991; **B.** From 1991 to the present.

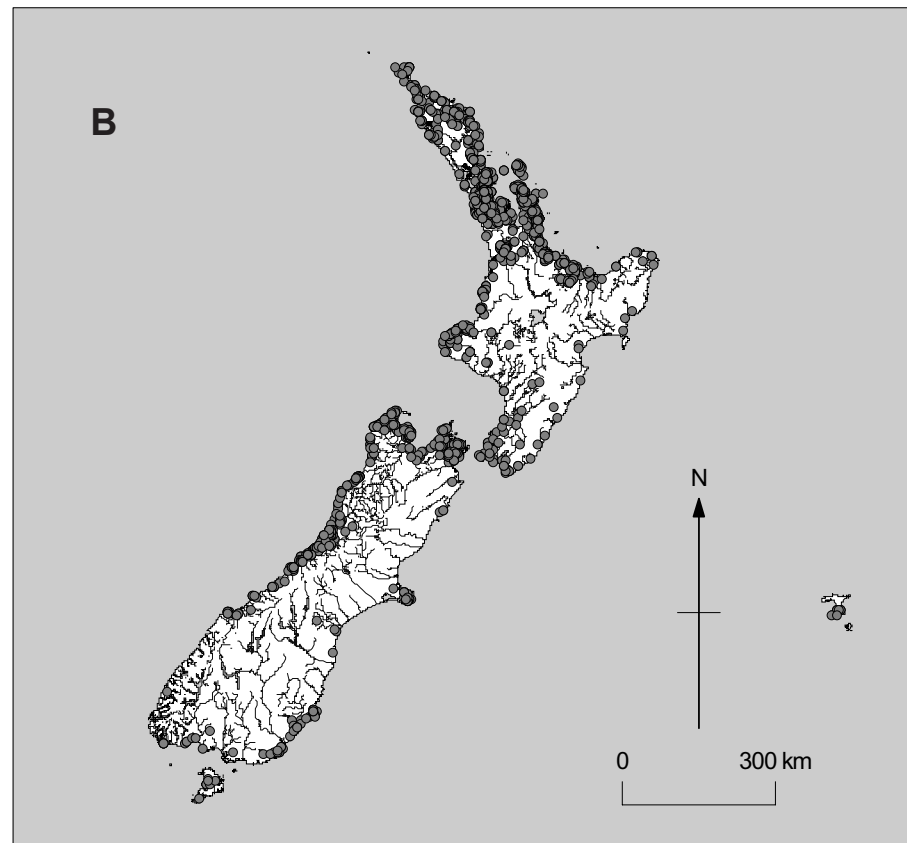
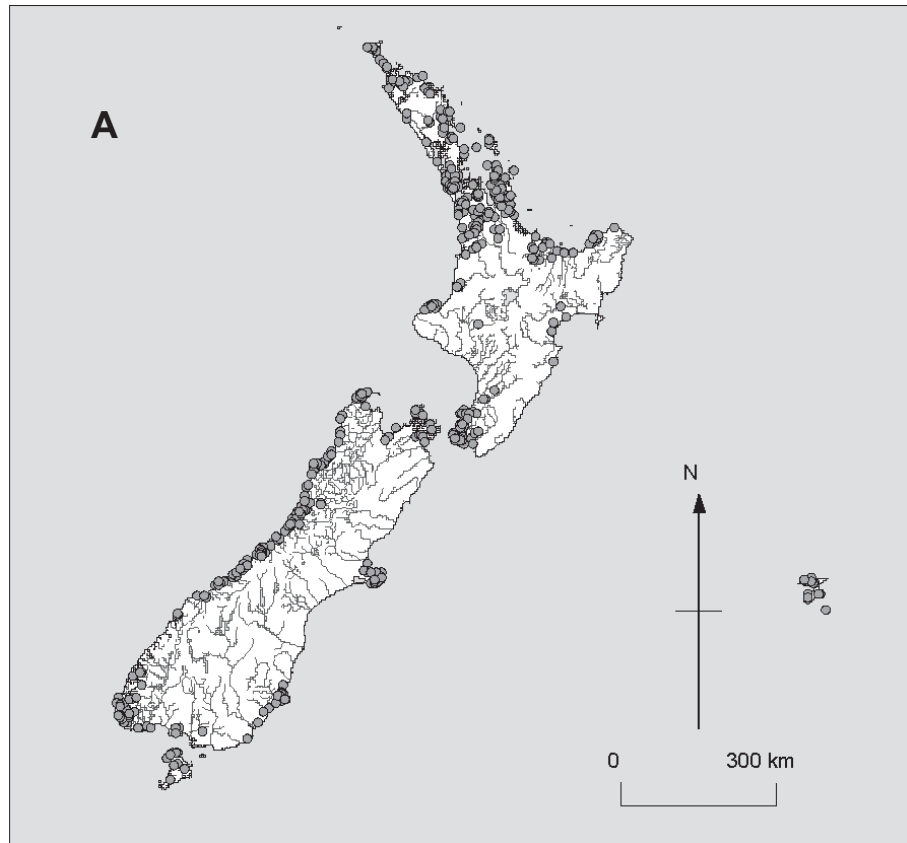


Figure 3. Banded kokopu records in New Zealand: **A.** Prior to 1991; **B.** From 1991 to the present.

## 2.4 KOARO

This galaxiid is very widespread within New Zealand and its offshore islands, from sea level to extremely high altitudes and distances inland, as well as occurring in southeastern Australia and Tasmania. The species forms widespread land-locked populations in many inland lakes and alpine tarns. Like banded kokopu, it forms a significant component of the whitebait catch in some areas of New Zealand. While the species remains widespread in New Zealand, it has declined greatly in some lakes, especially in the central North Island (McDowall 2000) (Figs 4A and 4B).

# 3. Cause of decline and threats

Several common agents of decline have been implicated in the possible range contraction and decrease in abundance of large galaxiids generally. They include: overharvesting of the juvenile whitebait stage; impediments to migration and recruitment; habitat destruction; pollution of waterways; changes in catchment landuse, and; the impacts of introduced species. Diamond (1989) divides these agents into the following categories which he describes as the 'evil quartet' responsible for extinction of species:

- Overkill
- Habitat destruction and fragmentation
- Impacts of introduced species
- Chains of extinction

While it is likely that a combination of all four categories has contributed to the declines and presently exerts ongoing threats to all four species, the relative importance of each category is probably specific to the decline of each species. Therefore, in order to accurately identify the relative importance of each category, separate consideration is required for each species. This exercise is made difficult by a lack of historical information and data.

Shortjaw kokopu have been historically recognised as a naturally sparse species with secretive habits (McDowall et al. 1996). Although no historical data exist that demonstrate the species has declined, it is likely that deforestation has impacted negatively on the species, given its specific habitat preferences and avoidance of degraded stream environments (West 1989). The effect of brown trout (*Salmo trutta*) and whitebait fishing on current shortjaw kokopu distribution has not been investigated. At present there is no nationally co-ordinated monitoring for shortjaw kokopu, or any of the other three large galaxiids, to assess factors such as national oceanic recruitment success.

The loss of around 85% to 90% of New Zealand's wetlands (Ministry for the Environment 1997) in the last 100 years has severely impacted on the habitat and distribution of giant kokopu in New Zealand. In the mid-1800s for example, this species was well known from south Canterbury streams and wetlands, but is now absent from most of this region (Bonnett 2000). Loss and degradation of



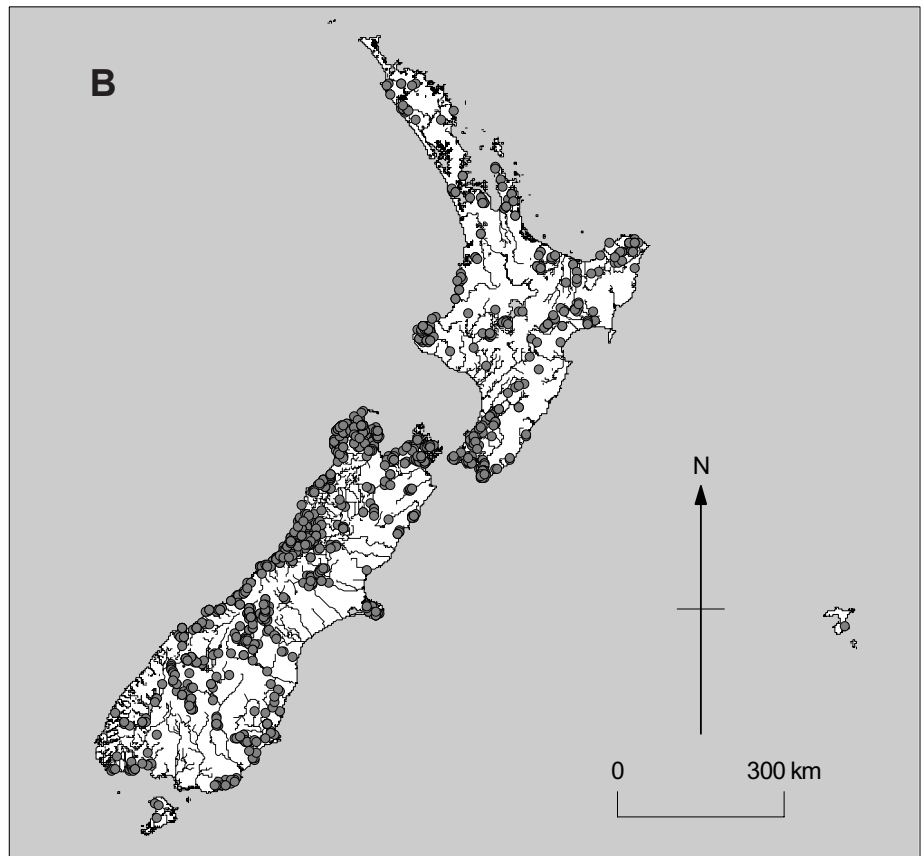
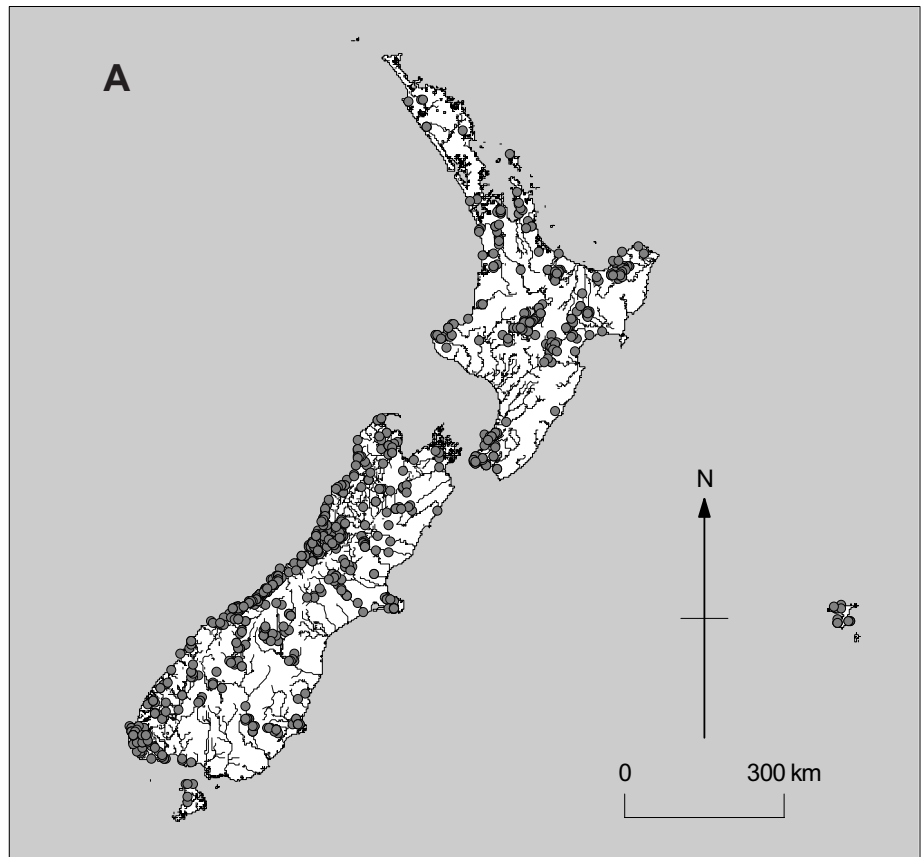


Figure 4. Koaro records in New Zealand: **A.** Prior to 1991; **B.** From 1991 to the present.

habitat through activities such as drainage schemes and landuse intensification were, and still are, the biggest agents of decline for this species (Rowe et al. 2000). Other potential threats that have not yet been thoroughly investigated include the effects of sport fish such as brown trout (Townsend 1996) and perch (*Perca fluviatilis*), and the effect of invasive pest fish such as koi carp and *Gambusia affinis* (Rowe 1998). Partial obstruction and/or complete loss of fish passage in some regions are also likely to have negatively affected the distribution of giant kokopu along with koaro, shortjaw, and banded kokopu (Joy & Death 2000).

The decline in the historic distribution of banded kokopu, evident through the disappearance of the species from agricultural plains, is thought to be primarily due to the ongoing loss and degradation of adult habitat, such as streams in preferred native forest catchments, through deforestation and other landuse changes (McDowall 1990; Rowe et al. 2000). Loss of wetlands is also likely to have affected the distribution of this species, but to a lesser extent than giant kokopu. The effects of sport and invasive pest fish species on banded kokopu have not been studied.

Like banded kokopu, the decline in the historic range and abundance of koaro is likely to have been caused by the ongoing loss of adult habitat through deforestation and other landuse changes, leading to stream eutrophication and other effects. Population declines have also been documented in North Island lakes following the introduction of trout and smelt (McDowall 1990). The effect of invasive introduced fish species on koaro, such as the recent invasion of Lake Taupo by catfish (*Ameiurus nebulosus*), has not yet been thoroughly studied.

## 4. Species ecology and biology

Nearly half of New Zealand's native fish species, including the large galaxiids within this recovery plan, have a diadromous life-history. Diadromous fish migrate between fresh and salt water, usually in relation to spawning. This feature has a number of implications for species management, including consideration of the number of populations of each species (Joy et al. 2000). For example, all species contained within this recovery plan are treated as national populations owing to mixing of their genetic material each year during whitebait migrations. This means that fish located within individual streams have to be considered as 'population areas' rather than distinct populations. Exceptions to this are land-locked populations (occurring in three of these species), where life-history is completed entirely within freshwater, usually in lakes.

Diadromy creates uncertainty in predicting recruitment success. As well as the vagaries of possible effects of changes in oceanic conditions on larval growth and whitebait return (through global warming), the number of breeding adults required nationally to sustain adequate recruitment of whitebait from the ocean back into freshwater habitat is unknown. There may well be a critical national population size, below which recruitment failure occurs.

Shortjaw kokopu are a diadromous, largely nocturnal fish species restricted to small to medium lower-order rivers and streams, generally associated with podocarp forest. Spawning occurs over the April to June period each year (Charteris 2002). Information on age and growth of shortjaw kokopu is sparse; it is likely that they live at least as long as banded kokopu, up to around 9 years old. Shortjaw kokopu feed extensively on terrestrial invertebrates taken from the stream surface, as well as grazing instream boulders for caddisfly larvae (McDowall 2000).

Giant kokopu are diadromous but have the ability to form land-locked populations. The species favours small to medium-sized, gently flowing, overgrown weedy/boggy streams, swampy lagoons, and lake margins. They are cryptic, mostly nocturnal fish, maturing at the age of 2 or 3 years, and spawning in autumn/winter. This species has a diverse diet including terrestrial insects, aquatic insects and koura (McDowall 1990).

Banded kokopu, like giant kokopu, are mainly diadromous and have the ability to form land-locked populations. Their preferred habitat is pools and backwaters in slow flowing, first- to third-order tributaries and rivers, with reasonably extensive riparian vegetation providing bank cover (McCullough 1998). This species has been shown to live for at least 9 years in the wild, though anecdotal information suggests they may live in excess of 20 years in the wild (A. Rebergen, DOC Wairarapa, pers comm. March 2002). Females become relatively more abundant than males in the older age classes of the population owing to sex-related differential mortality (Hopkins 1979). Spawning occurs from autumn/early winter and has been observed to take place amongst forest litter along stream margins during high flows (Mitchell & Penlington 1982; Charteris 2002). Like other large-bodied galaxiids, the banded kokopu is an opportunistic feeder, consuming an extensive range of terrestrial invertebrates and aquatic insect larvae such as caddisflies and mayflies, taken from drift or the stream bed (McDowall 2000).

Koaro, while diadromous, also form extensive land-locked populations in many inland lakes and alpine tarns of New Zealand. The species is an aggressive migrant, found at the highest altitudes of all the New Zealand native freshwater fish. The species favours clear, swiftly flowing, boulder-cobble streams of small to moderate size that flow through forest, although it often occurs in tussock stream, particularly those flowing into high-altitude lakes. Spawning occurs from March to May and the only known spawning habitat is in riffle habitat (McDowall & Surren 1995; Allibone & Caskey 2000). It is a cryptic, largely nocturnal fish (McDowall 2000). Like the other large galaxiids, koaro have a varied diet feeding on a diverse array of aquatic insects and terrestrial invertebrates.

## 5. Past conservation efforts

Past conservation efforts for all four species covered by this recovery plan have been in the form of three main areas: advocacy (Resource Management Act, land purchase cases, land status changes, fish passage); improving knowledge of the species' ecology; and regulation of the whitebait fishery. Land status changes specifically to preserve lake-locked koaro populations have occurred with the creation of three faunistic reserves (Lake Chalice, Lake Christabel and Lake Rotopounamu). Other, more recent, land status changes have resulted in enormous indirect benefits for securing threatened fish habitat, such as the creation of Kahurangi National Park. Earlier conservation initiatives, while not implemented for fish conservation, now provide large areas of protected habitat for fish such as shortjaw kokopu. Creation of lowland conservation areas such as Abel Tasman National Park and Marlborough Sounds reserve areas have helped preserve valuable habitat for these species into the future.

In order to improve the level of information required to develop and implement a strategy for the management of populations and habitats of large galaxiids, DOC has commissioned a number of studies (McDowall et al. 1996; Boubée et al. 1999; Bonnett 2000). Several, relevant, non-DOC funded studies have also been undertaken by R.M. McDowall (NIWA), University researchers and other NIWA staff.

In addition to ecological studies, public awareness projects for large galaxiids have been initiated, including: the Northland 'Whitebait Connection' conservation awareness programme (Seitzer & Kerr 2001), aimed at improving community involvement in stream restoration and enhancement; and DOC Southern Regional Office's 'Whitebait Marketing Plan' (Hutchinson 2001).

## 6. Long-term recovery goal

The long-term recovery goal is that the current geographic range, habitat and genetic diversity of large galaxiid species are maintained and improved within New Zealand.

## 7. Options for recovery

### 7.1 OPTION 1 — DO NOTHING

This relies on existing protected areas to protect large galaxiid populations. This option is not recommended. Many protected land areas within New Zealand consist of high-altitude uplands, with waterways predominantly unsuitable to shortjaw, banded and particularly giant kokopu. There is also a lack of nationally consistent survey and monitoring information for these species. Current conservation status classification for these species is simply based on ‘best-guess’ expert opinion rather than objective quantitative data.

### 7.2 OPTION 2 — UNDERTAKE NATIONAL PRIORITY WORK

Undertaking national priority work involves using threatened fish recovery plans as tools to co-ordinate required management work and research needs, and to identify funding requirements. This is the preferred option because recovery plans give effect to programmes set out in DOC’s draft FreshSAP and the Department’s Statement of Intent 2003-06 (DOC 2003b).

## 8. Objectives for the term of the plan

**Objective 1:** Identify, manage and advocate the protection of habitat and migratory pathways.

**Objective 2:** Trial habitat restoration and recruitment enhancement, and monitor results.

**Objective 3:** Identify and protect unique land-locked populations and migratory multi-species assemblages.

**Objective 4:** Determine the current geographic ranges of shortjaw and giant kokopu within and between catchments.

**Objective 5:** Determine and address information gaps relevant to management.

**Objective 6:** Determine population trends and range contraction/expansion.

**Objective 7:** Involve Iwi in the implementation of this recovery plan.



## 9. Work plan

Specific work plan actions that are required to achieve each objective, and performance measures to assess success in meeting objectives, are set out below. The work plan actions have been ranked to assist prioritisation of recovery plan actions. The priority rankings of ESSENTIAL, HIGH, and MEDIUM equate respectively to the level I (securing taxa from extinction<sup>1</sup>), level II (maintaining genetic diversity within the species<sup>2</sup>) and level III (increasing security further) rankings outlined in DOC's draft national policy work on Natural Heritage Concepts and Principles (WGNHO-104078; section 3.1.6). A work plan summary for all actions for Conservancies with large galaxiids is provided in WGNCR-51599 (Large galaxiid recovery plan timetable).

### **Objective 1: Identify, manage and advocate the protection of habitat and migratory pathways**

#### ***Performance measure***

Protective measures achieved for large galaxiid habitat through plan or resource consent hearings and non-statutory initiatives, by 2013.

#### ***Explanation***

Habitat loss and degradation are key issues facing large galaxiids, particularly giant kokopu. Many areas of habitat are located within private land, potentially subject to future development. The only tools to address these threats are public awareness, planning advocacy and protection through covenanting or land-purchase deals. To date, Resource Management Act advocacy has been the main tool used to combat these threats. In the case of planning advocacy, it is vitally important that liaison with Area staff occurs and, where necessary, a consultative working group process is initiated, to ensure that proactive non-statutory Area initiatives with landowners are not jeopardised. Other tools such as covenanting are also required in relation to wetland protection for giant and banded kokopu. Many of the actions listed below are also duplicated in the mudfish recovery plan (DOC 2003a), as wetlands often provide habitat for both mudfish and/or large galaxiids.

#### ***Action 1.1***

Inventory water bodies occupied by shortjaw and giant kokopu within each Conservancy and prioritise privately owned ones for protection by 2006.

**Priority:** HIGH.

**Responsibility:** Freshwater Technical Support Officers and Programme Managers in Areas assigned by those Conservancies containing shortjaw and giant kokopu (see Appendix 1).

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<sup>1</sup> This category captures work associated with identifying agents of decline in some instances.

<sup>2</sup> Defined as preventing major range contraction or the extinction of genetically distinct local populations.

### *Action 1.2*

Throughout the life of this recovery plan, list large galaxiid sites (from Action 1.1) in Protected Natural Area (PNA) reports, Recommended Areas for Protection (RAP) lists or as an addendum to other existing reports where possible.

**Priority:** HIGH.

**Responsibility:** Freshwater Technical Support Officers and Programme Managers in Areas assigned by those Conservancies containing large galaxiids (see Appendix 1).

### *Action 1.3*

Throughout the life of this recovery plan, liaise with landowners of sites with large galaxiids outside the statutory planning process and keep a record of discussion where appropriate.

**Priority:** HIGH.

**Responsibility:** Freshwater Technical Support Officers and Programme Managers in Areas assigned by those Conservancies containing large galaxiids (see Appendix 1).

### *Action 1.4*

Throughout the life of this recovery plan, seek protection of wetlands containing large galaxiid populations on private land through non-statutory processes such as covenanting and/or purchase.

**Priority:** HIGH.

**Responsibility:** Freshwater Technical Support Officers and Programme Managers in Areas assigned by those Conservancies containing large galaxiids (see Appendix 1).

### *Action 1.5*

Throughout the life of this recovery plan, advocate through statutory planning processes, protection of large galaxiid habitat (including migratory pathways).

**Priority:** HIGH.

**Responsibility:** Community Relations Officers and Freshwater Technical Support Officers in Areas assigned by those Conservancies containing large galaxiids (see Appendix 1).

### *Action 1.6*

Where possible, undertake monitoring, control and educational programmes to prevent the spread and establishment of introduced fish into habitat with large galaxiids, throughout the life of this recovery plan.

**Priority:** HIGH.

**Responsibility:** Freshwater Technical Support Officers, Programme Managers, Community Relations Officers, Northern Regional Office.

#### *Action 1.7*

Advocate, through both regional plans and resource consent applications, drain maintenance techniques that minimise impact on habitat provided by drains for giant and banded kokopu, throughout the life of this recovery plan.

**Priority:** HIGH.

**Responsibility:** Community Relations Officers and Freshwater Technical Support Officers in Areas assigned by those Conservancies containing giant and banded kokopu (see Appendix 1).

#### *Action 1.8*

Advocate the use of a multi-agency code of practice for drainage through resource consent/plan provisions, throughout the life of this plan.

**Priority:** HIGH (all species).

**Responsibility:** Community Relations Officers and Freshwater Technical Support Officers in Areas assigned by those Conservancies containing large galaxiids (see Appendix 1).

#### *Action 1.9*

Write a community relations plan by 2006 on the importance of sites with large galaxiids.

**Priority:** HIGH (all species).

**Responsibility:** Northern Regional Office and/or Recovery Group.

#### *Action 1.10*

Prepare a fact sheet template on large galaxiids by 2007. Distribute to each conservancy for distribution to key target audience (see Action 1.9), along with information on how to protect and/or manage large galaxiid habitat.

**Priority:** HIGH (all species).

**Responsibility:** Northern Regional Office and/or Recovery Group.

#### *Action 1.11*

Seek out and nominate to External Relations Division private land owners and/or managers who demonstrate environment-friendly land-management practices for wetlands generally, and large galaxiid sites specifically, for the DOC World Wetland Day awards annually until 2013.

**Priority:** HIGH.

**Responsibility:** Programme Managers, External Relations Division.

### **Objective 2: Trial habitat restoration and recruitment enhancement, and monitor results**

#### ***Performance measure***

By 2013, there will be a body of robust empirical information on factors that increase the abundance of large galaxiids.

### ***Explanation***

Monitoring of existing and new habitat restoration projects for large galaxiids is required to determine the success of these projects. At present, many restoration projects undertaken by a number of agencies do not have associated monitoring of the effects on populations of large migratory galaxiid population.

#### *Action 2.1*

Utilise existing and new habitat restoration projects to investigate factors that increase the abundance of large galaxiids by the end of 2012. Existing opportunities include: Otago trout exclusion; Taranaki fish pass restoration; habitat enhancement in Rotorua Lakes/streams, Whakatane streams, Waikato and Golden Bay (Dogon/Gorge Creeks); establishment of giant kokopu in Wharariki Wetland (Golden Bay), Kaituna Wildlife Management Reserve, and other lake restoration projects throughout New Zealand where giant kokopu may exist.

**Priority:** MEDIUM.

**Responsibility:** Recovery Group; Freshwater Technical Support Officers and Programme Managers in Areas assigned by those Conservancies containing large galaxiids (see Appendix 1).

#### *Action 2.2*

Trial the use of specially constructed whitebait catch-sorting buckets in conservancies, where appropriate, by the end of 2006.

**Priority:** MEDIUM.

**Responsibility:** Recovery Group, Freshwater Technical Support Officers, Programme Managers

### **Objective 3: Identify and protect unique land-locked populations and migratory multi-species assemblages**

#### ***Performance measure***

Unique populations of land-locked and migratory multi-species assemblages of large galaxiids are identified and protection measures initiated by 2013.

### ***Explanation***

The preservation of land-locked populations is important; these populations may exhibit genetic structures somewhat different from those of migratory populations, which are thought to maintain constant gene flow throughout the whole of New Zealand. It is important to preserve aquatic ecosystems containing multi-species assemblages of large galaxiids (e.g. Stewart Island) as such systems are now somewhat scarce within New Zealand waterways owing to an array of impacts such as hydro-schemes, landuse intensification, and possibly introduced fish.

#### *Action 3.1*

Develop methods to identify land-locked populations of large galaxiids by 2013.

**Priority:** HIGH.

**Responsibility:** Recovery Group Leader, Conservation Advisory Scientists.

*Action 3.2*

Using allele-frequency genetic analysis determine the genetic diversity of land-locked populations of banded kokopu by 2005, giant kokopu by 2008 and koaro by 2013.

**Priority:** HIGH.

**Responsibility:** Terrestrial Conservation Unit.

*Action 3.3*

List, in order of their genetic and/or morphological distinctiveness, known land-locked populations of banded kokopu by 2005, giant kokopu by 2008 and koaro by 2013.

**Priority:** HIGH.

**Responsibility:** Terrestrial Conservation Unit.

*Action 3.4*

Using formal and informal agreements, education and direct management programmes, minimise the potential for human-induced disturbances to occur in ecologically important land-locked populations of large galaxiids by 2013. Examples of disturbances include the introduction of invasive aquatic species and degradation of water quality.

**Priority:** HIGH.

**Responsibility:** Programme Managers, Freshwater Technical Support Officers and Community Relations Officers in Areas assigned by those Conservancies containing in ecologically important land-locked populations of large galaxiids (see Appendix 2).

*Action 3.5*

Survey lakes and/or tributaries for previously unrecorded land-locked large galaxiid populations by 2013.

**Priority:** HIGH.

**Responsibility:** Programme Managers in Areas assigned by those Conservancies containing large galaxiids (see Appendix 1).

**Objective 4: Determine current geographic range of shortjaw and giant kokopu within and between catchments**

***Performance measure***

At least 150 previously unrecorded potential shortjaw kokopu and 150 previously unrecorded potential giant kokopu sites have been surveyed within regions outlined by the recovery plan by 2006.

***Explanation***

Recent, targeted, spotlighting surveys of shortjaw kokopu in Nelson/Marlborough, Wanganui and Wellington Conservancies have produced a surprising number of new records of shortjaw and, to a lesser extent, giant



kokopu. Further national survey work for both species is required to gain an accurate picture of current national distribution to aid in future assessments of conservation status of these species.

*Action 4.1*

Produce standard survey and monitoring guidelines for shortjaw kokopu by 2003.

**Priority:** HIGH.

**Responsibility:** Terrestrial Conservation Unit.

*Action 4.2*

Survey at least 150 potential shortjaw kokopu sites by 2006 using methods described in survey guidelines (Action 4.1). Survey work to be undertaken in the following areas: Fiordland, West Coast, Wellington, Western Ruahines, Wanganui River, Motu/Wairoa, Mokau, Tukituki, Waimana, Manawhe and Coromandel.

**Priority:** HIGH.

**Responsibility:** Programme Managers.

*Action 4.3*

Survey at least 150 potential giant kokopu sites by 2006 using methods described in survey guidelines (Action 4.1). Survey work to be undertaken in the following areas: Stewart Island, Southland Plains, Fiordland, Wellington Conservancy, Wanganui River, Mokau, and Northland Conservancy.

**Priority:** HIGH.

**Responsibility:** Programme Managers.

**Objective 5: Determine and address information gaps relevant to management**

***Performance measure***

Information gaps and research priorities are identified and research projects initiated.

***Explanation***

Information on the ecology and/or biology of large galaxiids is essential to pinpoint the relative importance of various agents of decline and thus enable the appropriate management decisions to be made.

*Action 5.1*

Develop techniques for survey and/or monitoring of giant kokopu, and revise survey and/or monitoring publication (Action 4.1) by 2005.

**Priority:** HIGH.

**Responsibility:** Terrestrial Conservation Unit.

### *Action 5.2*

Identify the contribution from geographical representation of each species to the overall genetic variation within that species. Do this for all species (migratory shortjaw and giant kokopu populations only, and land-locked populations of all species) by 2013.

**Priority:** HIGH.

**Responsibility:** Recovery Group Leader, Conservation Advisory Scientists.

### *Action 5.3*

Research priorities (listed in Section 10 of this document) are identified and initiated throughout the life time of this recovery plan.

**Priority:** HIGH.

**Responsibility:** Recovery Group.

## **Objective 6: Determine population trends and range contraction and/or expansion**

### ***Performance measure***

Large galaxiid populations within regions listed in this recovery plan are monitored annually and shortjaw and giant kokopu records >10 years old are re-surveyed by 2006.

### ***Explanation***

There is currently a lack of methodical or comparable national survey and monitoring records of large galaxiids upon which to base an accurate assessment of current conservation status. Recent ranking of these species through the new threatened species ranking system (Hitchmough 2002) classified shortjaw and giant kokopu as in Gradual Decline, and koaro and banded kokopu as Not Threatened, with a Data Poor qualifier for banded kokopu. All of these rankings are fairly subjective and based on 'best-guess' estimates. National monitoring of large galaxiid species is required, to give information on whether species' ranges are continuing to contract and whether a lack of oceanic recruitment is causing this contraction. Because of the diadromous life history of these species, despite relatively large national populations, national recruitment failure is a possibility and monitoring will help determine how real this threat is. This objective is the key to the success of this recovery plan, as once it is met decisions on whether to resource protective initiatives such as stream fencing for these species will be able to be more readily made.

### *Action 6.1*

Initiate national monitoring of populations of large galaxiids annually from 2004.

**Priority:** HIGH.

**Responsibility:** Programme Managers, Terrestrial Conservation Unit (tagging training and/or assistance).

*Action 6.2*

Review monitoring programme (Action 6.1) after 5 years of data collection.

**Priority:** HIGH.

**Responsibility:** Recovery Group.

*Action 6.3*

Re-survey existing shortjaw and giant kokopu New Zealand freshwater fish database records that are <sup>3</sup> 10 years old (from April 2002), using survey guidelines (Action 4.1) by 2006.

**Priority:** HIGH.

**Responsibility:** Programme Managers.

**Objective 7: Involve Iwi in the implementation of this recovery plan**

***Performance measure***

Copies of the annual report on the implementation of recovery plan are provided to all Kaupapa Atawhai Managers and Ngai Tahu.

***Explanation***

The Recovery Leaders' Annual Report gives a yearly update on implementation of recovery plans, including any Iwi involvement with plan actions that have been implemented over the reporting year. This provides an efficient mechanism by which to keep tangata whenua informed of progress. Furthermore, the open invitation for any of the Kaupapa Atawhai Managers or Ngai Tahu to sit on annual Recovery Group meetings provides a mechanism for Iwi feedback to the Recovery Group, and a facility for plan changes if required.

*Action 7.1*

Throughout the life of this plan, engage local tangata whenua on a project-by-project basis.

**Priority:** HIGH.

**Responsibility:** Programme Managers, Freshwater Technical Science Officers (Kaupapa Atawhai Managers to assist).

*Action 7.2*

Throughout the life of this plan, report regularly, through mutually agreed means, to tangata whenua.

**Priority:** HIGH.

**Responsibility:** Programme Managers, Freshwater Technical Science Officers (Kaupapa Atawhai Managers to assist).

*Action 7.3*

Throughout the life of this plan, incorporate actions arising out of Treaty settlements as the need arises.

**Priority:** HIGH.

**Responsibility:** Recovery Group (Kaupapa Atawhai Manager to assist).

#### *Action 7.4*

Throughout the life of this plan, co-operate with mutually agreed tangata whenua-led initiatives relating to implementation of this plan.

**Priority:** HIGH.

**Responsibility:** Programme Managers, Freshwater Technical Science Officers (Kaupapa Atawhai Managers to assist)

## 10. Research priorities

Information regarding the ecology and biology of large galaxiids is essential to identify agents of decline and their relative importance, and to make sound management decisions. The priorities for research include:

- Research exotic fish interactions with large galaxiids.
- Determine the significance of by-catch of giant kokopu from commercial eel netting to the overall population health, particularly spawning success, using tagging and/or population monitoring at heavily fished population sites.
- Determine the effect of fishing-induced changes to the eel population structure on population areas of giant kokopu.
- Evaluate the effectiveness of existing and new fish-pass designs for large galaxiid passage.
- Determine microhabitat preferences in a variety of habitat types (standing and flowing systems) of large galaxiids.
- Determine the spawning biology of large galaxiids.
- Determine juvenile rearing habitat of large galaxiid species.
- Determine the timing and identification of peak shortjaw and giant kokopu whitebait runs.
- Determine the relative vulnerability to harvest of large galaxiid whitebait.
- Determine the mechanisms and frequency of recruitment.

## 11. Review date

This plan will be reviewed after 10 years, or sooner if new information leads to proposals for a significant change in direction. The plan will remain operative until a reviewed plan is in place. The proposed review date of this recovery plan is 2013.

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# Appendix 1

## CONSERVANCIES CONTAINING LARGE GALAXIIDS

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| SPECIES                | CONSERVANCIES          |                    |
|------------------------|------------------------|--------------------|
| Shortjaw kokopu        | Northland              | Wellington         |
|                        | Auckland               | Nelson/Marlborough |
|                        | Waikato                | West Coast         |
|                        | Bay of Plenty          | Canterbury         |
|                        | East Coast/Hawke's Bay | Otago              |
|                        | Wanganui               | Southland          |
|                        | Giant kokopu           | Northland          |
| Auckland               |                        | Nelson/Marlborough |
| Waikato                |                        | West Coast         |
| Bay of Plenty          |                        | Canterbury         |
| East Coast/Hawke's Bay |                        | Otago              |
| Wanganui               |                        | Southland          |
| Banded kokopu          |                        | Northland          |
|                        | Auckland               | Nelson/Marlborough |
|                        | Waikato                | West Coast         |
|                        | Bay of Plenty          | Canterbury         |
|                        | East Coast/Hawke's Bay | Otago              |
|                        | Wanganui               | Southland          |
|                        | Koaro                  | Northland          |
| Auckland               |                        | Nelson/Marlborough |
| Waikato                |                        | West Coast         |
| Bay of Plenty          |                        | Canterbury         |
| East Coast/Hawke's Bay |                        | Otago              |
| Tongariro/Taupo        |                        | Southland          |
| Wanganui               |                        |                    |

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# Appendix 2

## LOCATIONS OF LAND-LOCKED POPULATIONS OF LARGE GALAXIIDS

(See WGNCR-34468 for latest update.)

TABLE A2.1 GIANT KOKOPU.

| SITE             | AREA OFFICE,<br>CONSERVANCY | KEY VALUE(S) | PRESENTLY<br>PROTECTED? |
|------------------|-----------------------------|--------------|-------------------------|
| Lake Monowai     | Te Anau, Southland          |              |                         |
| Lake Mistletoe   | Te Anau, Southland          |              |                         |
| Lake Luxmore     | Te Anau, Southland          |              |                         |
| Horseshoe Lagoon | Ruakapuka, Canterbury       |              |                         |
| Ota Creek        | Murihiku, Southland         |              |                         |
| Lake Haupiri     | Greymouth, West Coast       |              |                         |
| Lake Kaniere     | Hokitika, West Coast        |              |                         |
| Lake Brunner     | Greymouth, West Coast       |              |                         |

TABLE A2.2 BANDED KOKOPU.

| SITE             | AREA OFFICE,<br>CONSERVANCY       | KEY VALUE(S)  | PRESENTLY<br>PROTECTED?                   |
|------------------|-----------------------------------|---|---|
| Kaihoka Lakes    | Golden Bay,<br>Nelson/Marlborough | Exotic-fish free  | Scenic reserve                            |
| Cossey Dam       | Auckland, Auckland                |   | Water reserve catchment                   |
| Wairoa Dam       | Auckland, Auckland                |   | Water reserve catchment                   |
| Mangatawhiri Dam | Auckland, Auckland                |   | Water reserve catchment                   |
| Lake Ototoa      | Warkworth, Auckland               |   |   |
| Lake Waahi       | Waikato, Waikato                  |   |   |
| Lake Okataina    | Rotorua Lakes/Bay of Plenty       | Land-locked koaro also present.<br>Important trout fishery lake | Tributaries in scenic<br>reserve, bed UCL |

UCL = Unallocated crown land.

TABLE A2.3 KOARO.

| SITE   | AREA OFFICE,<br>CONSERVANCY              | KEY VALUE(S)  | PRESENTLY<br>PROTECTED?                        |
|--|--|---|--|
| Lake Wanaka                                  | Wanaka, Otago                            |   | Some tributary streams                         |
| Lake Wakatipu                                | Queenstown, Otago                        |   | Some tributary streams                         |
| Lake Von                                     | Queenstown, Otago                        |   |  |
| Lake Hawea                                   | Wanaka, Otago                            |   | Some tributary streams                         |
| Lake Dunstan<br>(hydro-electric storage)     | Central Otago, Otago                     | Possible negative impacts<br>on non-migratory galaxiids | Not required                                   |
| Lake Roxburgh<br>(hydro-electric storage)    | Central Otago, Otago                     |   | Not required                                   |
| Lake Mahinerangi<br>(hydro-electric storage) | Coastal Otago, Otago                     | Negative impacts on non-<br>migratory galaxiids         | Not required                                   |
| Lake Monowai                                 | Te Anau, Southland                       |   | National park                                  |
| Lake Hauroko*                                | Te Anau, Southland                       | Near pristine   | National park                                  |
| Lake Poteriteri*                             | Te Anau, Southland                       | Large scale   | National park                                  |
| Lake Te Anau                                 | Te Anau, Southland                       |   | National park                                  |
| Lake Manapouri                               | Te Anau, Southland                       |   | National park                                  |
| Fiordland Lakes<br>(unknown number)          | Te Anau, Southland                       | Possibly exotic-fish free                               | National park                                  |
| Mavora Lakes                                 | Te Anau, Southland                       |   | Some tributary streams                         |
| Lake Tekapo                                  | Twizel, Canterbury                       |   |  |
| Lake Ohau                                    | Twizel, Canterbury                       |   |  |
| Lake Pukaki                                  | Twizel, Canterbury                       |   |  |
| Lake Aviemore                                | Twizel, Canterbury                       |   |  |
| Lake Benmore                                 | Twizel, Canterbury                       |   |  |
| Lake Waitaki                                 | Twizel, Canterbury                       |   |  |
| Lake Coleridge                               | Waimakiriri, Canterbury                  |   |  |
| Ashburton Lakes                              | Ruakapuka, Canterbury                    |   |  |
| Blue Lakes                                   | Aoraki, Canterbury                       |   |  |
| Arthur's Pass Lakes*                         | Waimakariri, Canterbury                  |   |  |
| Lake Taupo                                   | Turangi Taupo, Tongariro/Taupo           |   | Some tributary streams                         |
| Lake Rotoaira                                | Turangi Taupo, Tongariro/Taupo           |   | Some tributary streams                         |
| Lake Waikareiti                              | Aniwaniwa,<br>East Coast/Hawke's Bay     | Exotic-fish free  | National park                                  |
| Lake Waikaremoana                            | Aniwaniwa,<br>East Coast/Hawke's Bay     | National park   |  |
| Cossey Dam                                   | Auckland, Auckland                       |   | Water reserve catchment                        |
| Lake Rotoroa                                 | St Arnaud,<br>Nelson/Marlborough         |   | National park                                  |
| Lake Rotoiti                                 | St Arnaud,<br>Nelson/Marlborough         |   | National park                                  |
| Lake Chalice                                 | South Marlborough,<br>Nelson/Marlborough | Exotic-fish free  | Faunistic reserve                              |
| Lake Christabel                              | Reefton, West Coast                      |   | Faunistic reserve                              |
| Lake Rotoiti                                 | Rotorua Lakes/Bay of Plenty              | Previously abundant in these lakes                      | Some tributaries in scenic<br>reserve, bed UCL |
| Lake Okareka                                 | Rotorua Lakes/Bay of Plenty              | Previously abundant in these lakes                      | Scenic reserve                                 |
| Lake Rotorua                                 | Rotorua Lakes/Bay of Plenty              | Previously abundant in these lakes                      | UCL  |
| Lake Okataina                                | Rotorua Lakes/Bay of Plenty              | Land-locked banded kokopu<br>also present               | Tributaries in scenic<br>reserve, bed UCL      |
| Lake Tarawera                                | Rotorua Lakes/Bay of Plenty              | Previously abundant in these lakes                      | 50% scenic reserve, 50% UCL                    |

\* Migratory status of koaro to be confirmed.

UCL = Unallocated crown land.

# Appendix 3

## PROPOSED LARGE GALAXIID MONITORING SITES

(See WGNCR-34480 for latest update.)

| SITE               | SUGGESTED<br>STREAM                      | SPECIES<br>TO MONITOR            | AREA OFFICE<br>OR FIELD CENTRE | CONSERVANCY         |
|--------------------|--|----------------------------------|--------------------------------|---------------------|
| West Coast 1       | Jackson Bay area                         | Shortjaw kokopu                  | Haast                          | West Coast          |
| West Coast 2       | Hunt Creek,<br>Manakiaiaua River trib.   | Shortjaw kokopu                  | Franz Josef                    | West Coast          |
| West Coast 3       | Jones Creek                              | Shortjaw kokopu                  | Hokitika                       | West Coast          |
| West Coast 4       | Omanu Creek<br>Buller River trib.        | Shortjaw kokopu                  | Westport                       | West Coast          |
| West Coast 5       | Karamea River trib.                      | Shortjaw kokopu                  | Karamea                        | West Coast          |
| Northwest Nelson 1 | Kaituna River,<br>Aorere River trib.     | Shortjaw kokopu                  | Golden Bay                     | Nelson/ Marlborough |
| Northwest Nelson 2 | Little Granity,<br>Aorere River trib.    | Shortjaw kokopu                  | Golden Bay                     | Nelson/ Marlborough |
| Able Tasman        | Torrent River                            | Shortjaw kokopu<br>Giant kokopu  | Motueka                        | Nelson/ Marlborough |
| Marlborough 1      | Ruataniwha Stream                        | Shortjaw kokopu                  | Sounds                         | Nelson/ Marlborough |
| Marlborough 2      | Chance Bay Stream                        | Shortjaw kokopu                  | Sounds                         | Nelson/ Marlborough |
| Wellington 1       | Waikawa Stream                           | Shortjaw kokopu                  | Kapiti                         | Wellington          |
| Manawatu River     | Mangatainoka River                       | Shortjaw kokopu                  | Kapiti                         | Wellington          |
| Wanganui River     | Manganuiateao River<br>or Opotiki Stream | Shortjaw kokopu                  | Turangi                        | Tongariro/Taupo     |
| Taranaki 1         | Katikara Stream (2 sites)                | Shortjaw kokopu<br>Giant kokopu? | New Plymouth                   | Wanganui            |
| Taranaki 2         | Stony River trib                         | Shortjaw kokopu                  | New Plymouth                   | Stratford           |
| Waikato 1          | Mangakara Stream,<br>Waikato River trib. | Shortjaw kokopu                  | Waikato                        | Waikato             |
| Waikato 2          | Kotanemoeroa Stream<br>(coastal)         | Shortjaw kokopu                  | Maniapoto                      | Waikato             |
| Northland 1        | Moetangi Stream                          | Shortjaw kokopu                  | Waipoua F.C.                   | Northland           |
| Northland 2        | Waiwarawara Stream                       | Shortjaw kokopu                  | Whangarei                      | Northland           |
| Coromandel 1       | Waiharakeke Stream                       | Shortjaw kokopu<br>Giant kokopu? | Hauraki                        | Waikato             |
| Bay of Plenty      | Herepuru                                 | Shortjaw kokopu                  |                                | Bay of Plenty       |
| Bay of Plenty      | Arawhatawhata                            | Shortjaw kokopu                  |                                | Bay of Plenty       |
| East Coast 1       | Stoney Creek                             | Shortjaw kokopu                  |                                | East Coast          |
| East Coast 2       | Whanarua Stream                          | Shortjaw kokopu                  |                                | East Coast          |
| East Coast 3       | Upper Motu trib.                         | Shortjaw kokopu                  |                                | East Coast          |
| Hurangi Ranges     | Pararaki Stream                          | Shortjaw kokopu<br>Giant kokopu  | Wairarapa                      | Wellington          |
| Kaikoura           | Ohau or Blue Duck<br>Streams             | Shortjaw kokopu                  | Kaikoura                       | Nelson/Marlborough  |
| Banks Peninsula    | Flea Bay Stream                          | Shortjaw kokopu                  | Akaroa F.C.                    | Canterbury          |

*Continued next page >>*

| SITE               | SUGGESTED STREAM                    | SPECIES TO MONITOR | AREA OFFICE OR FIELD CENTRE | CONSERVANCY            |
|--------------------|-------------------------------------|--------------------|-----------------------------|------------------------|
| Fiordland 1        | Port Craig area                     | Shortjaw kokopu    |                             | Southland              |
| Fiordland 2        | Dusky Sound                         | Shortjaw kokopu    |                             | Southland              |
| Fiordland 3        | Milford Sound<br>(survey first)     | Shortjaw kokopu    |                             | Southland              |
| Stewart Island     | Rakeahua River                      | Giant kokopu       | Stewart Island              | Southland              |
| Stewart Island     | Freshwater River                    | Giant kokopu       | Stewart Island              | Southland              |
| Southland 1        | Lake Luxmore                        | Giant kokopu       | Te Anau                     | Southland              |
| Southland 2        | Lake Mistletoe                      | Giant kokopu       | Te Anau                     | Southland              |
| Southland 3        | Waituna Creek                       | Giant kokopu       | Murihiku                    | Southland              |
| Southland 4        | Southern Fiordland                  | Giant kokopu       | Tuatapere F.C.              | Southland              |
| West Coast 1       | Jackson Bay area                    | Giant kokopu       | Haast                       | West Coast             |
| West Coast 2       | Makawhio River                      | Giant kokopu       | Franz Josef                 | West Coast             |
| West Coast 3       | Lake Mahinapua                      | Giant kokopu       | Hokitika                    | West Coast             |
| West Coast 4       | Bradshaws Creek                     | Giant kokopu       | Westport                    | West Coast             |
| West Coast 5       | Baker Creek                         | Giant kokopu       | Karamea                     | West Coast             |
| Northwest Nelson   | Mangarakau Swamp                    | Giant kokopu       | Golden Bay                  | Nelson/Marlborough     |
| Northwest Nelson   | Lake Otuhie                         | Giant kokopu       | Golden Bay                  | Nelson/Marlborough     |
| Golden Bay         | Dogon Creek                         | Giant kokopu       | Golden Bay                  | Nelson/Marlborough     |
| Marlborough Sounds | Nydia Bay                           | Giant kokopu       | Sounds                      | Nelson/Marlborough     |
| Wellington         | Makara Stream                       | Giant kokopu       | Poneke                      | Wellington             |
| Taranaki           | South Taranaki Coast                | Giant kokopu       | Stratford                   | Wanganui               |
| Taranaki           | Tarata                              | Giant kokopu       | New Plymouth                | Wanganui               |
| Taranaki           | Mokau River                         | Giant kokopu       | New Plymouth                | Wanganui               |
| Waikato 1          | Waikato River trib.                 | Giant kokopu       | Waikato                     | Waikato                |
| Waikato 2          | Waikato River trib.                 | Giant kokopu       | Waikato                     | Waikato                |
| Auckland           | Nukamea Stream                      | Giant kokopu       | Warkworth                   | Auckland               |
| Coromandel         | Pepe Stream                         | Giant kokopu       | Hauraki                     | Waikato                |
| Bay of Plenty      | Herepuru Stream                     | Giant kokopu       | Tauranga                    | Bay of Plenty          |
| Bay of Plenty      | Ngakuroa                            | Giant kokopu       |                             | Bay of Plenty          |
| East Cape          | Waitawake Stream                    | Giant kokopu       | Te Araroa F.C.              | East Coast/Hawke's Bay |
| East Cape          | Karakatawhero River trib.           | Giant kokopu       | Te Araroa F.C.              | East Coast/Hawke's Bay |
| Hurangi Ranges     | Oterei River                        | Giant kokopu       | Wairarapa                   | Wellington             |
| Wellington         | Gollans Stream/<br>Lake Kohangatera | Giant kokopu       | Poneke                      | Wellington             |
| Kaikoura           | Kowhai River                        | Giant kokopu       | Kaikoura                    | Nelson/Marlborough     |
| South Canterbury   | Horseshoe Lagoon                    | Giant kokopu       | Ruakapaku                   | Canterbury             |
| Otago 1            | Trotters Creek                      | Giant kokopu       | Coastal Otago               | Otago                  |
| Otago 2            | Orokonui Creek                      | Giant kokopu       | Coastal Otago               | Otago                  |
| Otago 3            | Lake Waiholo trib.                  | Giant kokopu       | Coastal Otago               | Otago                  |
| Otago 4            | Catlins River                       | Giant kokopu       | Owaka F.C.                  | Otago                  |