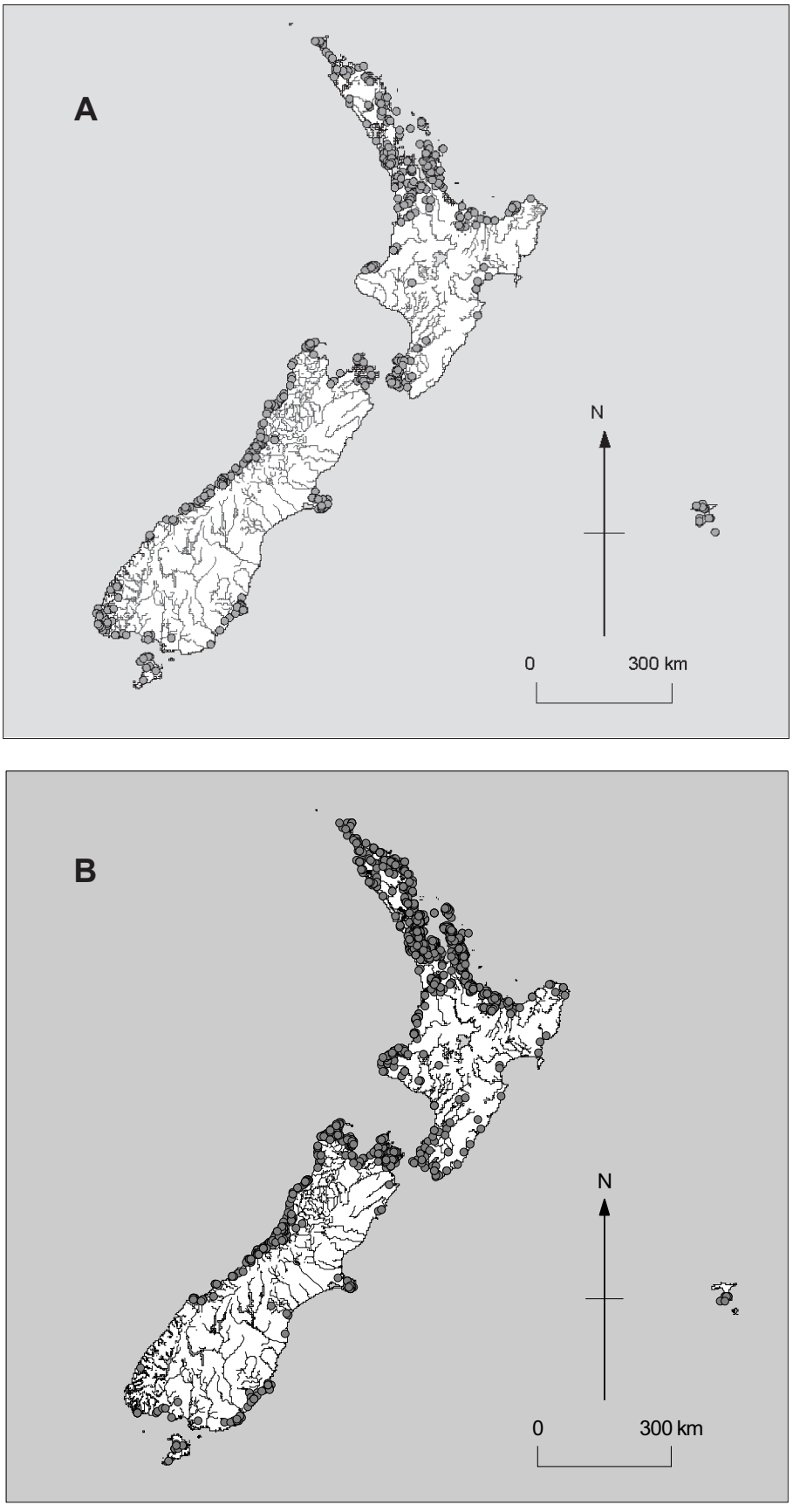

Figure 3. Banded kokopu records in New Zealand: **A.** Prior to 1991; **B**. From 1991 to the present.

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

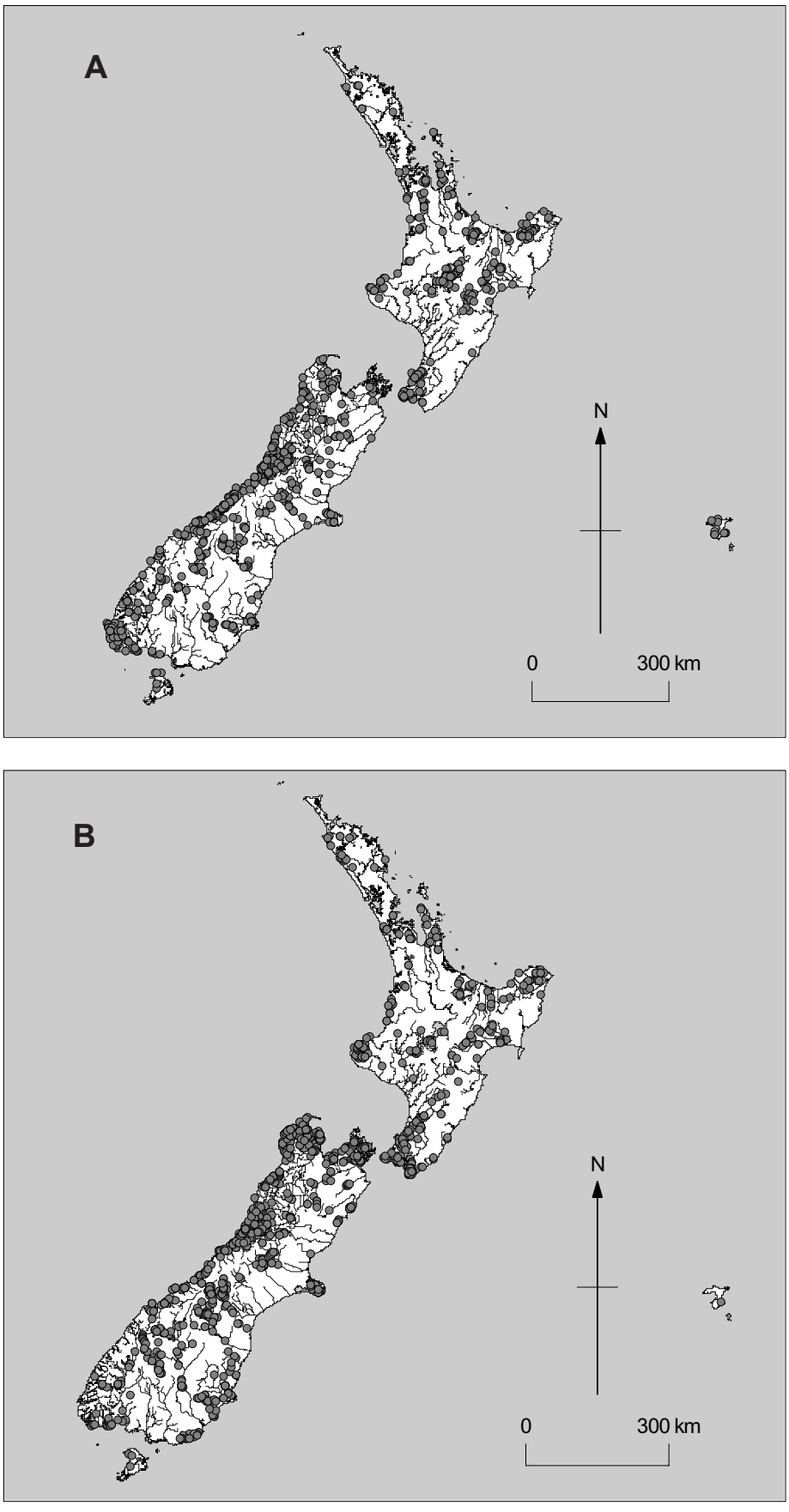

Figure 4. Koaro records in New Zealand: **A.** Prior to 1991; **B.** From 1991 to the present.

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[1]), level II (maintaining genetic diversity within the species[2]) 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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1 This category captures work associated with identifying agents of decline in some instances.

2 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 (Dogan/Gorge Creeks); establishment of giant kokopu in Whatariki 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 ³ 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

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

Appendix 2

LOCATIONS OF LAND-LOCKED POPULATIONS OF LARGE GALAXIIDS

(See WGNCR-34468 for latest update.)

TABLE A2.1 GIANT KOKOPU.

SITE	AREA OFFICE, CONSERVANCY	KEY VALUE(S)	PRESENTLY 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, CONSERVANCY	KEY VALUE(S)	PRESENTLY PROTECTED?
Kaihoka Lakes	Golden Bay, 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. Important trout fishery lake	Tributaries in scenic reserve, bed UCL

UCL = Unallocated crown land.

TABLE A2.3 KOARO.

SITE	AREA OFFICE, CONSERVANCY	KEY VALUE(S)	PRESENTLY 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 (hydro-electric storage)	Central Otago, Otago	Possible negative impacts on non-migratory galaxiids	Not required
Lake Roxburgh (hydro-electric storage)	Central Otago, Otago		Not required
Lake Mahinerangi (hydro-electric storage)	Coastal Otago, Otago	Negative impacts on non-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 (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, East Coast/Hawke's Bay	Exotic-fish free	National park
Lake Waikaremoana	Aniwaniwa, East Coast/Hawke's Bay	National park	
Cossey Dam	Auckland, Auckland		Water reserve catchment
Lake Rotoroa	St Arnaud, Nelson/Marlborough		National park
Lake Rotoiti	St Arnaud, Nelson/Marlborough		National park
Lake Chalice	South Marlborough, 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 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 also present	Tributaries in scenic 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 STREAM	SPECIES TO MONITOR	AREA OFFICE OR FIELD CENTRE	CONSERVANCY
West Coast 1	Jackson Bay area	Shortjaw kokopu	Haast	West Coast
West Coast 2	Hunt Creek, Manakaiaua River trib.	Shortjaw kokopu	Franz Josef	West Coast
West Coast 3	Jones Creek	Shortjaw kokopu	Hokitika	West Coast
West Coast 4	Omanu Creek Buller River trib.	Shortjaw kokopu	Westport	West Coast
West Coast 5	Karamea River trib.	Shortjaw kokopu	Karamea	West Coast
Northwest Nelson 1	Kaituna River, Aorere River trib.	Shortjaw kokopu	Golden Bay	Nelson/ Marlborough
Northwest Nelson 2	Little Granity, Aorere River trib.	Shortjaw kokopu	Golden Bay	Nelson/ Marlborough
Able Tasman	Torrent River	Shortjaw kokopu 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 or Opotiki Stream	Shortjaw kokopu	Turangi	Tongariro/Taupo
Taranaki 1	Katikara Stream (2 sites)	Shortjaw kokopu Giant kokopu?	New Plymouth	Wanganui
Taranaki 2	Stony River trib	Shortjaw kokopu	New Plymouth	Stratford
Waikato 1	Mangakara Stream, Waikato River trib.	Shortjaw kokopu	Waikato	Waikato
Waikato 2	Kotanemoeroa Stream (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 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 Giant kokopu	Wairarapa	Wellington
Kaikoura	Ohau or Blue Duck Streams	Shortjaw kokopu	Kaikoura	Nelson/Marlborough
Banks Peninsula	Flea Bay Stream	Shortjaw kokopu	Akaroa F.C.	Canterbury

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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 (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/ 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 Waihola trib.	Giant kokopu	Coastal Otago	Otago
Otago 4	Catlins River	Giant kokopu	Owaka F.C.	Otago