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 July 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 non-migratory galaxiids, and with an interest in their conservation has been established. The purpose of the non-migratory 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 non-migratory galaxiids are welcome and should be directed to the recovery group via any office of the Department or to the Biodiversity Recovery Unit.

Published Recovery Plans

NO.	SPECIES	YEAR APPROVED
52	Grassy plants of fertile sites	2004
51	Mudfish (*Neochanna* spp.)	2003
50	Kiwi (*Apteryx* sp.)	2003
49	*Powelliphanta* land snails	2003
48	North Island *Oligosoma* spp. skink	2002
47	Tuatara	2001
46	Chatham Island fantail, Chatham Island tomtit and Chatham Island warbler	2001
45	Forbes' parakeet and Chatham Island red-crowned parakeet	2001
44	New Zealand shore plover	2001
43	Chatham Island shag and Pitt Island shag	2001
42	Chatham Island mollymawk, northern royal albatross, Pacific mollymawk	2001
41	Chatham Island tui	2001
40	Black robin	2001
39	Parea	2001
38	Chatham Island oystercatcher	2001
37	Chatham petrel	2001
36	Chatham Island taiko	2001
35	Hoiho	2001
34	Pygmy button daisy	2001
33	*Hebe cupressoides*	2000
32*	Inland *Lepidium*	2000
31	*Muehlenbeckia astonii*	2000
30	North Island kokako	1999
29*	Weka	1999
28*	*Pittosporum patulum*	1999
27	*Cyclodina* skinks	1999
26	Coastal cresses	1999
25	Threatened weta	1998
24	Striped skink	1998
23*	Fairy tern	1997
22*	Blue duck	1997
21	Kakapo	1996
20	Stitchbird	1996
19*	Brown teal	1996
18*	Native frogs	1996
17*	New Zealand (Hooker's) sea lion	1995
16*	*Dactylanthus taylorii*	1995
15*	Bat (peka peka)	1995
14	Otago and grand skinks	1995
13*	Giant land snail	1995
12*	Takahe	1994
11*	South Island saddleback	1994
10*	New Zealand dotterel	1993
9*	Tuatara	1993
8*	Kowhai ngutukaka	1993
7*	Subantarctic teal	1993
6*	Mohua (yellowhead)	1993
5	Chevron skink	1993
4	Black stilt	1993
3*	Whitaker's and robust skinks	1992
2	Kiwi	1991
1*	North Island kokako	1991
—*	Yellow-eyed penguin	1991

*Out of print.
In-print issues are available free of charge from DOC Science Publishing, Science & Research Unit, PO Box 10-420, Wellington.
All recovery plans from No.25 (1998 and later) are available on the DOC website www.doc.govt.nz > Publications > Science and Research > Biodiversity Recovery Unit

New Zealand non-migratory galaxiid fishes recovery plan

2003–13

THREATENED SPECIES RECOVERY PLAN 53

Published by
Department of Conservation
PO Box 10-420
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Prepared by Richard Allibone and Rhys Barrier for Biodiversity Recovery Unit, Department of Conservation, Wellington

Cover: Clockwise, from top left: dwarf galaxias (photo: Tony Eldon); flathead galaxias (photo: Richard Allibone); dune lakes galaxias (photo: Michael Pingram); dusky galaxias (photo: Richard Allibone); bignose galaxias (photo: Simon Elkington); upland longjaw galaxias (photo: Simon Elkington).

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CONTENTS

Abstract

Non-migratory galaxiid fishes (*Galaxias* spp.) occur throughout New Zealand, although individual species generally have very restricted distributions. Species have been declining in both the number of populations and abundance due to a variety of causes such as changes in land use, impact of introduced species and water abstraction. Recovery actions are addressed for the following endemic non-migratory galaxias: flathead galaxias (*Galaxias depressiceps*), dusky galaxias (*Galaxias pullus*), Eldon's galaxias (*Galaxias eldoni*), roundhead galaxias (*Galaxias anomalus*), Gollum galaxias (*Galaxias gollumoides*), dwarf galaxias (*Galaxias divergens*), bignose galaxias (*Galaxias macronasus*), upland longjaw galaxias (*Galaxias prognathus*), lowland longjaw galaxias (*Galaxias cobitinis*), *Galaxias* sp. D (or Pool Burn galaxias), Teviot galaxias, southern flathead galaxias, northern galaxias, dwarf inanga (*Galaxias gracilis*), and dune lakes galaxias (*Galaxias* sp.). The actions in this plan focus on designating and protecting key populations for each galaxiid. Further actions include advocacy tasks to increase both iwi and general public awareness, participation in recovery work and research to determine critical biological aspects required for recovery.

1. Introduction

This recovery plan addresses issues for nine recognised species of endemic non-migratory galaxiid fishes: flathead galaxias (*Galaxias depressiceps*), dusky galaxias (*Galaxias pullus*), Eldon's galaxias (*Galaxias eldoni*), roundhead galaxias (*Galaxias anomalus*), Gollum galaxias (*Galaxias gollumoides*), dwarf galaxias (*Galaxias divergens*), bignose galaxias (*Galaxias macronasus*), upland longjaw galaxias (*Galaxias prognathus*), and lowland longjaw galaxias (*Galaxias cobitinis*); and a further six taxa of uncertain species status: *Galaxias* sp. D (or Pool Burn galaxias), Teviot galaxias, southern flathead galaxias, northern galaxias, dwarf inanga (*Galaxias gracilis*), and dune lakes galaxias (*Galaxias* sp.). All species or taxa recognised in this plan are either nationally threatened or Data Poor. This plan does not include the Canterbury galaxias (*Galaxias vulgaris*) or the alpine galaxias (*Galaxias paucispondylus*), as these species are not currently considered to be nationally threatened or data poor, despite some populations being under threat.

The species included in this plan have disparate distributions; some are local and restricted, and others are widespread and can be found throughout much of New Zealand, including Stewart Island. Many of these species occur in geographically distinct ranges, although distribution overlap occurs in Southland and Canterbury. Further taxonomic work is required to determine the status of some non-migratory galaxiid populations, namely *Galaxias* sp. D, Teviot galaxias, southern flathead galaxias, northern galaxias, dwarf inanga and dune lakes galaxias. In light of this, regular review and updating of this recovery plan is expected.

The fish species addressed in this plan may also be considered as 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). They are regarded by Iwi as an integral component of the freshwater food web, a component that must be conserved and sustainably managed.

The Department of Conservation's new 'threat of extinction' ranking system does not assign management priorities to species but, instead, focuses entirely on the level of 'threat of extinction' a taxa faces (Molloy et al. 2002). Using this classification system (Hitchmough 2002), the lowland longjaw galaxias is ranked as Nationally Critical with the Extreme Fluctuations qualifier. It should be noted that populations of lowland longjaw galaxias in Coastal Otago and Twizel Areas are genetically distinct (Jon Waters pers. comm.). *Galaxias* sp. D is ranked as Nationally Vulnerable with the Data Poor qualifier. Dune lakes galaxias and dwarf inanga are ranked as in Serious Decline, with dwarf inanga also having the Conservation Dependent qualifier. Roundhead, flathead, dwarf, Eldon's and dusky galaxias are all ranked as in Gradual Decline; roundhead with the Extreme Fluctuation qualifier, and Eldon's and dusky as Conservation Dependent. Upland longjaw galaxias is ranked as Sparse with the Data Poor qualifier. Gollum galaxias is ranked as Not Threatened with the Data Poor qualifier. The remaining species and possible species assemblages covered in this plan are classified as Data Deficient and are currently unable to be ranked.

The intention of this recovery plan is to provide strategic guidance to Department of Conservation freshwater fish conservation management in order to achieve greater coordination nationally and to ensure the highest priority recovery work is undertaken. This recovery plan is intended to be used alongside Conservancy Conservation Management Strategies to assist in Conservancy and Area business planning. This plan sets out the recovery programme for non-migratory galaxiid species for the next 10 years (2003–13). It has been produced in tandem with a large galaxiid recovery plan, and mudfish recovery plan (Department of Conservation 2003a), which aim to guide 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 (Department of Conservation 2003b), and will be linked to the strategic action plan for freshwater (FreshSAP) which is currently being prepared.

2. Past and present distribution and population size

A new species of longjaw galaxias (*Galaxias cobitinis*, lowland longjaw galaxias; McDowall & Waters 2002) has an extremely limited distribution, occurring in 14 km of Kauru and Kakanui Rivers and at six sites in the Waitaki River catchment. In June 2001 the population size in the Kauru River was estimated to be less than 250 mature individuals. Subsequent survey work has

shown that this population undergoes extreme fluctuations in size as river condition varies. The populations in the Waitaki catchment are all thought to be small and to contain few individuals.

The newly recognised bignose galaxias from the upper Waitaki is presently known from only 12 wetland streams. These sites are widely separated and indicate that the range of this species may once have encompassed the whole of the Mackenzie Basin.

Roundhead galaxias occur only in the Taieri River system and the Manuherikia River. This species is locally common but has undergone some range reduction. Fragmentation of populations has occurred as a result of water abstraction and brown trout (*Salmo trutta*) invasion (Townsend 1996). The Kye Burn and its tributaries contain the largest roundhead galaxias population currently known. Populations have also been recorded in 12 other streams. Historically, roundheads would have been common in low-gradient streams throughout the Maniototo and Manuherikia areas of Otago.

Eldon's galaxias are confined to eastern Otago, primarily in the lower tributaries of the Taieri River (Lees Stream, Sutton Stream, Traquair Burn, Whare Creek, Deep Stream); also a few tributaries of the Waipori River near Lake Mahinerangi, and two tributaries of the Tokomairiro River. Six of the 15 known populations are small and very vulnerable to extinction. The largest population exists in the Deep Stream catchment (a Taieri River tributary); much of this catchment forms a water reserve for Dunedin City and is protected from development. This species' past distribution is likely to have been small and restricted to the area that populations are presently found. This species occurs from around 160 to 1100 m a.s.l. Although it is known only from a restricted area, it remains locally common, but its range has been reduced by the spread of brown trout (Townsend 1996; Allibone 1997; McDowall 2000).

Dusky galaxias are confined to eastern Otago, primarily in the Waipori River (tributary of Taieri River), from just below Mahinerangi Dam upstream to the upper headwaters; and in upper tributaries of the Tuapeka and Waitahuna Rivers and one tributary of the upper Taieri River (Allibone & McDowall 1997; Allibone 1999; DOC unpubl. data). Distribution surveys are incomplete but, at present, only 19 populations are known. The largest populations exist in the upper Waipori River and a series of Waipori River tributaries draining the Lammerlaw Ranges. The present-day range of this species is thought to have contracted in the Clutha catchment, while the Waipori distribution is similar to its historic range but considerably fragmented. The presence or absence of this species is generally controlled by predatory and competing fish species such as brown trout, brook char (*Salvelinus fontinalis*) and koaro (*Galaxias brevipinnis*) (McDowall & Allibone 1994; Allibone & McDowall 1997; Allibone 1999).

Flathead galaxias occur in Central and Eastern Otago, in tributaries of the Taieri, Shag and Waikouaiti Rivers and Akatore Creek. A total of 17 populations are known. This species occurs at elevations of 20–1100 m a.s.l. and is present in plantation forest and tussock catchments (Allibone 1997). The largest area occupied by flathead galaxias is the upper Taieri River and its tributaries from its source to Canadian Flat. Other large populations exist in Linn Burn, Nenthorn Stream and Three O'Clock Stream (all Taieri River tributaries). The present distribution of flathead galaxias is similar to its historic range. While

widespread in this region and locally common, populations have been fragmented as the flathead galaxias has been displaced by brown trout (McIntosh et al. 1994; Townsend 1996).

Upland longjaw galaxias occur in the upper reaches of five Canterbury rivers (the Waitaki, Rakaia, Ashburton, Hurunui and Rangitata) and the upper reaches of the Maruia River. This fish is very cryptic and irregularly recorded. Consequently, current population trends of upland longjaw galaxias are unknown, although it has not been recorded in the Maruia and Hurunui Rivers since 1974.

Gollum galaxias occur on Stewart Island (McDowall & Chadderton 1999), across Southland and the Catlins District, and in some tributaries of the Clutha River (Waters et al. 2001b). This species is locally common, but appears to have a fragmented distribution as a result of trout interactions and the impacts of farming development. The historic range and current population abundance of Gollum galaxias are unknown.

The dwarf galaxias is the most widespread non-migratory galaxiid, occurring on the West Coast, in Nelson/Marlborough, Wellington, Manawatu, Hawke's Bay, Bay of Plenty and Waikato. This geographic range encompasses the historic range of the species, but population fragmentation within this range appears to be occurring, probably due to the impacts of habitat alteration and introduced fish (Hopkins 1970). Most populations are known from single site records and the sizes of populations in all catchments are unknown.

Dwarf inanga/dune lakes galaxias are small-bodied lake-dwelling galaxiids restricted to two groups of lakes on North Kaipara Head in Northland. In addition, one translocated population occurs in Lake Otatoa in the Auckland Region. Gleeson et al. (1999) carried out a genetic analysis of fish from the two lakes. This study indicated that the two groups of lakes contained genetically distinct galaxiid populations and recommended treating these as distinct units (Gleeson et al. 1999). However, there is now some debate as to whether one or two species are present (Ling et al. 2001). This recovery plan treats these fish as two separate species: dwarf inanga (*Galaxias gracilis*) in eight Poutu lakes (including Lake Rototuna) and Lake Ototoa (a translocated population on South Kaipara Head); and dune lakes galaxias (*Galaxias* sp.) in three Kai Iwi lakes. The fish populations in most of these lakes have undergone significant declines.

A number of other non-migratory species have yet to be taxonomically classified. These new species include *Galaxias* sp. D, Teviot galaxias, southern flathead galaxias, and northern galaxias. The distributions of these galaxiids range from very restricted to widespread in areas of the South Island.

3. Cause of decline and threats

Dune lakes galaxias and dwarf inanga declines have been attributed to the introduction of exotic fish species, changes to water quality, the impacts of invasive macrophytes and the introduction of eels (Rowe & Chisnall 1997). The causes of decline appear to vary among the lakes and the inter-relationships among various deleterious impacts are not understood.

The stream-dwelling galaxiids in the South Island, such as flathead galaxias, dusky galaxias, Eldon's galaxias, Gollum galaxias, dwarf galaxias and roundhead galaxias, have all undergone range reduction and population fragmentation following salmonid introductions (Townsend 1996; Allibone & McDowall 1997; Allibone 1999; McDowall 2000). Brown trout is the most commonly implicated species, but brook char and, occasionally, rainbow trout (*Oncorhynchus mykiss*) are also implicated. Many galaxiid populations exist today in areas inaccessible to salmonids. These areas are protected by barriers such as waterfalls, which prevent upstream movement by salmonids. It is expected that the occasional failure of these barriers will allow salmonids to continue to expand their ranges and that there will be a corresponding decline in galaxiid distributions. The deliberate introduction of salmonids into new areas is also a potential threat to galaxiid populations, but the magnitude and probability of this threat is unknown.

Water abstraction in the Otago region has also been found to impact on populations of flathead galaxias (Allibone 2000), and similar impacts are likely for roundhead galaxias, *Galaxias* sp. D, Eldon's galaxias, dusky galaxias and lowland longjaw galaxias. Water abstraction can directly reduce the available habitat for fish. Other serious impacts associated with water abstraction are the passage of fish to new areas via water races that transfer water from one stream to another. Fish passage via this mechanism has been shown to cause the loss of galaxiids when salmonids and koaro have gained access to previously inaccessible waterways (McDowall & Allibone 1994). Contact between previously isolated galaxiids has also occurred leading to hybridisation between species (Esa et al. 2000).

Another major concern at present is the increasing frequency and severity of droughts in the South Island and the east coast of the North Island. Many non-migratory galaxiid populations are found in small streams in these regions and are therefore vulnerable to local extinction in dry periods. Water abstraction demands are also likely to increase in the future, increasing the risk of low flows impacting upon populations.

In addition, populations of dusky, dwarf and Eldon's galaxias are found in production forestry areas and are subject to the effects of reduced water flow in these areas as the trees grow and impacts associated with logging.

The loss or degradation of suitable habitat through the impacts of farming, particularly of stock, on in-stream habitat, and poor riparian margin management, may cause declines in abundance as well as range contraction. A number of non-migratory galaxiid species have limited geographic ranges and less than 20 known populations. Such restricted ranges increase the species' vulnerability to widespread impacts, such as drought.

4. Species ecology and biology

All species in this recovery plan are non-migratory and all but two are stream residents; dwarf inanga and dune lakes galaxias are lake residents. A number of the species have received little, if any, biological investigation; however, the data available does indicate some common biological characteristics.

Spawning generally occurs in late winter and spring for the stream-dwelling species (Hopkins 1971; Allibone & McDowall 1997; Allibone & Townsend 1997a). However, upland longjaw galaxias are thought to have two spawning periods; one in spring and a second in late summer (Bonnett 1992). Known spawning habitat varies among species and includes nesting amongst the substrate and roots and leaves of overhanging riparian vegetation (Allibone & Townsend 1997a). The spawning time of dwarf inanga and dune lakes galaxias varies among lakes and occurs in an unknown habitat in spring and summer (Rowe et al. 1999).

Diet varies for each species based on habitat type, which also influences food availability. Like most galaxiids, non-migratory species are generalists, taking advantage of the most common types of palatable aquatic insects (Bonnett et al. 1989; Glova et al. 1992; Allibone & Townsend 1998). The diet generally consists of mayflies, free-living caddisflies and chironomid larvae. Hard-bodied items such as snails and cased caddisflies are generally avoided. Diet preferences of species such as Gollum galaxias and bignose galaxias have not been studied.

Habitat use among the various galaxiids varies between the lake- and stream-dwelling species. Among the stream dwellers there are considerable differences in the streams occupied. Roundhead galaxias and southern flatheads appear to occupy low-gradient streams with dominantly gravel and cobble substrates (Allibone & Townsend 1997b). Other species, such as flathead galaxias, Eldon's galaxias and dusky galaxias occupy a broad range of low- to high-gradient streams with stable beds often dominated by boulder and bedrock substrates (Allibone & Townsend 1997b). Observations indicate that many of these species have very flexible habitat usage and, in the absence of other fish species, will occupy all instream habitats. Both the longjaw galaxiids appear to prefer braided river beds and reside amongst cobbles and gravel in very shallow riffle areas (McDowall 1990; McDowall & Waters 2002).

5. Past conservation efforts

It is only within the last decade that many of these species have been described, and most were formerly considered to be Canterbury galaxias, a species that was not considered threatened (e.g. McDowall 1990). Other species in remote areas have only just been documented due to a lack of historical survey work. Most work to date has included taxonomic and distribution analyses, followed

by species descriptions (Allibone et al. 1996; McDowall & Wallis 1996; McDowall 1997; Wallis et al. 2001; Waters & Wallis 2001; Waters et al. 2001a & 2001b; McDowall & Waters 2003). Such work needs to continue in order to determine the status of some of the other non-migratory galaxiids.

Otago Conservancy staff have also been involved in specific advocacy for non-migratory galaxiids during Resource Management Act processes, particularly in relation to impacts of water takes and landuse practices on the more range-restricted species. Two years of biodiversity funding has been used to determine the distribution of non-migratory galaxiids in relation to water abstraction within Otago. The Crown Lands Tenure Review programme for leasehold properties in Southland, Otago and Canterbury has included native fish surveys. Through this process, some streams and catchments have been incorporated into the conservation estate, thus protecting populations of flathead, Eldon's, dusky, and Gollum galaxias, and *Galaxias* sp. D. In order to develop an understanding of population structures and processes, monitoring programmes for Eldon's and dusky galaxias are ongoing in Otago. Two invasive fish removal projects have also been undertaken in conjunction with Fish & Game Otago in the Waipori River catchment to remove koaro and brown trout from dusky and Eldon's galaxias streams, respectively. These operations are ongoing and, as yet, it is not known if they have been successful and galaxiid recovery has occurred.

6. Recovery goals

6.1 LONG-TERM GOAL

The long-term recovery goal is to return non-migratory galaxiid species and assemblages to fully functional components of freshwater ecosystems, secure from human-induced threat of decline, in ranges, densities and associations that approximate their pre-European conditions.

6.2 TEN-YEAR GOAL

The ten-year goal is for the current geographic range, habitat and genetic diversity of all non-migratory galaxiid species to be maintained and improved within New Zealand.

7. Options for recovery

7.1 OPTION 1—NO ACTION

This would involve relying on existing protected areas to protect populations of non-migratory galaxiids. This option is not recommended, as the majority of populations occur outside of protected areas.

7.2 OPTION 2—UNDERTAKE NATIONAL PRIORITY WORK

Undertake national priority work using threatened fish recovery plans as a tool for co-ordination of 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 Freshwater Strategic Action Plan, which is still being prepared, and the Department's Statement of Intent 2003–06 (Department of Conservation 2003).

8. Objectives for the term of the plan

8.1 ECOSYSTEM OBJECTIVES

Objective 1: Identify, protect and manage a minimum of 30 habitats with key[1] non-migratory galaxiid populations, for each species.

Objective 2: Seek to identify, protect, manage, or advocate sustainable site management for all non-migratory galaxiid habitat.

8.2 IWI OBJECTIVE

Objective 3: Give effect to DOC's responsibilities under Section 4 of the Treaty of Waitangi by seeking to involve Iwi in the implementation of this recovery plan.

8.3 SPECIES OBJECTIVES

Objective 4: Clarify taxonomic issues associated with non-migratory galaxiids.

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[1] See Appendix 1 for key site criteria.

Objective 5: Determine the conservation status of non-migratory galaxiids.

Objective 6: Determine threats and impacts to non-migratory galaxiids.

Objective 7: Undertake research required for the restoration and management of non-migratory galaxiids.

Objective 8: Manage and recover non-migratory galaxiids.

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[2]), level II (maintaining genetic diversity within the species[3]) and level III (increasing security further) ranking outlined in DOC national policy work on Natural Heritage Concepts and Principles (Department of Conservation 2001, section 3.1.6). A work plan summary detailing all actions required by conservancies with respect to non-migratory galaxiids has been developed (Department of Conservation n.d. c, see reference list, Section 11).

9.1 ECOSYSTEM OBJECTIVES

Objective 1: Identify, protect and manage a minimum of 30 habitats with key non-migratory galaxiid populations, for each species.

Performance measure

By 2006, threats are identified and protective measures initiated for 30 water bodies containing key populations of each threatened non-migratory galaxiid species. This is done through tenure review, district plan or resource consent hearings, physical restoration and protection activities or non-statutory initiatives such as covenanting.

Explanation

Forestry operations, farming impacts such as poor riparian management, and water abstraction are key issues affecting most non-migratory galaxiid species. More co-ordinated action to address these threats is required for nationally threatened species, particularly those with highly restricted geographic ranges. Legal protection of habitat applied in tandem with minimum water flows set statutorily through the Resource Management Act (RMA) are the most effective

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2 This category captures work associated with identifying agents of decline in some instances.

3 Defined as preventing major range contraction or the extinction of genetically distinct local populations.

methods for addressing these threats. To date, advocacy under the RMA has been the main approach used. However, a more targeted effort using other initiatives such as purchase or covenanting of land is also required for identified key non-migratory population sites. Other options include more targeted advocacy through guiding documents such as the draft multi-species recovery plan for Canterbury's braided rivers.

Action 1.1

Identify a minimum of 30 key non-migratory galaxiid sites for each species by June 2005.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Freshwater Technical Support Officers and Programme Managers for those Conservancies and Areas (as listed in Appendix 2) containing the above species.

Action 1.2

Throughout the life of this plan, prevent invasion of non-migratory galaxiid habitat by fish species not historically present within the site by assessing barriers (for methods, see Department of Conservation n.d. a, reference list), and maintaining and improving poor barriers. Inform landowners of the barriers and their value, and seek agreement from landowners to protect the barriers. Request landowners not to transfer fish above barriers or allow other people to do so.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Freshwater Technical Support Officers, Programme Managers and Community Relations Officers for those Conservancies and Areas (as listed in Appendix 2) containing the above species.

Action 1.3

For the life of this plan, seek to obtain and increase protection for key non-migratory sites on private land by gaining protection levels given in Appendix 3. Annually report gains in protection achieved and sites at which this is achieved.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's

galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Freshwater Technical Support Officers and Programme Managers for those Conservancies and Areas (see Appendix 2) containing the above species.

Action 1.4

Manage key non-migratory galaxiid sites for non-migratory habitat, including RMA actions to protect water quality. Annually report management actions (see Appendix 4) taken, and at which sites these were taken.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Freshwater Technical Support Officers and Programme Managers for those Conservancies and Areas (see Appendix 2) containing the above species.

Action 1.5

Undertake annual identification and and review of key site list from June 2006.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Recovery Group

Action 1.6

List key non-migratory galaxiid sites (from Action 1.1) in Protected Natural Area (PNA) reports, Recommended Areas for Protection (RAP) lists, or as addenda to existing reports, where possible. Put a key site list in Conservancy Management Strategies and provide these to local authorities, Iwi, and Fish and Game Councils by 2006.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Freshwater Technical Support Officers for those Conservancies and Areas (see Appendix 2) containing the above species.

Action 1.7

Liaise annually with landowners of key non-migratory sites and keep a record of discussions, where appropriate.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Programme Managers for Areas with key sites.

Objective 2: Seek to identify, protect, manage, or advocate sustainable site management for all non-migratory galaxiid habitat.

Performance measure

Protective measures (given in Appendix 3) achieved for all non-migratory galaxiid habitat through plan and resource consent hearings, physical restoration and protection activities or other non-statutory initiatives by 2013.

Explanation

There is a lack of awareness by local authorities and the public regarding the state of New Zealand fish species. Many areas of non-migratory galaxiid habitat are located within private land, potentially subject to future development. As well as targeted initiatives for key non-migratory galaxiid sites (Objective 1), it is important that more general public awareness and advocacy for all non-migratory galaxiid habitat continues. In the case of planning advocacy, it is vitally important that liaison with DOC Area staff occurs and, where necessary, a consultative working group process is initiated to ensure advocacy work with landowners initiated by Area staff is not jeopardised.

Action 2.1

Throughout the life of the recovery plan, advocate protection of non-migratory galaxiids through Regional and District Plans.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Freshwater Technical Support Officers and Community Relations Officers for those Conservancies and Areas (see Appendix 2) containing the above species.

Action 2.2

Throughout the life of the recovery plan, DOC staff work with local communities and stakeholders (using management actions such as those given in Appendix 4) to protect non-migratory galaxiid habitat.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Freshwater Technical Support Officers, Programme Managers and Community Relations Officers for those Conservancies and Areas (see Appendix 2) containing the above species.

Action 2.3

As the opportunity arises, nominate private landowners of non-migratory galaxiid sites who demonstrate environment-friendly land management practices for rural environment awards.

Priority: HIGH (all species).

Responsibility: Programme Managers and Community Relations Officers for those Areas containing non-migratory galaxiid species (see Appendix 2).

Action 2.4

By June 2006, develop a community relations campaign addressing the importance of non-migratory galaxiids for all South Island Conservancies, and those North Island Conservancies with dwarf galaxias. The community relations plan is to include objectives and the time frames in which the objectives are to be achieved.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: DOC Northern Regional Office; Recovery Group.

Action 2.5

By 2013, develop methods such as the creation of habitats suitable for spawning, juvenile rearing, and for adults of non-migratory galaxiids in artificial

waterways, and utilise or develop management practices such as weed clearance and silt removal to maximise the potential for non-migratory galaxiids to inhabit waterways.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: DOC Science & Research; Northern Regional Office; Recovery Group.

Action 2.6

Throughout the life of the plan, prevent invasion of non-migratory galaxiid habitat by fish species not historically present within site.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Freshwater Technical Support Officers and Programme Managers for those Conservancy Areas (see Appendix 2) containing the above species.

Action 2.7

Throughout the life of the recovery plan, maintain a list of fish-free streams and lakes as potential translocation sites.

Priority: ESSENTIAL (lowland longjaw galaxias, bignose galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias, dwarf inanga, dune lakes galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Freshwater Technical Support Officers and Programme Managers for those Conservancies and Areas (see Appendix 2) containing the above species.

Action 2.8

Review success or otherwise, by June 2005, of tenure review for protection of non-migratory galaxiid species habitat.

Priority: HIGH (lowland longjaw galaxias, bignose galaxias, roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, upland longjaw galaxias, northern galaxias).

MEDIUM (dwarf and Gollum galaxias).

Responsibility: Recovery Group and Freshwater Technical Support Officers for those Conservancies and Areas (see Appendix 2) containing the above species.

9.2 IWI OBJECTIVE

Objective 3: Give effect to DOC's treaty of Waitangi responsibilities through seeking to involve Iwi in the implementation of this recovery plan.

Performance measure

Copies of the Non-migratory Galaxiid Recovery Group leader's annual report to be sent to all DOC Kaupapa Atawhai Managers and Ngai Tahu.

Explanation

There is a high level of interest from Iwi in freshwater fish and DOC has existing obligations to involve tangata whenua in its freshwater fish work.

Action 3.1

Consult with tangata whenua through mutually agreed means on a project by project basis.

Priority: HIGH (all species).

Responsibility: Programme Managers and Technical Support Officers (Kaupapa Atawhai Managers to assist) for those Conservancies and Areas containing non-migratory galaxiid species (see Appendix 2).

Action 3.2

Report regularly (at least annually) through mutually agreed means to tangata whenua.

Priority: HIGH (all species).

Responsibility: Recovery Group leader, Programme Managers and Technical Support Officers (Kaupapa Atawhai Managers to assist) for those Conservancies and Areas containing non-migratory galaxiid species (see Appendix 2).

Action 3.3

Explore options with tangata whenua for habitat protection and restoration to extend available non-migratory galaxiid habitat. Relevant tangata whenua to be notified of all translocation events, fish removal operations and new barrier construction projects.

Priority: HIGH (all species).

Responsibility: Programme Managers and Technical Support Officers (Kaupapa Atawhai Managers to assist) for those Conservancies and Areas containing non-migratory galaxiid species (see Appendix 2).

Action 3.4

Co-operate on mutually agreed tangata whenua-led initiatives relating to the implementation of this plan.

Priority: HIGH (all species).

Responsibility: Programme Managers and Technical Support Officers (Kaupapa Atawhai Managers to assist) for those Conservancies and Areas containing non-migratory galaxiid species (see Appendix 2).

Action 3.5

Where Customary Freshwater Fisheries regulations exist, consult with tangata whenua about identification of rahui areas for non-migratory galaxiid species. These areas would be exempt from fishing activity or introductions of freshwater fish species that can be considered a threat to the ecological integrity of specific species at risk.

Priority: HIGH (all species).

Responsibility: Programme Managers and Technical Support Officers (Kaupapa Atawhai Managers to assist) for those Conservancies and Areas containing non-migratory galaxiid species (see Appendix 2).

9.3 SPECIES OBJECTIVES

Objective 4: Clarify taxonomic issues associated with non-migratory galaxiids.

Performance measure

Taxonomic issues are resolved and highest priority ESSENTIAL monitoring is initiated by June 2004.

Explanation

There are a number of issues associated with taxonomy of non-migratory galaxiids that require immediate resolution. It is also vital that monitoring of highest priority species is initiated to establish a baseline for on-going assessment of population health.

Action 4.1

By 2004, determine taxonomic status of all 'tag name groups' and produce a morphological key to distinguish among species. Liaise with external science providers to prioritise research and arrange DOC assistance and seek DOC funding, if required.

Priority: ESSENTIAL (Teviot galaxias, southern flathead galaxias, northern galaxias, *Galaxias* sp. D).

Responsibility: Recovery Group leader.

Action 4.2

Re-survey and report on existing database records greater than 20 years old and all sites where unidentified galaxiids are recorded, by 2010.

Priority: ESSENTIAL (lowland longjaw galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias).

MEDIUM (Gollum galaxias, upland longjaw galaxias).

Responsibility: Programme Managers and Freshwater Technical Support Officers, Canterbury, West Coast, Otago and Southland Conservancies.

Objective 5: Determine the conservation status of non-migratory galaxiids.

Performance measure

Non-migratory galaxiid distribution is determined and conservation status assigned.

Explanation

A lack of knowledge regarding non-migratory galaxiid species' distribution means that conservation priorities and actions cannot be accurately targeted to the highest priority sites. Survey and monitoring work is therefore required in order to more accurately determine the distribution, population trends and conservation status of the species.

Action 5.1

Add existing stream information to the non-migratory galaxiid stream register and new information as it is obtained (see Action 5.3). Table 1 gives priorities and responsibilities for these actions by species.

TABLE 1. PRIORITIES AND RESPONSIBILITIES FOR ADDING STREAM INFORMATION TO THE NON-MIGRATORY GALAXIID STREAM REGISTER BY SPECIES.

SPECIES	PRIORITY	RESPONSIBILITY
Lowland longjaw galaxias	ESSENTIAL	Coastal Otago and Twizel PMs
Bignose galaxias	ESSENTIAL	Twizel PM
Dune lakes galaxias	ESSENTIAL	Northland Freshwater TSO
Dwarf inanga	HIGH	Northland Freshwater TSO
Roundhead galaxias	HIGH	Central Otago and Coastal Otago PMs
Flathead galaxias	HIGH	Central Otago and Coastal Otago PMs
Southern flathead galaxias	HIGH	Southland PMs
Galaxias sp. D	HIGH	Murihiku, Central Otago and Coastal Otago PMs
Teviot galaxias	HIGH	Central Otago PM
Eldon's galaxias	HIGH	Coastal Otago PM
Dusky galaxias	HIGH	Coastal Otago PM
Northern galaxias	HIGH	South Marlborough, West Coast and North Canterbury PMs
Upland longjaw galaxias	MEDIUM	Canterbury, Greymouth PM, Freshwater TSOs
Dwarf galaxias[1]	MEDIUM	PMs for Areas with key sites

[1] Key sites only, see Appendix 1.

Note: PM = Programme Manager, TSO = Technical Support Officer.

Action 5.2

By June 2006, produce a report detailing the number of Gollum, southern flathead and northern galaxias populations known, and land ownership of properties adjacent to streams occupied by these species.

Priority: MEDIUM.

Responsibility: Freshwater Technical Support Officers, Southland, Canterbury and Nelson/Marlborough Conservancies.

Action 5.3

Survey for new non-migratory galaxiid populations. Follow surveying methods outlined in the non-migratory galaxiid survey guidelines (Department of Conservation n.d. b, see reference list). Table 2 gives priorities and responsibilities for these surveys by species.

Action 5.4

By 2005, re-survey isolated populations of dwarf galaxias in the Bay of Plenty and East Coast/Hawke's Bay Conservancies. By 2010, re-survey all dwarf galaxias database records more than 10 years old (as at April 2002). Note that alpine galaxias records in the Wairau River need checking.

Priority: HIGH.

Responsibility: Programme Managers, West Coast, Nelson/Marlborough, Wellington, Wanganui, and East Coast/Hawke's Bay Conservancies.

TABLE 2. PRIORITIES AND RESPONSIBILITIES FOR SURVEYS FOR NEW NON-MIGRATORY GALAXIID POPULATIONS.

SPECIES	PRIORITY	COMPLETION DATE	LOCATION	RESPONSIBILITY
Teviot galaxias	ESSENTIAL	July 2005	Teviot catchment	Central Otago PM
Bignose galaxias	ESSENTIAL	July 2004	Mackenzie basin Upper Waitaki River and tributaries	Canterbury Freshwater TSO and Twizel PM
Lowland longjaw galaxias	ESSENTIAL	July 2004	Braided river habitats in the Kakanui River Waitaki River tributaries including the Otamatapaio River	Otago and Canterbury PMs
	ESSENTIAL	Every 2 years	Hakataramea River and tributaries	Otago and Canterbury PMs
Dune lakes galaxias	ESSENTIAL	July 2004	Lake Kai Iwi	Kauri Coast PM
Upland longjaw galaxias	HIGH	2004	Maruia River	Greymouth PM
	HIGH	2007	Waitaki River	Twizel PM
	HIGH	2007	Rangitata River	Raukapuka PM
	HIGH	2007	Rakaia River	Raukapuka / Waimakariri PMs
	HIGH	2010	Hurunui River	North Canterbury PM
	HIGH	2010	Ashburton River	Raukapuka PM
	HIGH	2010	Waimakariri River	Waimakariri PM
Eldon's galaxias	HIGH	July 2006	Taieri and Tokomairiro catchments (40 streams)	Coastal Otago PM
Flathead galaxias	HIGH	July 2005	Waikouaiti catchment, Shag catchment, upper Taieri (upstream from Canadian Flat) and northern half of Rock and Pillar Range	Coastal Otago PM
Galaxias sp. D	HIGH	July 2005	Lindis River, Dunstan Range, Mannor Burn, Pool Burn, Pomahaka, Tuapeka, and Waitahuna River catchments	Murihiku, Central Otago, Coastal Otago PMs
Roundhead galaxias	HIGH	July 2005	Manuherikia, Maniototo and Strath Taieri regions	Central and Coastal Otago PMs
Dusky galaxias	HIGH	July 2010	Waipori, Tuapeka, Beaumont and Teviot catchments (50 streams)	Coastal Otago PM
Dwarf galaxias	HIGH	2010	Clarence catchment	North Canterbury and South Marlborough PMs
Northern galaxias	HIGH	2010	Clarence catchment Maruia catchment	North Canterbury, Greymouth and South Marlborough PMs
Southern flathead galaxias	HIGH	2011	Matarua, Oreti, Aparima and Waiua rivers	Southland PM
Gollum galaxias	MEDIUM	2004	Lower Clutha and Southland regions	Southland and Coastal Otago PMs

Note: PM = Programme Manager, TSO = Technical Support Officer.

Action 5.5

Establish monitoring sites and programmes for key non-migratory galaxiid populations. Conservancies and Area Offices to propose sites for Recovery Group approval. Monitoring to follow non-migratory galaxiid monitoring guidelines for stream populations (Department of Conservation n.d. a). Table 3 gives priorities and responsibilities for establishing these monitoring sites and programmes.

TABLE 3. PRIORITIES AND RESPONSIBILITIES FOR ESTABLISHING NON-MIGRATORY GALAXIID MONITORING SITES AND PROGRAMMES.

SPECIES	PRIORITY	COMPLETION DATE	POPULATIONS	RESPONSIBILITY
Lowland longjaw galaxias	ESSENTIAL	2004 2005	1 (7 Sites Kauru River) 2 Waitaki (if large population found)	Otago Freshwater TSO, Coastal Otago and Twizel PMs
Dune lakes galaxias	ESSENTIAL	July 2004	Kai Iwi Lakes	Kauri Coast PM, Northland CAS, and Freshwater TSO
Bignose galaxias	ESSENTIAL	2009	3	Twizel PM and Freshwater TSO
Dwarf galaxias	HIGH	July 2004	15	West Coast, Nelson/Marlborough, Wellington and East Coast/ Hawke's Bay PMs
Dwarf inanga	HIGH	July 2004	Poutu Lakes	Kauri Coast and Warkworth PMs
Dusky galaxias	HIGH	July 2005	3 streams	Coastal Otago PM
Eldon's galaxias	HIGH	July 2005	3 streams	Coastal Otago PM
Flathead galaxias	HIGH	July 2005	3 streams	Central and Coastal Otago PMs
Galaxias sp. D	HIGH	July 2005	3 streams	Murihiku, Central and Coastal Otago PMs
Gollum galaxias	HIGH	July 2005	4 streams	Southland and Coastal Otago PMs
Northern galaxias	HIGH	July 2005	4 streams	North Canterbury, Greymouth and South Marlborough PMs
Roundhead galaxias	HIGH	July 2005	3 streams	Central and Coastal Otago PMs
Southern flathead galaxias	HIGH	July 2005	3 streams	Southland PM
Teviot galaxias	HIGH	July 2006	2 streams	Central and CoastalOtago PMs

Note: TSO = Technical Support Officer, PM = Programme Manager, CAS = Conservancy Advisory Scientist.

Action 5.6

Establish monitoring sites at isolated populations of dwarf galaxias in the Bay of Plenty and East Coast/Hawke's Bay Conservancies by June 2006, and monitor these sites throughout the life of the recovery plan. Conservancies and Area Offices to propose sites for Recovery Group approval. Stream monitoring sites to follow non-migratory galaxiid monitoring guidelines (Department of Conservation n.d. a).

Priority: HIGH.

Responsibility: Programme Managers, Tauranga, Rangitaiki and Aniwaniwa.

Action 5.7

At monitoring sites (Action 5.5), determine population structure of non-migratory galaxiid species for which it is unknown at January 2004, and report results. Table 4 gives priorities and responsibilities for determining population structure.

TABLE 4. PRIORITIES AND RESPONSIBILITIES FOR DETERMINING NON-MIGRATORY GALAXIID POPULATION STRUCTURE.

SPECIES	PRIORITY	COMPLETION DATE	RESPONSIBILITY
Southern flathead galaxias	HIGH	July 2009	Southland PM, CAS and Freshwater TSO
Dusky galaxias	MEDIUM	July 2006	Coastal Otago PM, CAS and Freshwater TSO
Eldon's galaxias	MEDIUM	July 2006	Coastal Otago PM, CAS and Freshwater TSO
Galaxias sp. D	MEDIUM	July 2006	Murihiku, Central Otago PM, CAS and Freshwater TSO
Gollum galaxias	MEDIUM	July 2008	Southland PM, CAS and Freshwater TSO
Teviot galaxias	MEDIUM	July 2012	Central Otago PM, CAS and Freshwater TSO

Note: TSO = Technical Support Officer, PM = Programme Manager, CAS = Conservancy Advisory Scientist.

Action 5.8

Utilising monitoring data (Action 5.5), determine the rate of decline of non-migratory galaxiids by July 2006, and reassess every two years in light of the most recent monitoring data. Table 5 gives priorities and responsibilities for determining rate of decline of non-migratory galaxiids.

TABLE 5. PRIORITIES AND RESPONSIBILITIES FOR DETERMINING RATE OF DECLINE OF NON-MIGRATORY GALAXIIDS.

SPECIES	PRIORITY	LOCATION	RESPONSIBILITY
Dune lakes galaxias	ESSENTIAL	Kai Iwi lakes	Recovery Group, Kauri Coast PM and Freshwater TSO
Lowland longjaw galaxias	ESSENTIAL	Kauru River	Canterbury and Otago PMs and Freshwater TSOs
Dwarf inanga	HIGH	Poutu lakes	Recovery Group, Kauri Coast and Warkworth PMs and Freshwater TSOs

Note: TSO = Technical Support Officer, PM = Programme Manager.

Action 5.9

If less than 15 populations each of bignose galaxias and lowland longjaw galaxias have been discovered (through Actions 5.3) by July 2005, then determine the geographic range, number of populations, and population size and trajectory of the upper Waitaki River populations by July 2008.

Priority: ESSENTIAL.

Responsibility: Programme Manager, Twizel and Freshwater Technical Support Officer, Canterbury.

Objective 6: Determine threats and impacts to non-migratory galaxiids.

Performance measure

All threats to non-migratory galaxiid species are identified and impacts are quantified within the given time frames.

Explanation

For species management, it is essential to have improved knowledge of the threats and impacts affecting non-migratory galaxiids so that the relative importance of the various agents of decline can be assessed. The inter-relationships between the various causes of decline also need to be investigated to allow integrated management of these impacts.

Action 6.1

Establish additional monitoring sites (to those selected for Action 5.5) in two streams containing dusky galaxias and three streams containing Eldon's galaxias in pine plantation prior to logging by June 2006, and monitor populations for 5 years post-logging. Stream monitoring sites to follow non-migratory galaxiid monitoring guidelines (Department of Conservation n.d. a). Report on logging impact and subsequent recovery within one year of the completion of the post-logging monitoring.

Priority: HIGH.

Responsibility: Programme Manager, Conservancy Advisory Scientist and Freshwater Technical Support Officer, Coastal Otago.

Action 6.2

Determine the role of potentially threatening fish species in the decline of non-migratory galaxiids. Table 6 gives priorities and responsibilities for determining the role of threatening fish species.

Action 6.3

Determine the impact of gravel extraction on the lowland longjaw galaxias population in Kauru River by July 2006, utilising monitoring data (see Action 5.5) gathered from control and gravel extraction sites.

Priority: ESSENTIAL.

Responsibility: Conservancy Advisory Scientist, Freshwater Technical Support Officer and Programme Manager, Otago.

TABLE 6. PRIORITIES AND RESPONSIBILITIES FOR DETERMINING THE ROLE OF THREATENING FISH SPECIES IN THE DECLINE OF NON-MIGRATORY GALAXIIDS.

SPECIES	PRIORITY	COMPLETION DATE	ORDER OF THREAT	RESPONSIBILITY
Bignose galaxias	ESSENTIAL	July 2007	1. Brown trout 2. Canterbury galaxias 3. Koaro 4. Rainbow trout 5. Upland bully	Twizel PM, Canterbury CAS and Freshwater TSO
Lowland longjaw galaxias	ESSENTIAL	July 2007	1. Brown trout 2. Canterbury galaxias 3. Koaro 4. Rainbow trout 5. Upland bully	Canterbury and Otago CAS and Freshwater TSOs, Twizel and Coastal Otago PM
Dune lakes galaxias	HIGH	July 2008	1. Rainbow trout 2. Gambusia 3. Longfin eel 4. Perch	Kauri Coast and Warkworth PMs, Auckland and Northland TSOs CAS and Freshwater
Dwarf inanga	HIGH	July 2008	1. Rainbow trout 2. Gambusia 3. Longfin eel 4. Perch	Kauri Coast and Warkworth PMs, Auckland and Northland CAS and Freshwater TSOs
Galaxias sp. D	MEDIUM	2010	1. Brown trout 2. Brook char	Murihiku and Central Otago PM, CAS and Freshwater TSO
Gollum galaxias	MEDIUM	2011	1. Brown trout 2. Koaro	Southland PM, CAS and Freshwater TSO
Southern flathead galaxias	MEDIUM	2012	1. Brown trout 2. Brook char	Southland PM, CAS and Freshwater TSO

PM = Programme Manager, CAS = Conservancy Advisory Scientist, TSO = Technical Support Officer.

Action 6.4

By June 2008, for Poutu lakes and Kai Iwi lakes respectively, determine if declining water quality due to contaminated run-off is impacting on dwarf inanga and dune lakes galaxias. Species population monitoring data and water quality monitoring programmes for the respective lakes should be used.

Priority: HIGH.

Responsibility: Programme Manager, Kauri Coast; Conservancy Advisory Scientist and Freshwater Technical Support Officer, Northland Conservancy.

Action 6.5

If Action 7.2 determines that macrophytes provide spawning habitat for dune lakes galaxias and dwarf inanga; then by June 2010 determine, via lab trials, whether introduced macrophyte invasions in the Poutu and Kai Iwi lakes are likely to cause the loss of dune lakes galaxias and dwarf inanga spawning habitat; or, alternatively, that they will provide spawning habitat.

Priority: HIGH.

Responsibility: Programme Manager, Kauri Coast; Conservancy Advisory Scientist and Freshwater Technical Support Officer, Northland Conservancy.

Action 6.6

Determine, by July 2006, via flow monitoring and population monitoring (as in Action 5.5), the impact of flow regime and periods of no surface flow on lowland longjaw galaxias in Kauru River.

Priority: ESSENTIAL.

Responsibility: Conservancy Advisory Scientist, Freshwater Technical Support Officer and Programme Manager, Otago Conservancy.

Action 6.7

Determine, by July 2008, the impact of landuse change on non-migratory galaxiids.

Priority: ESSENTIAL (lowland longjaw galaxias).

HIGH (roundhead galaxias, flathead galaxias, southern flathead galaxias, *Galaxias* sp. D, Teviot galaxias, Eldon's galaxias, dusky galaxias, bignose galaxias).

Responsibility: Conservancy Advisory Scientists, Freshwater Technical Support Officers and Programme Managers for those Conservancies and Areas (see Appendix 2) containing the above species.

Objective 7: Undertake research required for the restoration and management of non-migratory galaxiids.

Performance measure

Research gaps are addressed to provide clear technical and management advice for Programme Managers to achieve the actions outlined in Objective 5 (conservation status objective).

Explanation

Only limited knowledge of non-migratory galaxiid spawning biology and habitat preferences is available at present. Improved information is required for advocacy, management purposes and to better target RMA consent actions.

Action 7.1

Determine habitat preferences for Instream Flow Incremental Methodology (IFIM) habitat modelling of non-migratory galaxiids. Advocate for the use of these habitat preferences for setting of residual and minimum flows in resource consent applications for water use and Regional Council water plans. Table 7 gives priorities and responsibilities for determining habitat preferences for non-migratory galaxiids.

TABLE 7. PRIORITIES AND RESPONSIBILITIES FOR DETERMINING HABITAT PREFERENCES FOR NON-MIGRATORY GALAXIIDS.

SPECIES	PRIORITY	COMPLETION DATE	RESPONSIBILITY
Lowland longjaw galaxias	ESSENTIAL	July 2003	Otago Freshwater TSO to commission appropriate research
Bignose galaxias	ESSENTIAL	2008	Canterbury Freshwater TSO
Galaxias sp. D	HIGH	July 2006	Murihiku and Central Otago PM, CAS and Freshwater TSO
Northern galaxias	HIGH	2009	North Canterbury, Greymouth and South Marlborough PMs
Teviot galaxias	HIGH	July 2012	Central Otago PM, CAS and Freshwater TSO
Southern flathead galaxias	MEDIUM	July 2006	Southland PM, CAS and Freshwater TSO
Gollum galaxias	MEDIUM	July 2007	Southland PM, CAS and Freshwater TSO
Dusky galaxias	MEDIUM	2013	Coastal Otago PM, CAS and Freshwater TSO
Dwarf galaxias	MEDIUM	2013	Recovery Group Leader
Eldon's galaxias	MEDIUM	2013	Coastal Otago PM, CAS and Freshwater TSO
Upland longjaw galaxias	MEDIUM	2013	Canterbury Freshwater TSO

PM = Programme Manager, CAS = Conservancy Advisory Scientist, TSO = Technical Support Officer.

Action 7.2

Determine spawning habitat and timing for non-migratory galaxiids. Spawning assessments of Teviot, *Galaxias* sp. D, northern galaxias and southern flathead galaxias are to proceed only if they are recognised as distinct species (see Action 4.1). Table 8 gives priorities and responsibilities for determining spawning habitat and timing for non-migratory galaxiids.

Action 7.3

By July 2005, determine optimum conditions for holding lowland longjaw galaxias in captivity for periods of up to 3 months.

Priority: ESSENTIAL.

Responsibility: Programme Manager, Coastal Otago; Conservancy Advisory Scientist, Otago.

Action 7.4

By June 2004, trial the use of visual implant elastomer tagging (or other suitable methods) with lowland longjaw galaxias. If successful, use tagging to determine (by June 2006) lowland longjaw galaxias dispersal from drought refuges following the resumption of surface flow in the Kauru River.

TABLE 8. PRIORITIES AND RESPONSIBILITIES FOR DETERMINING SPAWNING HABITAT AND TIMING FOR NON-MIGRATORY GALAXIIDS.

SPECIES	PRIORITY	COMPLETION DATE	RESPONSIBILITY
Lowland longjaw galaxias	ESSENTIAL	July 2004	Otago CAS, Freshwater TSO and PM
Dune lakes galaxias	ESSENTIAL	July 2006	Kauri Coast PM, CAS and Freshwater TSO
Bignose galaxias	ESSENTIAL	July 2007	Twizel PM, Canterbury CAS and Freshwater TSO
Northern galaxias	HIGH	2006	North Canterbury, Greymouth and South Marlborough PMs
Southern flathead galaxias	HIGH	July 2007	Southland PM, CAS and Freshwater TSO
Dwarf inanga	HIGH	July 2008	Kauri Coast PM, Northland CAS and Freshwater TSO
Eldon's galaxias	HIGH	July 2010	Coastal Otago PM, CAS and Freshwater TSO
Galaxias sp. D	MEDIUM	July 2006	Murihiku and Central Otago PM, CAS and Freshwater TSO
Gollum galaxias	MEDIUM	July 2006	Southland PM, CAS and Freshwater TSO
Dwarf galaxias	MEDIUM	July 2010	West Coast, Nelson/Marlborough, Wellington, Wanganui, East Coast/ Hawke's Bay, Bay of Plenty PMs, CASs and Freshwater TSOs
Teviot galaxias	MEDIUM	July 2010	Central Otago PM, CAS and Freshwater TSO
Upland longjaw galaxias	MEDIUM	July 2010	Canterbury PMs, CAS and Freshwater TSO

PM = Programme Manager, CAS = Conservancy Advisory Scientist, TSO = Technical Support Officer.

Priority: ESSENTIAL.

Responsibility: Conservancy Advisory Scientist, Freshwater Technical Support Officer and Programme Manager, Otago.

Action 7.5

By June 2006, use excavation and refuge pit monitoring to determine whether lowland longjaw galaxias are able to work their way down through the stream bed substrate to utilise sub-surface ground water as a drought refuge.

Priority: ESSENTIAL.

Responsibility: Programme Manager, Coastal Otago, Freshwater Technical Support Officer, Otago.

Action 7.6

By June 2010, assess, by gut sample analysis, the diet of larval, juvenile and adult life-history phases of dwarf inanga, dune lakes galaxias and Gambusia (*Gambusia affinis*) (in Kai Iwi lakes), and compare dwarf inanga and dune lakes galaxias diet with that of Gambusia to determine whether there is competition for food between the species.

Priority: HIGH.

Responsibility: Programme Manager, Kauri Coast; Conservancy Advisory Scientist and Freshwater Technical Support Officer, Northland.

Action 7.7

By June 2006, determine the role of macrophytes in mediating Gambusia and rainbow trout impacts on dune lakes galaxias.

Priority: ESSENTIAL.

Responsibility: Programme Manager, Kauri Coast; Conservancy Advisory Scientist and Freshwater Technical Support Officer, Northland.

Action 7.8

By June 2005, determine frequency and fishing effort required to accurately survey and monitor dune lakes galaxias. Test mark-recapture and SCUBA diver fish count methods for population censuses (also applies to dwarf inanga).

Priority: ESSENTIAL.

Responsibility: Programme Manager, Kauri Coast; Conservancy Advisory Scientist and Freshwater Technical Support Officer, Northland.

Action 7.9

By 2010 use mitochondrial DNA analysis to determine upland longjaw galaxias population structure among catchments.

Priority: HIGH.

Responsibility: Conservancy Advisory Scientist and Freshwater Technical Support Officer, Canterbury.

Objective 8: Manage and recover non-migratory galaxiids.

Performance measure

No managed population has been lost due to mis-management, and existing populations have been maintained or enhanced and / or the establishment of new populations has been successful.

Explanation

A long-term strategy may be required to maintain non-migratory galaxiids. At present, threats to the survival of some species are unknown and options for conservation management have not been assessed. This process will determine, in consultation with other affected parties, the best conservation strategy.

Action 8.1

For any non-migratory galaxiid species with less than 15 known populations, produce a contingency plan to manage them in the event of an emergency (i.e. drought; chemical spill; introduction of predatory, competitive or potentially hybridising fish species) within one year of the completion of survey actions (Action 5.3).

Priority: ESSENTIAL.

Responsibility: Recovery Group Leader to assign responsibility when survey actions (5.3) complete.

Action 8.2

By June 2006, complete koaro removal from a Waipori River tributary and monitor dusky galaxias recovery at this site and at the Burnt Creek invasive species exclusion area. Produce two reports on the results of these operations: the first report in 2007 addressing the removal of koaro, and the second in 2013 addressing the removal of koaro and the recovery of dusky galaxias populations.

Priority: HIGH.

Responsibility: Programme Manager, Coastal Otago; Conservancy Advisory Scientist and Freshwater Technical Support Officer, Otago.

Action 8.3

By June 2004, complete brown trout and koaro removal at Shepherd Stream. Determine the results of the operation including recommendation for brown trout removal and exclusion, and report on recovery of Eldon's galaxias populations in 2007 and 2013.

Priority: HIGH.

Responsibility: Programme Manager, Coastal Otago; Conservancy Advisory Scientist and Freshwater Technical Support Officer, Otago.

Action 8.4

By June 2004, locate using surveys and the New Zealand freshwater fish database (NZFFD), fish-free streams or streams containing only Canterbury galaxias in North Otago, and prioritise (using site security, access and legal status) translocation sites for lowland longjaw galaxias. Carry out one translocation by June 2005 and monitor the translocated population according to the monitoring guidelines (Department of Conservation n.d. a).

Priority: ESSENTIAL.

Responsibility: Programme Manager, Coastal Otago; Freshwater Technical Support Officer, Otago.

Action 8.5

By June 2006, construct a koaro passage barrier on the water race connecting Knights and Broad streams (Taieri River) so that koaro cannot access Broad Stream from Knights Stream. By June 2008, remove koaro from Broad Stream above the water race junction and downstream approximately 100 metres to the large waterfall. By June 2009, translocate Eldon's galaxias from Lee Stream / Canton Stream to Broad Stream. Monitor, according to the monitoring guidelines (Department of Conservation n.d. a), translocation success until 2013, reporting annually to Recovery Group.

Priority: HIGH.

Responsibility: Programme Manager, Coastal Otago.

Action 8.6

By 2005, for protection of lowland longjaw galaxias, investigate and pursue legal protection options (including DOC purchase, or covenanting) for Kauru River bed.

Priority: ESSENTIAL.

Responsibility: Programme Manager and Statutory Land Management Technical Support Officer, Otago.

Action 8.7

By July 2007, produce a management plan (in conjunction with adjacent land owners, Otago Regional Council and Fish and Game Otago) for the lowland longjaw galaxias in Kauru River.

Priority: ESSENTIAL.

Responsibility: Community Relations Officer and Freshwater Technical Support Officer, Otago.

Action 8.8

For known populations of bignose galaxias, rank potential management options (see Appendix 4) for the species by June 2008. Initiate any required actions to maintain stable populations and increase small populations (i.e. less than 500 adults), with the aim of maintaining all populations with greater than 500 adults by June 2010.

Priority: ESSENTIAL.

Responsibility: Freshwater Technical Support Officer, Canterbury.

Action 8.9

By June 2007, determine in Lake Kai Iwi (dependent on Te Kuihi and Te Roroa agreement), or another lake without dune lakes galaxias, whether Gambusia removal can be successfully achieved by utilising habitat alteration, predatory fish stocking or physical removals. Methods trialled must be target species-specific to avoid significant loss of dune lakes galaxias.

Priority: ESSENTIAL.

Responsibility: Programme Manager, Kauri Coast; Conservancy Advisory Scientist and Freshwater Technical Support Officer, Northland.

Action 8.10

If monitoring (Action 5.5) shows that dune lakes galaxias continues to decline, seek to revise the existing management plan for the Kai Iwi lakes in conjunction with Iwi, Fish and Game Northland and the Kaipara District Council by June 2009.

Priority: ESSENTIAL.

Responsibility: Programme Manager and Freshwater Technical Support Officer, Northland.

Action 8.11

By June 2008, establish, with the agreement of Te Kiuhi and Te Roroa, an introduced fish-free population of dune lakes galaxias by translocation. Monitor success of translocation using snorkel surveys.

Priority: ESSENTIAL.

Responsibility: Programme Manager and Freshwater Technical Support Officer, Kauri Coast.

Action 8.12

By June 2010, fence all conservation estate around the Poutu Lakes to conserve dwarf inanga by preventing stock access to the lakes, and manage conservation estate riparian areas to reduce nutrient inputs into the lakes.

Priority: HIGH.

Responsibility: Programme Manager, Kauri Coast.

Action 8.13

Throughout the life of this recovery plan, monitor (on an annual basis, during November–February) for the invasion of exotic fish in all exotic fish-free lakes that dwarf inanga inhabit. If exotic fish are detected, assess within 4 months the potential impact, and whether removal is desired and feasible.

Priority: ESSENTIAL.

Responsibility: Programme Manager, Kauri Coast; Freshwater Technical Support Officer, Northland.

Action 8.14

By June 2010, produce a management plan for dwarf inanga lakes in conjunction with Iwi, Fish and Game Northland and the Northland Regional Council.

Priority: HIGH.

Responsibility: Freshwater Technical Support Officer, Northland.

10. 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 date that is proposed for review of this recovery plan is 2013.

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Appendix 1

DEFINING KEY POPULATIONS FOR NON-MIGRATORY GALAXIIDS

By the end of its 10-year period, this recovery plan seeks to have all non-migratory galaxiid species classified as either Not Threatened or in Gradual Decline. The criteria for Gradual Decline are either 5000 mature individuals or 15 populations; this recovery plan is aiming for the latter. Up to 30 key populations need to be identified for each species in order to achieve this aim with some confidence in the long-term. More than 30 key sites should be designated if the sites fit within criteria 1–5 below.

The definitions of key populations are based on DOC's draft Natural Heritage Concepts and Principles (Department of Conservation 2001, see reference list, main text). The key populations are to be selected to preserve large populations or habitats, key scientific sites and to maintain the geographic range of species and the genetic and biological diversity within each non-migratory galaxiid species.

Criteria for key populations

- The three largest populations of any non-migratory galaxiid within any evolutionary significant unit (ESU). Population size will be determined from the area of habitat available and density estimates from monitoring sites for the species. When two or more sites are equivalent in terms of population size, the key populations can be determined using other conservation values including: the presence of other rare species, the degree of modification and the degree of control DOC has over outside influences on the habitat.
- The type locality of each species (or the nearest present-day population that is thought to be in the same ESU).
- Populations that are geographic outliers and are remnants of the historic range of the species, and populations that maintain the geographic range of ESUs.
- Populations at long-term research sites.
- Populations in unusual habitats for the species.
- Protected sites being actively managed under an integrated management programme.
- Further sites to be classified on habitat size and ease of protection and management if fewer than 30 have been designated for a species. Consultation between DOC Area Managers and the Non-migratory Galaxiid Recovery Group is recommended when designating these populations.

Appendix 2

DOC CONSERVANCIES AND CONSERVANCY AREAS CONTAINING NON-MIGRATORY GALAXIID SPECIES

SPECIES	RESPONSIBILITY—CONSERVANCY (AREAS)
Lowland longjaw galaxias	Otago (Coastal Otago) Canterbury (Twizel)
Bignose galaxias	Canterbury (Twizel)
Dune lakes galaxias	Northland (Kauri Coast)
Dwarf inanga	Northland (Kauri Coast) Auckland (Warkworth)
Roundhead galaxias	Otago (Central Otago, Coastal Otago)
Gollum galaxias	Southland (Te Anau, Murihiku, Southern Islands) Otago (Coastal Otago)
Flathead galaxias	Otago (Central Otago, Coastal Otago)
Southern flathead galaxias	Southland (Te Anau, Murihiku, Southern Islands)
Galaxias sp. D	Otago (Central Otago, Wanaka, Coastal Otago) Southland (Murihiku)
Teviot galaxias	Otago (Central Otago)
Eldon's galaxias	Otago (Coastal Otago)
Dusky galaxias	Otago (Coastal Otago, Central Otago)
Dwarf galaxias	West Coast (Greymouth-Mawheranui, Hokitika, Buller-Kawatiri) Nelson/Marlborough (Motueka, Sounds, South Marlborough, St Arnaud) Wellington (Kapiti, Poneke, Wairarapa) East Coast/Hawke's Bay (Hawke's Bay, Aniwaniwa) Bay of Plenty (Rangitaiki, Tauranga) Wanganui (Palmerston North) Canterbury (North Canterbury)
Northern galaxias	Nelson/Marlborough (South Marlborough) West Coast (Greymouth-Mawheranui) Canterbury (North Canterbury)
Upland longjaw galaxias	West Coast (Greymouth-Mawheranui) Canterbury (Twizel, North Canterbury, Raukapuka, Waimakariri, Aoraki) Nelson/Marlborough (South Marlborough)

Appendix 3

LEVELS OF PROTECTION FOR KEY POPULATIONS OF NON-MIGRATORY GALAXIIDS

The objective of any specific protection action is to gain the maximum possible protection for a galaxiid population. Early consultation with DOC Statutory Land Management staff will find the best option for key sites. The three major threats to non-migratory galaxiids (reduction in water quality and availability and invasion by other fish species) are controlled via the protection objectives below:

- Landuse change impacts that reduce water and habitat quality are halted or reduced by catchment level management and protection of riparian margins.
- Prohibiting or controlling abstractive activities (e.g. water or gravel abstraction) in the stream prevents or limits habitat loss.
- Invasion of galaxiid habitat by competing, predatory or potentially hybridising fish species is prevented by maintaining the barriers that isolate the populations and prevent invasion via water races.

Isolation of non-migratory galaxiid populations from salmonid invasion is seen to be a key factor in preventing acute local extinction events. Reducing land use impacts and abstraction activities will reduce long-term chronic impacts that may eventually lead to significant decline in population size or even extinction.

Levels of protection

The levels of protection listed below (from maximum to minimum level) are the most preferred options; however, other options are also available.

1. The catchment containing the key population is in Public Conservation estate or legally covenanted area (e.g. DOC or Queen Elizabeth the 2nd National Trust (QEII)) that allows any required management action to take place. Downstream barriers preventing invasion by fish species are contained within this area and are maintained to prevent failure. No abstractive activities occur within the catchment inhabited by the galaxiids or upstream areas.
2. The catchment containing the key population is within a covenanted area (e.g. DOC or QEII) that is destocked and fenced. Downstream barriers preventing invasion by other fish species are contained within this area and are maintained to prevent failure. No abstractive activities occur within the area inhabited by the galaxiids or upstream and this is recognised in Regional Council plans.
3. The catchment containing the key population has fenced riparian margins preventing stock access and is managed by the Department of Conservation or is a covenanted area (e.g. DOC or QEII), allowing any required management actions to take place. Downstream barriers preventing invasion by other fish species are contained within this area and are maintained to prevent failure. No abstractive activities occur within the area inhabited by the galaxiids or upstream and this is recognised in Regional Council plans.

4. The catchment containing the key population is a covenanted area (e.g. DOC or QEII) with stock grazing limited to sheep (no cattle, deer or goats). Downstream barriers preventing invasion by other fish species are contained within this area and are maintained to prevent failure. No abstractive activities occur within the area inhabited by the galaxiids or upstream, and this is recognised in Regional Council plans.
5. The catchment containing the key population is a covenanted area (e.g. DOC or QEII) with low-intensity stock grazing. Downstream barriers preventing invasion by other fish species are contained within this area and are maintained to prevent failure. No abstractive activities occur within the area inhabited by the galaxiids or upstream, and this is recognised in Regional Council plans.
6. The catchment containing the key population is freehold. Downstream barriers preventing invasion by other fish species, have been identified and are maintained to prevent failure. A legal agreement exists with the landowner(s) (e.g. a management agreement) to allow DOC access to these sites to maintain the barriers. No abstractive activities occur within the area inhabited by the galaxiids or upstream, and this is recognised in Regional Council plans.
7. The catchment containing the key population is freehold. Downstream barriers preventing invasion by other fish species have been identified and are maintained to prevent failure. A legal agreement exists with the landowner(s) to allow DOC access to these sites to maintain the barriers. Water abstraction activities occur within the area inhabited by the galaxiids or upstream, but the special status of the catchment is recognised in Regional Council plans and residual or minimum flows are in place and monitored. Abstraction sites (water or other) allow fish passage through the sites (e.g. over weirs or dams), but fish passage is prevented along the abstraction pathway (e.g. water race or pipe line) to prevent invasive fish access to the stream.
8. The catchment containing the key population is freehold. Downstream barriers preventing invasion by other fish species have been identified and are maintained to prevent failure. An agreement exists with the landowner(s) to allow DOC access to these sites to maintain the barriers. Water and other abstraction activities occur within the area inhabited by the galaxiids or upstream, but the special status of the catchment is recognised in Regional Council plans. Residual or minimum flows are in place and monitored, or other appropriate environmental conditions exist on the abstraction consent. Abstraction sites (water or other) allow fish passage through the sites (e.g. over weirs or dams), but fish passage is prevented along the abstraction pathway (e.g. water race or pipe line) to prevent invasive fish access to the stream.

Appendix 4

MANAGEMENT ACTIONS FOR KEY NON-MIGRATORY GALAXIID SITES

1. Natural barriers to fish that prevent invasion of habitat by undesired fish species are assessed and improved (if required). Flood-damaged barriers are repaired. Status of barriers are assessed according to the barrier assessment protocol in the non-migratory galaxiid monitoring guidelines (for streams and small rivers) (Department of Conservation n.d. a; see reference list, main text).
2. Fish passage barriers are installed on any water abstraction water races that connect the key sites to water bodies that contain other known threatened fish species.
3. Grazing stock are excluded from the stream margins where their impacts are detrimental to stream habitat, especially spawning habitat, or direct nutrient inputs resulting from stock are causing water quality decline.
4. Fire-fighting plans record the presence of key non-migratory galaxiid streams to avoid, where possible, the use of toxic fire retardants in the riparian margins. Burning permits require that riparian margins are left unburnt.
5. Water abstraction in key sites to be managed with the following priority actions. Resource consent applications should be assessed and Regional Councils requested to apply the following conditions. For high quality sites, seek Regional Council plan changes or recognise in new plans that these streams are special habitats. Actions for water abstraction in order of most to least desirable:
   a. No abstraction.
   b. Abstraction with fish passage. Minimum flow set at MALF (Mean Annual Low Flow) or by IFIM habitat preference methods. Water take situated as far downstream on the water body as possible to minimise impact. Galaxiid population monitored to assess whether the minimum flows set are achieving galaxiid protection. A review condition on the consent allows new minimum flow to be set if required.
   c. Abstraction with fish passage. Minimum flow set at MALF or by IFIM habitat preference methods. Galaxiid population monitored to assess whether the minimum flows set are achieving protection. A review condition on the consent allows a new minimum flow to be set if required.
   d. Abstraction with fish passage. Minimum flow set at MALF or by IFIM habitat preference methods. Water take situated as far downstream on the water body as possible to minimise impact. A review condition on the consent allows a new minimum flow to be set if required.
   e. Abstraction with fish passage. Minimum flow set at MALF or by IFIM habitat preference methods. A review condition on the consent allows a new minimum flow to be set if required.
   f. Abstraction with fish passage. Minimum flow set at MALF or by IFIM habitat preference methods.

6. For water abstraction that operates continuously from key sites, work with abstraction consent holder to manage the abstraction pathway (water race) as fish habitat. Seek consent conditions that recognise that this is required as mitigation for abstraction and loss of instream habitat. This management action must recognise that fish passage barriers (action 2 above) are a higher priority if the water race connects to other water bodies.
7. New dams (e.g. hydro-electric or irrigation storage) are assessed to determine whether key sites will be flooded and downstream barriers to fish invasion lost. Advocate through the RMA process for no loss of galaxiid habitat, and that if barriers are to be flooded new barriers are constructed upstream of the flooded area to protect the galaxiid site. Barriers and assessment must consider the possibility that koaro will establish in the new reservoir and that any barriers will have to exclude climbing juvenile koaro.