

EXECUTIVE SUMMARY

The term 'whitebait' is a collective name for small transparent native fish that migrate from the sea into rivers and streams during spring and summer. Upstream-moving schools or runs of whitebait occur in coastal streams around Tasmania. Whitebait, as defined under the *Inland Fisheries Act 1995* (The Act), includes any of the following species of fish: Tasmanian whitebait (*Lovettia sealii*), jollytail (*Galaxias maculatus*), climbing galaxias (*Galaxias brevipinnis*), spotted galaxias (*Galaxias truttaceus*), Tasmanian mudfish (*Neochanna cleaveri*) and Tasmanian smelt (*Retropinna tasmanica*). The whitebait runs are composed of these species, with species composition varying with tide, time and location. Most whitebait are juveniles, with the exception of *Lovettia* which are adults migrating to spawn.

A limited licensed recreational fishery for whitebait has operated in Tasmania since 1990 under the jurisdiction of the Inland Fisheries Service (*Inland Fisheries Act 1995*). Participation in the fishery over the past four years has slowly increased with the 2005 season having the highest number of licence holders since 1990. Whitebait are caught for personal consumption and are considered a seasonal delicacy, especially across the North of the State. Management of the fishery has been aimed to protect populations of whitebait species and avoid indirect impact on anglers targeting other species, while enabling a small legal catch of whitebait for personal consumption. Poaching and illegal sales are ongoing problems associated with the whitebait fishery.

This plan provides background information on the whitebait fishery, and establishes objectives and recommendations for the future management of the fishery. This includes the recreational fishery and other aspects such as conservation and commercial exploitation and opportunities.

The main objectives and actions of the whitebait fishery management plan are to:

- Maintain a recreational whitebait fishery.
- Maintain the current daily catch limit at 1 kg and the season and possession limits at 10 kg.
- Increase the current four week season to a six week season, commencing on the 1st of October each year to provide fishers greater opportunity to capture their seasonal limit.

Whitebait Fishery Management Plan

- Open the Mersey and Leven rivers on a seasonal open/close rotation to whitebait fishing.
- Open several additional smaller rivers and on an open/close rotation management system to avoid over-exploitation.
- Amend the regulations so fishers must be within 8 metres of their net at all times and prohibit the use of natural vegetation as any part of their fishing equipment (including stakes), to help minimise damage to riparian vegetation.
- Undertake a limited monitoring program on selected open waters for the 2006 whitebait season, to gather information on the composition of whitebait fishers catch, to help determine the level of impact on threatened species.
- Investigate the feasibility of a more comprehensive fishery monitoring program to ensure the long-term sustainability of the fishery and to help determine the level of impact on by-catch.

Implementation of this plan is subject to funding being available. The plan will be reviewed after 5 years but may be amended within that period by the Director of Inland Fisheries.

LIST OF ABBREVIATIONS

Director	Director of the Inland Fisheries Service
DPIW	Department of Primary Industries and Water
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
IFS	Inland Fisheries Service
The Act	<i>Inland Fisheries Act 1995</i>
TSP Act	<i>Threatened Species Protection Act 1995</i>

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1 INTRODUCTION

1.1 Purpose Of The Plan

This plan is one of a series of fishery management plans that is being developed by the Inland Fisheries Service to provide vision, goals, objectives, directions and guidance for the management of Tasmania's freshwater fisheries. Each plan is designed to provide directions for fisheries management for a specified period.

This plan identifies priority areas of management and research necessary to achieve the vision and goals for the recreational whitebait fishery. This will also assist the Service to plan work programs and assign resources.

The plan strives to recognise and manage the competing needs of our fishery whilst ensuring the maintenance of our native fish populations.

1.2 Scope Of The Plan

The focus of this plan is the recreational fishery for whitebait. The plan also includes management of other whitebait values including native species conservation, recreational trout fishing, commercial fishery, and aquaculture.

1.3 Implementation And Funding

This plan will be implemented once accepted by the Director of Inland Fisheries. The actions in the plan will be subject to availability of funding. Where possible external funds will be sought to support actions.

1.4 Commencement Of Regulations

The fishery regulations contained in this plan will only take effect once the regulations have been gazetted.

1.5 Term Of The Plan

The term of this plan is 5 years, but it will remain in effect until superseded by an updated plan.

2 BACKGROUND

2.1 The Fishery

A regulated recreational whitebait fishery has operated in Tasmania since 1990 under the jurisdiction of the Inland Fisheries Service (IFS). Tasmania is the only State in Australia with a whitebait fishery. Whitebait is harvested by licensed fishers for personal consumption and is considered a seasonal delicacy. Fish are captured by scoop nets as they migrate upstream in schools.

The recreational fishery is open in specified rivers in the south-east, north-east and north-west of Tasmania. Participation in the fishery is highest in the north-west, with this region generally having double the number of licence holders than in the south-east, with the south-east generally having double the number of licence holders than in the north-east.

Management of the fishery has been aimed at protecting populations of whitebait species and avoiding indirect impact on anglers targeting other species, while allowing a small personal legal catch. Poaching and illegal sales of whitebait are ongoing problems associated with the fishery.

2.2 What Is Whitebait?

The term 'whitebait' is a collective name for small transparent native fish (primarily *Galaxias spp.*) that migrate from the sea into rivers and streams during spring and summer in the period August to December (Fulton and Pavuk 1988). Upstream-moving schools or 'runs' of whitebait occur in most coastal streams around the State. The small schooling fish are comprised of a mixture of juvenile fish (*Galaxias spp.*) and adult fish (*L. seallii*). As a group, whitebait are usually less than 70 mm long and are lightly pigmented. The density and species composition of runs is very variable from day to day, year to year and between rivers (Fulton and Pavuk 1988). The galaxias juveniles migrate upstream past the tidal influence and take up residence in main streams and tributaries. Generally each species will occupy different reaches of streams and mature into adults. Lovettia spawn in the upper tidal reaches with most adults gradually dieing after spawning.

Whitebait, as defined under the *Inland Fisheries Act 1995*, includes any of the following kinds or species of fish: (a) Tasmanian whitebait, *Lovettia seallii* (Johnston); (b) jollytail, *Galaxias maculatus* (Jenyns); (c) climbing galaxias,

Galaxias brevipinnis (Günther); (d) spotted galaxias, *Galaxias truttaceus* (Valenciennes); (e) Tasmanian mudfish, *Neochanna cleaveri* (Scott); and (f) Tasmanian smelt, *Retropinna tasmanica* (McCulloch). The whitebait runs include a mixture of these species, with proportions of each depending on the time of year. Runs may also include small numbers of other species such as juveniles of Australian grayling, *Prototroctes maraena* (Fulton and Pavuk 1988). Grayling is listed as a threatened species under State and Commonwealth legislation, and is also a protected species under the *Inland Fisheries Act 1995*.

3 LEGISLATION AND GUIDING DOCUMENTS

Legislation and policy documents applicable to whitebait management are:

3.1 Statutes

- *Inland Fisheries Act 1995*¹
- *Inland Fisheries Recreational Fisheries Regulations 1999*¹
- *Environment Protection and Biodiversity Conservation Act 1999*²
- *Threatened Species Protection Act 1995*¹
- *Water Management Act 1999*¹

¹ www.thelaw.tas.gov.au

² www.deh.gov.au

3.2 Guiding Documents

The following documents provide information and prescribe policy relevant to this plan:

- Tasmania's Nature Conservation Strategy 2002-2006³
- Threatened Species Strategy for Tasmania 2000³
- State Policy on Water Quality Management 1997³

³ www.dpiw.tas.gov.au

4 VALUES

There are several values associated with the whitebait fishery that are considered in this plan:

4.1 Conservation Of Native And Threatened Fish

- Whitebait runs consist of several native species.
- There are several genetically distinct stocks of Tasmanian whitebait.
- One threatened fish species, Australian grayling, is sometimes associated in whitebait runs.

4.2 Recreational Whitebait Fishery

- Opportunity to obtain whitebait for personal consumption.
- In Australia, such a fishery is unique to Tasmania.

4.3 Recreational Trout Fishery

- Popular sea-run trout fishing associated with whitebait runs.

4.4 Potential Commercial Opportunities

- Future potential commercial wild fishery.
- Potential aquaculture opportunities.

5 VISION AND GENERAL MANAGEMENT GOALS

5.1 Vision Statement

VISION

To provide reasonable access to a recreational whitebait fishery that is managed to ensure long term environmental sustainability.

5.2 Management Goals

The primary management goal is to ensure long-term sustainability of the whitebait fishery so that the fishery remains accessible to future generations of recreational fishers. This requires conservation of the native whitebait species by avoiding over-exploitation and protecting habitat.

6 CONSERVATION OF NATIVE FISH

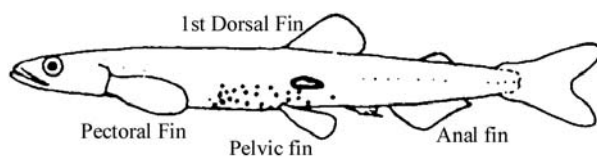
6.1 Introduction

Several native species comprise the whitebait runs, and ensuring that their populations remain healthy and abundant is essential for a sustainable whitebait fishery. A nationally threatened species, the Australian grayling, occurs with some whitebait runs in very small proportions and management will aim to assess the impact of the whitebait fishery on this species.

The basic biology of some whitebait species remains poorly understood. In particular, details of the life history of mudfish and smelt are not known (Fulton 1990). This information is needed to help manage the species sustainably.

The different species of juvenile galaxiids can be difficult to identify due to their small size and less obvious distinguishing features compared to the larger adult fish.

Tasmanian whitebait (*Lovettia sealii*)



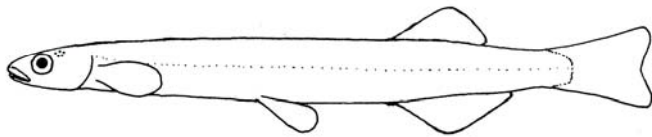
Two dorsal fins; first dorsal fin in front of anal fin. Gonad and swim bladder visible.

For this species it is the pre-spawning adults that are found in the whitebait run, not juveniles as is the case for the other species, hence the species is vulnerable to overfishing. The adult Tasmanian whitebait migrate into the upper estuaries in early spring to spawn. Prior to migration they live in the lower estuaries or the sea. Eggs are attached to submerged rocks or logs. Females produce up to about 350 eggs (Blackburn 1950, Fulton and Pavuk 1988). When the young hatch they drift out to sea to mature and return to spawn the following year. Most *Lovettia* adults die gradually after spawning although a very few apparently survive to two years old (Blackburn 1950). The Frish Company (Quinn and colleagues) found during aquaculture trials that within the one cohort some fish are larger, probably due to differential feeding (Jim Mulcahy *pers. comm.*). The peak of abundance of *Lovettia* in whitebait runs varies with location and from year to year but generally occurs from August to September, and earlier than galaxiids (Fulton and Pavuk

1988). *L. seallii* also occurs in southern Victoria, where it is listed as threatened on the *Flora and Fauna Guarantee Act 1988* (www.nativefish.asn.au).

Genetic studies of *Lovettia* conducted by Pavuk (1994) indicate that there are at least five genetically distinct stocks: north coast (Mersey, Inglis, Leven, Duck rivers); west coast (Pieman River); south-east coast (Derwent River); southern south-east coast (Huon, Catamaran, Lune rivers); Tasman Peninsula (Allans Creek, Parsons Bay Creek).

Jollytail (*Galaxias maculatus*)



Long and slender in shape. Dorsal fin begins directly above origin of anal fin. Five black star pattern on top of head.

Adult jollytails live in streams and migrate down to estuaries in the autumn to spawn. Eggs are deposited in marshes amongst vegetation at the limit of the peak tide and hatch on a following tidal peak two or more weeks later (Benzie 1968, Pollard 1971, McDowall 1984). The young are then washed to sea, returning 5-6 months later as small transparent whitebait in spring or early summer. Jollytails can also maintain landlocked (non-migratory) populations in closed lakes, coastal lagoons and farm dams (Fulton 1990, Pollard 1971). The jollytail runs extend into summer (Fulton and Pavuk 1988).

Climbing galaxias (*Galaxias brevipinnis*)



Anal fin begins behind front half of dorsal fin. Fanned black pectoral fins and expanded pelvic fins carried horizontally and used for climbing. Upper lip may have dark pigment, lower lip usually without pigment. Distinct flat head.

Instead of undergoing extensive migration, climbing galaxias are thought to spawn in the general area of their adult habitat in streams, and along inundated stream edges (O'Connor and Koehn 1998). The larvae are then washed out to sea, returning in spring at about 5-6 months of age to grow into adults. Juveniles move upstream into the adult habitat and spawn at about 2-3 years of age. Their

peak of abundance in whitebait runs appears to be in late October to early November (Fulton and Pavuk 1988). Landlocked populations are widespread in the central highlands and do not form part of the whitebait fishery.

Spotted galaxias (*Galaxias truttaceus*)



Largest of the three juvenile galaxias. Anal fin begins below front half of dorsal fin. Both lips generally have some dark pigment. Distinct black band on tail.

Stream-dwelling populations of spotted galaxias breed in autumn. Like the climbing galaxias, the spotted galaxias is thought to breed in the general area of their adult habitat in streams. After hatching, the larval galaxias are washed out to sea, returning to rivers in the spring. They then move upstream to their adult habitat but do not spawn until about 2 years of age (Humphries 1989). The main peak of their abundance in the whitebait run is in October and the migration period is short (Fulton and Pavuk 1988), making them vulnerable to over-exploitation. Landlocked populations are widespread in the central highlands and do not form part of the whitebait fishery.

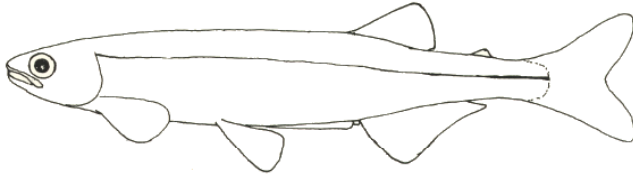
Tasmanian mudfish (*Neochanna cleaveri*)



Anal fin begins just behind dorsal fin. Distinct black band on base of tail. Lots of dark specks on top of head.

Juvenile mudfish are the smallest fish in whitebait runs. Adult mudfish live in swampy areas close to or around the estuaries and are thought to spawn in winter. The larvae move out to sea and return 2-3 months later to form part of the whitebait runs. In the absence of free water, adults may be found in membrane lined pockets in moist areas under logs or rocks (Andrews 1991, Fulton 1990). They are related to the New Zealand mudfishes and also occur in southern Victoria (Koehn and Raadik 1991).

Tasmanian smelt (*Retropinna tasmanica*)



Two dorsal fins; large first dorsal fin above anal fin. Has a characteristic cucumber smell. Is almost identical to Australian grayling juvenile stage differing only in the position of the dorsal fin. This fin is forward of the anal fin on the Australian grayling and above the anal fin on the smelt.

Both juvenile and adult smelt can be found in whitebait runs. The life history of these fish has not been studied in detail, but at least two age classes can be found in the spring migration. The largest of these are mature, suggesting that they are moving upstream to spawn. The larvae are then believed to spend a period at sea.

6.1.1 Other species

Other species in Tasmania which migrate between sea and freshwater to complete their life cycle are the Australian grayling (*Prototroctes maraena*), eels (*Anguilla australis* and *A. reinhardtii*) and lampreys (*Mordacia mordax* and *Geotria australis*). These species also migrate upstream into rivers in spring.

By-catch of non-whitebait species in the recreational whitebait fishery is minor in diversity and magnitude. Medium-sized predatory fish such as yellow-eyed mullet and trout are sometimes captured in the whitebait nets as they chase schools of whitebait. These fish are easily released. Other smaller species of fish have been infrequently recorded and are often sorted and discarded by fishers to avoid contamination of the whitebait catch. The design of the whitebait nets promote the release of fish unharmed back to the water because the nets trap fish and the mesh size is too small to cause entanglement.

Australian grayling are occasionally found amongst whitebait runs (Fulton and Pavuk 1988) whereas juvenile eels (elvers) form separate schools and migrate later from around November and move upstream after sunset. The life history and habitat use of the grayling is poorly known particularly in regard to migration between the sea/estuaries and freshwater. Australian grayling and Tasmanian smelt are both captured as by-catch and can be difficult to distinguish. These fish

are also sensitive to handling. Fishers usually discard both species as they share a characteristic strong cucumber odour when caught.

Available evidence (unpublished data from Fulton and Pavuk's studies) indicates that by-catch of grayling is small and unlikely to have significant impact on populations. However, research may be required to identify types and levels of impacts and determine methods to minimise any grayling by-catch.

Large numbers of very small (20 mm) sandies (*Pseudaphritis urvillii*) have been found with whitebait runs in some north-west rivers.

6.1.2 Habitat protection

Instream barriers that prevent the movement upstream of juvenile fish into adult habitat are one of the major threats to galaxiid whitebait populations. Weirs where whitebait accumulate are also a focus for large scale poaching. During 2001-2002, the IFS conducted a Natural Heritage Trust funded project to improve fish passage by removing weirs in the lower reaches of rivers or in some cases, modified the existing structure to help facilitate fish passage over them. Weirs were removed on Franklin Rivulet, Boobyalla, Little Swanport, Jordan, Browns, North West Bay and Mountain rivers. Fish passes or modifications were made to weirs on the Duck, Rubicon, Tomahawk, Kermandie rivers and Lisdillon Rivulet to aid fish passage (Nelson 2003a, b). The Don River weir was also recently removed. Major fish barriers remain on many coastal rivers (Nelson 2003a).

Many rivers have major hydro-electric dams, which alter the flow regimes in lowland reaches and potentially effect whitebait migrations (McDowall and Eldon 1980) and habitat availability. An experimental flow release was made in the Mersey River to examine effects of improved flows on aquatic communities, but results are not yet available.

The Forth River has several major dams and flows are controlled by Hydro Tasmania according to power demands, resulting in variable river flows. Movement of whitebait upstream is impaired by a weir. Excavation works were conducted below the Forth River weir in 1996 with the aim of minimising the occurrence of mass strandings and deaths of whitebait below the weir during low flows. However, the river bed reverted to its previous arrangement. Strandings have been reduced in recent years by the reduced amount of whitebait reaching the weir, and fortuitous maintenance of flows allowing whitebait to get over the weir using the two fish passes (C. Thompson IFS *pers. comm.* June 2004).

Whitebaiting is not allowed within 100 metres downstream of the weir due primarily to the ease of exploitation of concentrated whitebait resulting from the weir, along with the potential risks associated with the unpredictable downstream water releases resulting from Hydro Tasmania's power generation.

G. maculatus spawns in lowland marshes and these are vulnerable to degradation from land reclamation, stock damage, weed infestation etc. In New Zealand, reed sweet grass (*Glyceria maxima*, previously known as *Poa aquatica*) has been found to be unsuitable for *G. maculatus* spawning habitat but is spreading into marsh areas (Taylor 2002). *Glyceria maxima* is found throughout Tasmania and is one of the most troublesome aquatic weeds (along with cumbungi) (DPIW 2002). Other threats to *G. maculatus* spawning habitat include oil pollution from adjacent boat ramps, leachate from rubbish dumps, mowing of bankside grass, and shading of understorey vegetation by willows (Taylor 2002). In New Zealand surveys were conducted to identify major *G. maculatus* (inanga) spawning sites so that they could be documented and protected (Taylor *et al.* 1992, Taylor 2002) but no such survey has been conducted in Tasmania.

Whitebait populations are impacted by habitat degradation including barriers to movement, water pollution, flow regulation, removal of woody spawning substrate, and alteration of lowland and estuarine marshes. The strandings of large numbers of whitebait below the Forth River weir in low flows is an example of an impact resulting from a barrier to movement.

6.1.3 Threats from pest species

Gambusia (*Gambusia holbrooki*) was rediscovered in Tamar River tributaries in 2001 after a localised population was thought to have been eradicated in 1993. There is a risk that the species will become established and widespread in Tasmania, particularly in warmer lowland waterbodies. It is a major threat to all native fish species, including whitebait species. Research in New Zealand (Baker *et al.* 2004) showed that *Gambusia* caused death to *G. maculatus* by attacking and damaging the caudal fin, and therefore could be a potential threat to the whitebait fishery. Work is being done in Tasmania to eradicate known populations of *Gambusia* where possible, research it's distribution and biology, and develop eradication methods for populations in difficult to manage sites such as riparian wetlands. Increased community understanding of the impacts of pest fish and weeds may help reduce their spread and impacts.

6.1.4 Existing conservation measures

The current management of the whitebait fishery is based on a precautionary management regime to avoid over-exploitation of the fishery.

By limiting the number of waters open to whitebait fishing, and limiting these waters to generally the larger river systems, this ensures there are unexploited populations. The larger fished rivers also provide for high escapement of whitebait as fishing effort is concentrated within a small portion of the cross-section of the river.

The commencement of the season is scheduled to avoid exploitation of Tasmanian whitebait (*L. seallii*), along with limiting the duration of the season on the other species. Fishing times are restricted between sunrise and sunset and the whitebait runs coincide within a period of the year when high flows can sometimes prevent successful fishing.

Further fishing gear restrictions include one net per licensed fisher that must not have wings or similar features to divert whitebait into them or impede them from escaping. Nets must also not exceed a set maximum circumference that also helps to limit harvest.

These regulatory measures are consistent with the conservative approach to the sustainable management of the fishery.

6.2 Issues

The following issues relating to native fish conservation are critical to the sustainability of the recreational fishery:

- Impact on threatened species.
- Maintaining healthy native fish populations.
- Regulation of the fishery to avoid over-exploitation.
- Protection and rehabilitation of habitat.
- Community awareness and support for conservation and habitat protection.

6.3 Goal For Future Management

GOAL

Conserve the native fish populations that constitute the recreational whitebait fishery.



6.4 Objectives

- Minimise impact of whitebait management on Australian grayling and other non-target native species.
- Obtain suitable information on the status of whitebait populations to enable sustainable fishery management.
- Protect and improve habitat for whitebait species, at all life stages (spawning, juvenile and adult habitat).
- Increase public awareness and support for native fish conservation.
- Increase knowledge of whitebait species biology so that regulations can be devised to avoid over-exploitation.
- Prevent the spread of pest fish, in particular *Gambusia*, into further rivers and streams.

6.5 Actions

- Determine the level and assess the significance of impact of the recreational whitebait fishery on Australian grayling. Examine past data on species composition of whitebait runs, and monitor whitebait runs and catches and confiscated illegal catches to determine whether Australian grayling are likely to be impacted by the recreational whitebait fishery.
- Educate fishers and regulate the fishery (e.g. rivers open, season timing) to minimise the impact on Australian grayling.
- Investigate the feasibility of a fishery monitoring program for whitebait species to determine catch size, composition and effort to provide information needed for sustainable management of the recreational fishery.
- Encourage and support research on the biology and habitat of whitebait.
- Develop and implement a public awareness program to increase support for conservation of whitebait species and habitat.
- Advocate, facilitate and conduct habitat protection activities such as instream barrier removal, provision of fish passage and environmental flows, mapping and fencing of estuarine marsh spawning habitat, maintenance of woody substrates for *Lovettia* spawning, maintenance of good water quality, and riparian vegetation improvement.

- Prioritise sites for removal of barriers to upstream movement or installation of effective fish passes.
- Liaise with water management authorities regarding provision of environmental flow requirements of whitebait species.
- Continue to support and participate in the *Gambusia* education, containment and eradication program in collaboration with other groups.

6.6 Responsibilities

- The Inland Fisheries Service is responsible for management of native freshwater fish, pest fish species and for directing provisions for fish passage.
- The Threatened Species Unit (DPIW), administers threatened species legislation, policy and programs and collaborates with other agencies responsible for managing threatened fauna and habitats.
- The Commonwealth Department of Environment and Heritage administers the *Environment Protection and Biodiversity Conservation Act 1999*.
- Water Resources Branch (DPIW), is responsible for management of constructed instream barriers used for gauging river flows and water storage (excluding Hydro impoundments) and provision of environmental flows.

7 RECREATIONAL WHITEBAIT FISHERY

7.1 Introduction

The recreational whitebait fishery was closed along with the commercial fishery in 1974 (IFC 1974, 1977). A regulated recreational fishery for whitebait was reopened for the first time in 1990, following studies by Fulton and Pavuk (1988) which concluded that stocks could support a limited recreational fishery regulated to avoid exploitation of *Lovettia*. The expectation that thousands of recreational licences would be sold and provide significant revenue to support the management of the fishery (Fulton and Pavuk 1988) has not been realised. Initially a specific whitebait licence, not an angling licence, was required to fish. This has changed in recent years where the whitebait licence has been incorporated into an Inland Recreational Fishing Licence. This licence permits the personal consumption of recreational catches and does not permit the sale or trade of whitebait.

Constraints on whitebait management

There are several factors that make it difficult to manage the recreational whitebait fishery, with the main limiting factor, in common with the New Zealand fishery (McDowall 1991, 1996a), being the lack of information required to manage the fishery according to sound biological principles. This information includes knowledge of the current status of populations, replacement rates, amount of catch, escapement and maintenance of adult populations, relative impacts of habitat deterioration and fishing pressure on populations, relationship between size of adult populations and runs, etc. The runs fluctuate significantly between rivers, days and years (Fulton and Pavuk 1988), and the factors contributing to this are largely unknown. However, the difficulties of obtaining such information are considerable, requiring a large, long-term research program (McDowall and Eldon 1980, McDowall 1996a). These large natural fluctuations also mean that detection of any stock decline due to overfishing will be difficult.

The procurement of catch data was attempted for the New Zealand whitebait fishery and proved expensive and unsuccessful, and because of the variability of runs, such data is meaningful only over a long time period (McDowall 1996a). Assessing the possible impact of catches on stock sustainability requires knowledge of the proportion of escapement and controlling factors, non-fishing mortality rates, and the carrying capacity of the adult habitat - all questions requiring major research effort to answer (Allibone *et al.* 1999).

The primary body of research conducted into whitebait biology and the status of populations in Tasmania has been Blackburn (1950) on *Lovettia*, and Fulton and Pavuk (1988) on all whitebait species. Unfortunately, much detail of the methods and results of this latter study remains unpublished.

Since the opening of the recreational fishery in 1990, the Service has conducted only limited monitoring of the fishery:

(i) Creel surveys (1990-1994): The survey program was discontinued because of the demand on IFS resources in relation to the size of the fishery. Such surveys have not been repeated.

(ii) Survey forms provided with the licence at point of sale (1990-2004): The return rate of survey forms was low giving a poor indication of activities of recreational fishers (Fulton 1991, IFS unpublished data). Therefore there are no reliable data on actual catches made during the past whitebait seasons. It is not possible to accurately estimate the illegal harvest either but it is considered significant at times (IFS unpublished data).

(iii) Adult population monitoring (1990-1992): An examination of the impacts of the fishery on resident stream populations of adult *G. maculatus* populations in the Great Forester, Inglis, Mersey and Cam rivers in 1990-92 indicated decreasing numbers at all sites (IFC 1993). Due to doubt over the design of the monitoring program to detect change that could be attributed to the fishery, the monitoring was not continued.

The 1996 Strategic Review of Inland Fisheries Management (Davies and Hussey 1996) recommended the establishment of a monitoring program to assess the state of the resource. The feasibility of this recommendation still needs to be assessed.

The limited knowledge of the biology of whitebait species is also a major limiting factor for management. *Lovettia* lives for one year only, produces a low number of eggs and it is the pre-spawning adults which can be caught as whitebait (Blackburn 1950). A large proportion of *G. maculatus* individuals are also short-lived (McDowall 1996b) making them vulnerable to decline if a recruitment season is poor. Whitebait species predominantly run upstream for only a limited time each year in spring, when they are vulnerable to capture, predation and adverse flow conditions.

Another limiting factor is habitat degradation which affects all species. Whitebait populations will be reduced by degradation including barriers to movement such as weirs and culverts, water pollution from sediment and chemicals, flow regulation and changes to estuarine spawning areas by stock trampling and grazing, weed invasion and removal of woody substrate. These issues are largely outside of IFS legislative authority. However, IFS legislation includes a section relating to fish barriers, and IFS has input into the farm dam approval process.

Fishery regulations

Regulations in relation to season timing, rivers open, methods, and catch limits are designed to limit the catch of whitebait and to provide for significant escapement of fish from fishers, and to focus harvests on *G. maculatus* rather than the easily over-exploited *Lovettia*. A summary of the seasons and rivers open for fishing since 1990 is given in Appendix 1. The allowed catch has remained unchanged at 1 kg maximum per day and up to 10 kg per person for the season, which is equal to the possession limit. Fishing gear has always been limited to a single whitebait net with a maximum circumference of 120 cm, to be used without any structures to divert fish into the net or impede them from escaping. New gear regulations in 1999 required a tag showing the licence number to be attached to the net and for the licensee to remain within 20 m of their set net (IFS 1999).

The season duration has been 4 weeks during September-October. Fishing time has always been restricted to the hours between sunrise and sunset.

In 2003, the season was shifted two weeks later, in response to comments that flooding earlier in the season often disrupts fishing. In New Zealand, flooding appears to stimulate runs (which are largely *G. maculatus*) with large runs occurring once floods have subsided (McDowall and Eldon 1980).

The present management of the recreational fishery has remained substantially unchanged since the recreational season opened in 1990. The fishing regulations were designed to sustain whitebait populations whilst allowing fishers the opportunity to obtain a small catch of whitebait for personal consumption.

Minor alterations have been made to the timing of the season, with the 2004 and 2005 seasons opening and closing 2 weeks later (ie open for the month of October).

Fishery compliance

Extensive illegal activity occurs in relation to whitebait migrations, including out of season fishing, exceeding bag limits, and sale of whitebait. In 1987, prior to opening of a legal fishery, 150 offences in relation to whitebait were listed to be heard in court (Fulton and Pavuk 1988). Illegal sales are reported on the north-west coast, with prices up to \$25 per kg (Davies and Hussey 1996). About 30-40 offences were recorded a year to 1996 which included a high proportion of repeat offenders. In response to the large volumes and sales of illegally caught whitebait, penalties of imprisonment and control orders for fisheries offences were introduced to the *Inland Fisheries Act 1995*.

The Service has tried various strategies to curb and bring whitebait poaching under control with limited success. Additional assistance has been provided by the Tasmania Police and Parks and Wildlife Services compliance rangers who became authorised under the *Inland Fisheries Act 1995* in 1999. A freecall Bushwatch/Fisherman's watch number is available for reporting of illegal activity (1800 005 555), along with Inland Fisheries own number 1 300 INFISH (1 300 463 474).

Improved community awareness about the impacts of illegal fishing could reduce the current level of community acceptance of poaching and support for illegal sales. The community is also a valuable source of information about whitebait poaching, and reporting of illegal activities should be encouraged. The use of media to publicise whitebait seizures and prosecutions has led to new information and further prosecutions.

Whitebait runs continue to be a focus for illegal fishing and sales, although the number of prosecutions has reduced since penal clauses were added to The Act in 2005. The whitebait runs continue to be a priority focus of enforcement effort by the Inland Fisheries.

7.2 Issues

Most of the issues for whitebait fishery management relate to sustainability of the recreational fishery:

- Lack of fishery data.
- Licensing and fees.
- Applicability of legislation and regulations.

- Increasing popularity of the fishery.
- Limiting the fishery to sustainable catch:
 - Season timing
 - Season length
 - Fishing methods
 - Allowable catch
 - Rivers and reaches open to fishing
- Enforcement - poaching and illegal sales.

7.3 Goal For Future Management

In the absence of detailed information on factors effecting populations, the fishery will continue to be managed with a precautionary status quo approach on the basis of the available biological information. Limited information on stocks is available from anecdotal observations and a small number of recreational catch reports, but the most useful data remains that of Fulton and Pavuk (1988) which is now almost 20 years old. This study provided basic information on timing of species runs which enables the open season to be timed to avoid the main *Lovettia* runs. The information available on the life history of the whitebait species (e.g. Blackburn 1950, Humphries 1989, Fulton and Pavuk 1988) enables their vulnerability to over-exploitation and habitat degradation to be considered in the management of the fishery.

GOAL

Provide a reasonable opportunity for fishers to obtain a catch of whitebait for personal consumption at sustainable levels for the fishery.

7.4 Objectives

- Continue to open a seasonal recreational fishery.
- Regulate the fishery to avoid over-exploitation of whitebait species.
- Regulate to allow a reasonable catch for personal consumption.
- Improve the flexibility of fishery regulations.

- Improve legislation and associated regulations to assist effective enforcement of fishery regulations.
- Effectively enforce whitebait fishery regulations.
- Obtain information on catch, effort and native fish populations and ensure sustainable management of the fishery.

7.5 Actions

7.5.1 Collection of fishery data

Issue: Lack of catch effort data for the fishery

Up until 2004, survey forms were provided to whitebait fishers when purchasing a licence, to detail their daily catch and time spent fishing for every water fished. The return rate of these forms was very low thus providing a poor indication of activities of the recreational fisher. There is currently no method used to help estimate total catch of the legal fishery and the effort required to obtain it.

Action:

- Reintroduce a fishers survey form along with providing an appropriate incentive to encourage form returns.

7.5.2 Legislation of fishery

Issue: Lack of flexibility in regulating the fishery

The requirement of the *Inland Fisheries Act 1995* to define regulatory aspects of the fishery on the licence means that changes to the season and/or rivers cannot be altered once the licences are printed and are in use. This limits the Director's ability to extend the season in times of excessive flooding.

Action:

- Evaluate the feasibility of amending The Act to enable the Director to determine the season and rivers open to fishing by Order and Public Announcement.

7.5.3 Increase in licence sales and licence type

Issue: Higher participation in fishery leading to over-exploitation

The past four years has seen a steady but slight increase in licence sales. If this trend continues and the increased participation is not proportional across the north-west, north-east and south-east regions, over time this may potentially start to lead to over-exploitation in some rivers.

Action:

- Monitor licence sale trends for the three different regions across the State to determine if growth in the fishery is evenly distributed.

Issue: Type of licence

There has been some concern from anglers that the whitebait licence fee is too high considering the opportunity to fish is reduced by flooding in the rivers. By increasing the season duration (as recommended above) licence holders will receive better value for the licence fee.

Action:

- Maintain the whitebait licence as an endorsement as part of the inland recreational fishing licence.

7.5.4 Fishery regulations

Issue: Impact of recreational fishing on whitebait populations

A closure of the fishery is not considered appropriate given the strong black market that already exists and thrives despite concerted efforts to curb the market and which would be further encouraged if opportunities did not exist for a participation in a legal fishery. The Service considers a closure may well be counterproductive in the objectives in maintaining some reasonable controls over the total exploitation of the fishery.

Action:

- Maintain the recreational whitebait fishery to be opened on an annual basis according to the regulatory controls recommended below, unless whitebait populations or other species are considered to be in decline.
- Regulate to set fishery season, allowable catch, methods and rivers open as detailed in this plan.

Issue: Season duration and timing

One of the issues of greatest concern for whitebait fishers is the season duration and the timing of the season. Spring rains that result in flooding of rivers can prevent fishing for extended periods during the season. The Service receives many comments about this problem, but it is an unavoidable part of the fishery as runs coincide with heavy spring rains.

A number of options have been considered to provide more opportunity for fishers to access the fishery. These include: a) extension of the season; b) fisher-nominated 4 week period within a longer season which operates in the same manner as short-term trout licences (for example a 4 week licence can be used at a nominated time within an 8 week season); c) a delayed 4 week season to avoid spring rains; d) an increased daily catch limit to allow fishers greater opportunity to catch their season limit; and e) a delayed extended season to avoid spring rains and to provide greater opportunity for fishing.

The complexity in amending The Act in the short term, along with effectively enforcing new flexible season regulations (eg. confusion amongst fishers with differing start dates to seasons that can change from year to year), limits the opportunity to implement some of these options.

The end of the Tasmanian whitebait (*L. sealii*) migration determines the start of the recreational whitebait season. The fishery is managed to minimise exploitation of Tasmanian whitebait. Consequently, the commencement of the whitebait season will not be opened earlier than mid-September.

An analysis of river flows in spring indicates that delaying the season to November is unlikely to reduce the risk of floods.

Action:

- Maintain the commencement of the whitebait season from the first day in October.
- Increase the whitebait season from the current four week season to a six week season.

Issue: Fishing methods

Some problems have arisen when enforcing regulations relating to attendance at nets by fishers. Consequently, regulations will be amended to align them with the regulation governing set rods for anglers, to ensure whitebait fishers

are within 8 metres of their net at all times. The practice of anchoring nets to the riverbank using stakes obtained from breaking branches off nearby vegetation has promoted damage to riparian vegetation, as well as in some instances where willow branches have been used, propagating this weed species. These regulations will reduce damage to riparian vegetation and riverbanks and improve policing of illegal fishing. Nets will have to be either held by hand, staked using a recognised stake (tent peg) or tied off to suitable vegetation.

Action:

- Amend the regulation (10.5.c) so that its is clear that fishers must be within 8 metres of their whitebait net while it is in use.
- Create a regulation that prohibits the use of natural vegetation as any part of a whitebait fishers fishing equipment.
- Maintain the other existing regulations in regard to fishing equipment and methods.

Issue: Allowable catch

The allowable catch on a daily and season basis are aimed at protecting whitebait from over-exploitation by spreading the fishing pressure over time and limiting the total harvest.

Some whitebait fishers have requested an increase in the daily and/or season bag limits. An increase in daily limit would allow opportunity for fishers to take more on days when the runs are good, as there can be many days when whitebait are not running due to river conditions. The season limit could be obtained in fewer days of fishing. Due to the low return rate of fishers' surveys the number of fishers catching the season limit cannot be estimated.

The present daily bag limit of 1 kg and season and possession limit of 10 kg appears to be adequate for providing for personal consumption and to ensure the fishery remains sustainable.

Action:

- The 1 kg daily bag limit and the 10 kg season and possession limit is consistent with providing sufficient catch for personal consumption. Consequently these regulations will not be changed.

Issue: Waters open to whitebait fishing

A number of factors have been considered in determining which rivers and reaches will be open for whitebait fishing. These are:

- ensuring the protection of Tasmanian whitebait;
- sustaining populations of other whitebait species;
- presence of weirs and other structures that impede migrations of whitebait, causing mass aggregations that encourage poaching;
- providing access to the fishery across regions and population centres;
- and avoidance of impact on the sea-run trout fishery.

Rivers or reaches unsuitable for opening include those with:

- limited public access (e.g. Cam River);
- small river size where it is easy to fish the entire river width so there is little escapement of whitebait past the fishing areas for recruitment to upstream river reaches;
- in-stream structures which block whitebait movement (the Forth and Duck rivers will have sections of river closed below the weir);
- reaches of rivers important for *Lovettia* spawning (the lower section of the Mersey River down stream of Frogmore Lane (B19) has been identified as important spawning ground for *Lovettia* and will be closed to fishing).

Most of the rivers presently open to fishing have been open every year since 1990 (Appendix 1). Fulton and Pavuk (1988) recommended that open rivers be rotated each year to spread the fishing pressure. This rotation has not been implemented. In a pre-1990 discussion paper, Fulton proposed that one each of the following pairs of rivers be opened each year in rotation: Duck/Inglis; Leven/Mersey; Tamar/Great Forester; Derwent/Huon.

Closure of a river to whitebait fishing will promote spawning and recruitment of whitebait from that river, and maximise the number of juveniles reaching adult habitat to maintain adult populations and subsequent spawning potential. There has been speculation that whitebait (*Galaxias spp.*) spawned in a specific river will “home” and return to that river, however, there is no evidence to support natal homing of juvenile galaxiids of any species (McDowall 2003). However this may not be the case with Tasmanian whitebait

(*L. seali*) as there are genetically different stocks of this species around the State.

The impact of whitebait fishing on adult galaxias populations (i.e. the amount of escapement needed to maintain adult populations) is unknown. It is likely that in smaller rivers a larger proportion of the migrating galaxiid juveniles are caught and therefore these rivers should be a priority for periodic closure. In larger rivers, a high proportion of the whitebait run is likely to be inaccessible and escape capture, particularly if flows are low enough to allow runs to travel up the middle of the river.

Action:

One of the challenges in the selection of rivers is balancing the need for providing access to rivers near population centres with the need to avoid excessive fishing pressure on particular rivers. A number of rivers have been considered for inclusion in the whitebait fishery to provide fishing opportunities in each region. Most of these rivers have a historical precedent and have been open to the whitebait fishery at some stage since 1991. All the rivers that will be open for whitebait fishing have been loosely classified into two groups based on potential for escapement of fish, river size and fishing pressure.

Type 1 (Open each season) Expected moderate to high escapement of whitebait due to river morphology, large size and generally light fishing pressure (low to moderate).

Type 1 rivers will be open each year for whitebait fishing.

Type 2 (Rotation) Estimated low escapement of whitebait due to small size and generally significant fishing pressure (moderate to high).

Type 2 rivers will be open and closed during the five year plan and alternated with nearby rivers where possible and appropriate.

The rivers will be managed according to a five year schedule which will determine their open/closed status for each season for the period 2006-2010.

South

The Derwent River and the Huon River are very large rivers and their physical nature provides significant opportunities for escapement of fish to pass through areas of fishing. Therefore these two rivers will open every season.

North-East

There are three rivers that will form part of a rotation for the north-east region: the Great Forester River, Little Forester River and the Brid River. There are access problems associated with all these rivers because of private land tenure and restrictions on gaining access to reaches of rivers. The rotation system will be based on the larger Great Forester River alternating with the smaller Little Forester and Brid rivers as shown in Table 1.

North

The Tamar River is a large river that provides significant opportunities for escapement and therefore will be open every season.

North-West

The north-west contains a number of rivers of a variety of sizes that are available to the whitebait fishery.

The Franklin Rivulet will remain open for the next three seasons and will then be closed to future fishing with the Rubicon River then opened to compensate. This will help enable the Franklin River to return to a more natural system in conjunction with the removal of the weir in 2002, while providing whitebait fishers of this water time to adjust. When the Rubicon River is opened, whitebait fishing will be excluded within a 50 metre section of the river below the weir located one kilometre upstream of the Frankford Road (B71).

The Mersey River, Forth River, Leven River and Inglis River, are classified as Type 1 rivers with the Forth and Inglis rivers open each season. However the Mersey and Leven rivers will be seasonally rotated open/closed due to whitebait conservation concerns for these waters.

Significant migrations of Tasmanian whitebait (*L. seallii*) occur in the Mersey River and to provide additional protection to this species, the reach of river below Frogmore Lane (B19) will be closed to fishing.

The Forth River weir is recognised as a partial barrier to whitebait, with large concentrations of fish aggregating below this structure making them susceptible to over-exploitation. Therefore as in the past, a 100 metre section of the river will remain closed to whitebaiting below the weir. The Don River, Black River, Deep Creek, Duck River, and the Montagu River are classified as Type 2 rivers and will be rested through an open/close regime (Table 1.).

The opening and closing of both the Duck River and Montagu River will alternate with the opening and closing of both the Black River and Deep Creek, to alleviate pressure on these Type 2 systems as shown in Table 1. As with the Forth River weir, the weir on the Duck River also concentrates fish making them susceptible to over-exploitation. Therefore as in the past, a 50 metre section of river will remain closed to whitebaiting below the weir.

West

There is assumed to be negligible fishing pressure at the Pieman River and Big Henty River and the physical nature of the rivers provide significant opportunities for escapement of whitebait. Consequently, these two rivers are classified as Type 1 and will remain open each season.

Table 1. Five year schedule of rivers open to whitebait fishing.

Region	River	River Type	Year 1	Year 2	Year 3	Year 4	Year 5
			2006	2007	2008	2009	2010
North East	Great Forester	2					
	Little Forester	2					
	Brid River ¹	2					
North	Tamar River	1					
South	Derwent River	1					
	Huon River	1					
North West	Franklin Rivulet	2					
	Rubicon River ¹	2					
	Mersey River ²	1					
	Don River	2					
	Forth River ³	1					
	Leven River	1					
	Inglis River	1					
	Black River	2					
	Deep Creek	2					
	Duck River ¹	2					
	Montagu River	2					
West	Pieman River	1					
	Big Henty River	1					

¹ Closed within 50 metres downstream of weir

² Upstream of Frogmore Lane (B19)

³ Closed within 100 metres downstream of weir

KEY

OPEN	CLOSED
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7.5.5 Compliance

Issue: There is a relatively high degree of poaching associated with the whitebait fishery in relation to the recreational trout fishery, along with the potential for over-exploitation by licensed fishers.

Actions:

- Review legislation and regulations to determine where changes can be made to assist enforcement of regulations. For example:
 - Imposing an automatic, rather than discretionary, disqualification of repeat offenders from holding a recreational angling or whitebait licence will assist compliance effort.
 - Undertake a review of penalties relating to whitebait offences to ensure they serve as an adequate deterrent and are consistent and commensurate with the type of illegal activity.
- Continue with the implementation of a compliance specific operational plan to guide whitebait compliance activities, including actions to deal with large scale illegal catches and illegal sales of whitebait.
- Develop and implement a public awareness program to reduce support for illegal catches and sales of whitebait and to increase awareness of whitebait values, threats to the sustainability of the fishery and further awareness of regulations governing the fishery. This could include regular media releases, information printed on the whitebait licence, other printed material such as brochures and posters, presentations to schools and clubs, and website material.
- Reporting of whitebaiting offences via the Bushwatch number 1800 005 555 will be promoted along with the Inland Fisheries number 1 300 INFISH (1 300 463 474).

7.6 Responsibilities

- The Inland Fisheries Service is responsible for management and regulation of the recreational whitebait fishery.

8 RECREATIONAL TROUT FISHERY

8.1 Introduction

The sea-run trout fishery is extremely popular amongst anglers with estuarine trout feeding heavily on the whitebait species. While Fulton and Pavuk (1988) considered that trout have not had a significant impact on whitebait on the basis that whitebait were prolific for 80 years in the presence of trout prior to heavy commercial fishing, there is no information about the state of whitebait stocks before trout became established in most rivers in the late 1800's.

Sea-run trout feeding on whitebait are targeted by anglers during the whitebait runs. Some anglers consider that the recreational whitebait fishery impacts on this trout fishery by reducing an important food item for trout. However, research by Nicholls (1958) found that there was no clear evidence that the commercial whitebait fishery had a direct influence on the number of estuarine trout taken, or number present. An apparent difference in trout numbers was thought to be due to catchability rather than abundance, because trout are easier to catch with fly and spinner when they are feeding on the surface during whitebait runs, whereas if there are no whitebait runs the trout can be caught only by bottom fishing (Nicholls 1958, Lynch 1965).

8.2 Issues

- Perceived negative impact of whitebait fishing on sea-run trout fishing.

8.3 Goal for Future Management

GOAL

Minimise impact of whitebait management on sea-run trout angling.

8.4 Objectives

- Increase angler recognition of the minimal impacts between the whitebait fishery and the sea-run trout fishery.
- Regulate the fishery to minimise interaction between whitebait fishers and trout anglers.

8.5 Actions

- Provide appropriate information to anglers so that an informed decision can be made in relation to the minimal impact both fisheries have on each other.
- Manage which rivers and reaches are open, to minimise direct interaction between whitebait fishing and trout angling.

8.6 Responsibilities

- The Inland Fisheries Service is responsible for managing and regulating the recreational trout fishery.

9 COMMERCIAL WILD FISHERY

9.1 Introduction

A commercial fishery for whitebait existed from at least the 1930's until 1974 when the fishery was closed. The commercial fishery was based mainly on *Lovettia* (Blackburn 1950), and the demand for a supply of fish for the canning industry stimulated the rapid expansion of the fishery in the early 1940s (Lynch 1965). Canning ceased in the 1950s and commercial interest subsided markedly (Lynch 1965). There was rapid decline of the fishery after the peak catch of 480 tonnes in 1947. Fulton (1984) considered that the extent of this decline was caused by overfishing. Blackburn (1950) conducted research on whitebait stocks and recommended closure of the northern fishery for a year in 1949 to allow recovery of the fishery, and the establishment of quotas for subsequent seasons. The fishery was re-opened in 1950 but continued to remain in decline, dropping to 1,010 kg in 1972, with the fishery finally closed after the 1974 season. Control of the fishery was transferred from The Tasmanian Fisheries Division to the Inland Fisheries Commission in 1965 (Fulton 1984).

No legal commercial fishery has operated since 1974, and in view of the past situation with commercial over-exploitation of stocks, and in the absence of evidence that stocks could now support a commercial fishery, the Service considers that a commercial whitebait fishery based on the harvest of wild fish is not sustainable or desirable.

9.2 Issues

- Sustainability of whitebait populations.
- Illegal harvest and sales.
- Commercial viability of whitebait.

9.3 Goal For Future Management

GOAL

Protect whitebait species and populations from the impacts of commercial fishing.

9.4 Objectives

- Protect the recreational whitebait fishery from the potential over-exploitation associated with a commercial fishery.

9.5 Actions

- Maintain the closure of the commercial fishery for whitebait.

9.6 Responsibilities

- The Inland Fisheries Service is responsible for managing and regulating commercial freshwater fisheries.

10 AQUACULTURE

10.1 Introduction

Fulton and Pavuk (1988) proposed that an investigation of the potential for aquaculture of whitebait should be encouraged as an alternative to wild harvests of natural stocks. Experimental trials were conducted in Tasmania on the aquaculture of the whitebait species *L. seallii* in 1987-1991 by Frish (Ben Quinn and colleagues) and *G. maculatus* (University of Tasmania School of Aquaculture). Culture of *Lovettia* on a commercial basis was not found to be viable due to the large feeding effort required for the 12 months leading to fish maturity (J. Mulcahy, J. Purser *pers. comm.*). To facilitate these trials, whitebait were listed as a 'declared fish' (permitted to be farmed) and 'applicable fish' (permitted to be processed and sold) under the *Inland Fisheries Act 1995*.

In New Zealand there is one extensive commercial operation which raises *G. maculatus* larvae for ocean 'ranching', with the intention that the juveniles return to their natal waters (Mitchell 2002). However, it has not been demonstrated that such 'homing' actually occurs, and the operation is considered unlikely to be successful in increasing whitebait runs (McDowall 2003).

There are presently no aquaculture trials in progress, although the University of Tasmania is interested in continuing earlier work on *Lovettia* and *G. maculatus* (J. Purser *pers. comm.*).

Davies and Hussey (1996) considered that there was still scope for further exploration of the commercial aquaculture potential of whitebait species, but development of any commercially viable aquaculture for either *Lovettia* or Galaxiid species is likely to be several years away. *Lovettia* culture in the foreseeable future is unlikely to be economic because they require a year of growth feeding on zooplankton before being marketable. However, in the absence of any legal commercial wild fishery, the implications of sale of cultured whitebait on poaching of wild stocks needs to be assessed before aquaculture is encouraged. Creation of a legal market and the problems of distinguishing illegally caught fish from cultured whitebait may increase the current black market for wild caught whitebait and make policing more difficult.

10.2 Issues

- Creation of a legal market may increase illegal catches and sales.
- Commercial-scale aquaculture methods for whitebait are not yet available.
- Long growth period of *Lovettia*.

10.3 Goal For Future Management

GOAL

Protect whitebait species and populations from impacts resulting from aquaculture.

10.4 Objectives

- Ensure that any potential whitebait aquaculture will not have negative effects on wild populations.

10.5 Actions

- Examine the implications of commercial whitebait aquaculture for wild whitebait species and populations, prior to any aquaculture venture being permitted.
- Support aquaculture research and development if anticipated effects of commercial aquaculture on wild populations are demonstrated to be not significantly negative.

10.6 Responsibilities

- The Inland Fisheries Service is responsible for managing and regulating the aquaculture and sale of whitebait.

11 IMPLEMENTATION, EVALUATION, REVIEW AND AMENDMENTS

11.1 Implementation Of The Plan

This plan will be implemented after it has been approved by the Director of Inland Fisheries.

A schedule of implementation of actions in this and other management and recovery plans will be developed on an annual basis and included in all operational plans.

To ensure that proper and sufficient progress of this plan is achieved, the Service will prepare an annual report reviewing the implementation of this plan and evaluation of management actions.

It is intended that this plan will remain as a guide for whitebait fishery management for five years.

11.2 Evaluation Of The Plan

The evaluation of this plan will be undertaken at two levels - project or action level, and at a planing level. Individual actions will be monitored and progress towards completion evaluated and reported on regularly. This monitoring will provide the basis for higher level evaluation of this plan which will occur annually and be reported to the Inland Fisheries Advisory Council (IFAC) and the Minister and be presented in annual reports.

11.3 Review Of The Plan

This plan will have a life of five years but it will remain applicable until superseded by a reviewed plan. The plan will be opened to public review towards the end of the five year term.

11.4 Amendments To The Plan

Any person seeking to amend this plan should make a written submission to the Director of Inland Fisheries. Submissions should clearly state the nature of the amendment, the reasons for the amendment and, if submitted on behalf of an organisation, contain a statement of support by that organisation. Submissions should also provide evidence that the proposed amendment embraces the goals

Whitebait Fishery Management Plan

and objectives of the fishery management plan and does not contravene the management requirements of other organisations.

The Director of Inland Fisheries may seek advice from IFAC and other relevant bodies about any submission. Any submission sent to the Director will be open to public scrutiny if an application is made to view the submission. The Director of Inland Fisheries will determine whether to accept or reject the proposed amendment.

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APPENDIX 1

Dates, rivers open and number of licences sold for recreational whitebait seasons. Data from IFS files, newsletters and annual reports.

Season	Open Dates	Rivers Open	No. of Licences Sold
1990	22 Sept -14 Oct	Pieman; Duck; Black; Deep Ck; Inglis; Franklin Rvt; Tamar; Great Forester; Ringarooma; Derwent; Huon	583 (Fulton 1991)
1991	21 Sept -20 Oct	as above plus Don; minus the Ringarooma	564 (IFS newsletter 21(1))
1992	26 Sept -25 Oct	as above plus Big Henty	470
1993	25 Sept -24 Oct	as above	500
1994	24 Sept -23 Oct	as above	408
1995	23 Sept -22 Oct	as above	588
1996	21 Sept -20 Oct	as above	478
1997	20 Sept -19 Oct	as above	611
1998	19 Sept -18 Oct	as above	591 (annual report)
1999	18 Sept -17 Oct	as above plus Forth	628 (IFS 2002)
2000	16 Sept -15 Oct	as above	549 (IFS 2002)
2001	15 Sept -14 Oct	as above	606 (IFS 2002)
2002	14 Sept -13 Oct	as above	497 (IFS 2003)
2003	27 Sept- 26 Oct	as above	563 (IFS 2004)
2004	01 Oct -31 Oct	as above	761 (IFS 2005)
2005	01 Oct -31 Oct	as above	777 (IFS 2006)

APPENDIX 2

Summary of Actions and Implementation Schedule

A. Conservation of Native Fish			Time Frame	
Goal	Conserve the native fish populations that are fished by the recreational whitebait fishery.	Responsibility	Short Term (1-2 years)	Medium Term (1-5 years)
Objective	Minimise impact of whitebait management on Australian grayling and other non - target native species.			
Action	<ul style="list-style-type: none"> Determine the level and assess significance of impact of the recreational whitebait fishery on Australian grayling. Examine past data on species composition of whitebait runs, and monitor whitebait runs and catches and confiscated illegal catches to determine whether Australian grayling are likely to be impacted by the recreational whitebait fishery. 	IFS		
Action	<ul style="list-style-type: none"> Educate fishers and regulate the fishery (e.g. rivers open, season timing) to minimise the impact on Australian grayling. 	IFS		
Objective	Obtain suitable information on the status of whitebait populations to enable sustainable fishery management.			
Action	<ul style="list-style-type: none"> Investigate the feasibility of a fishery monitoring program for whitebait species to determine catch size, composition and effort to provide information needed for sustainable management of the recreational fishery. 	IFS		
Action	<ul style="list-style-type: none"> Encourage and support research on the biology and habitat of whitebait. 	IFS		
Objective	Protect and improve habitat for whitebait species, at all life stages (spawning, juvenile and adult habitat).			
Action	<ul style="list-style-type: none"> Advocate, facilitate and conduct habitat protection activities such as instream barrier removal, provision of fish passage and environmental flows, mapping and fencing of estuarine marsh spawning habitat, maintenance of woody substrates for <i>Lovettia</i> spawning, maintenance of good water quality, and riparian vegetation improvement. 	IFS & DPIW		
Action	<ul style="list-style-type: none"> Prioritise sites for removal of barriers to upstream movement or installation of effective fish passes. 	IFS		
Action	<ul style="list-style-type: none"> Liaise with water management authorities regarding provision of environmental flow requirements of whitebait species. 	IFS & DPIW		
Objective	Increase public awareness and support for native fish conservation.			
Action	<ul style="list-style-type: none"> Develop and implement a public awareness program to increase support for conservation of whitebait species and habitat. 	IFS		

Objective	Increase knowledge of whitebait species biology so that regulations can be devised to avoid over-exploitation.			
Action	<ul style="list-style-type: none"> Research on the biology and habitat of whitebait will be encouraged and supported by the Service. 	IFS		
Objective	Prevent the spread of pest fish, in particular <i>Gambusia</i>, into further rivers and streams.			
Action	<ul style="list-style-type: none"> Continue to support and participate in the <i>Gambusia</i> education, containment and eradication program in collaboration with other groups. 	IFS		

B. Recreational Whitebait Fishery			Time Frame	
Goal	Provide reasonable opportunity for fishers to obtain a catch of whitebait for personal consumption at sustainable levels.	Responsibility	Short Term (1-2 years)	Medium Term (1-5 years)
Objective	Continue to open a seasonal recreational fishery.			
Action	<ul style="list-style-type: none"> Maintain the recreational whitebait fishery to be opened on an annual basis according to the regulatory controls recommended, unless whitebait populations or other species are considered to be in decline. 	IFS		
Action	<ul style="list-style-type: none"> Regulate to set fishery season, allowable catch, methods and rivers open as detailed. 	IFS		
Action	<ul style="list-style-type: none"> Maintain the whitebait licence as an endorsement as part of the inland recreational fishing licence. 	IFS		
Objective	Regulate the fishery to avoid over-exploitation of whitebait species.			
	<ul style="list-style-type: none"> Monitor licence sale trends for the three different regions across the State to determine if growth in the fishery is evenly distributed. 			
Action	<ul style="list-style-type: none"> Rivers open for fishing will be classified according to size and fishing pressure. Seasons for smaller rivers sustaining higher pressure will be rotated with other same classified rivers. 	IFS		
	<ul style="list-style-type: none"> Rivers will be managed according to a five year schedule that will determine their open/closed status for each season. 			
Objective	Regulate to allow a reasonable catch for personal consumption.			
Action	<ul style="list-style-type: none"> Maintain the 1 kg daily bag limit and the 10 kg season and possession limit. 	IFS		
Action	<ul style="list-style-type: none"> Maintain the commencement of the whitebait season from the first day in October. 	IFS		
	<ul style="list-style-type: none"> Increase the whitebait season from the current four week season to a 			

	six week season.			
Objective	Improve the flexibility of fishery regulation.			
	<ul style="list-style-type: none"> Evaluate the feasibility of amending The Act to enable the Director to determine the season and rivers open to fishing by Order and Public Announcement. 	IFS		
Objective	Improve legislation and associated regulations to assist effective enforcement of fishery regulations.			
Action	<ul style="list-style-type: none"> Amend the regulation (10.5.c) so that its is clear that fishers must be within 8 metres of their whitebait net while it is in use. 	IFS		
Action	<ul style="list-style-type: none"> Create a regulation that prohibits the use of natural vegetation as any part of a whitebait fishers fishing equipment. 	IFS		
Action	<ul style="list-style-type: none"> Maintain the other existing regulations in regard to fishing equipment and methods. 	IFS		
Objective	Effectively enforce whitebait fishery regulations.			
Action	<ul style="list-style-type: none"> Review legislation and regulations to determine where changes can be made to assist enforcement of regulations. 			
Action	<ul style="list-style-type: none"> Continue with implementation of the Compliance Operational Plan to guide whitebait compliance activities, including actions to deal with large scale illegal catches and illegal sales of whitebait. 	IFS		
Action	<ul style="list-style-type: none"> Develop and implement a public awareness program to reduce support for illegal catches and sales of whitebait. Increase awareness of whitebait values and threats to the viability of the fishery and further awareness of regulations governing the fishery. 	IFS		
Action	<ul style="list-style-type: none"> Reporting of whitebaiting offences via the Bushwatch number 1800 005 5 55 will be promoted along with the Inland Fisheries number 1 300 INFISH (1 300 463 474). 	IFS		
Objective	Obtain information on catch, effort and native fish populations and manage to ensure sustainability.			
Action	<ul style="list-style-type: none"> Reintroduce a fishers survey form along with providing an appropriate incentive to encourage form returns. 	IFS		
Action	<ul style="list-style-type: none"> Investigate the feasibility of a population monitoring program for whitebait species to determine catch size, composition and effort to provide information needed for sustainable management of the recreational fishery. 	IFS		

C. Recreational Trout Fishery			Time Frame	
Goal	Minimise impact of whitebait management on sea-run trout angling.	Responsibility	Short Term (1-2 years)	Medium Term (1-5 years)
Objective	Increase angler awareness of the minimal stock impacts associated with whitebait fishing and the sea-run trout fishery.			
Action	<ul style="list-style-type: none"> Provide appropriate information to anglers so that an informed decision can be made in relation to the minimal impact both fisheries have on each other. 	IFS		
Objective	Regulate the fishery to minimise interaction between whitebait fishers and trout anglers.			
Action	<ul style="list-style-type: none"> Manage which rivers and reaches are open, to minimise direct interaction between whitebait fishing and trout angling. 	IFS		

D. Commercial Wild Fishery			Time Frame	
Goal	Protect whitebait species and populations from the impacts of commercial fishing.	Responsibility	Short Term (1-2 years)	Medium Term (1-5 years)
Objective	Protect the recreational whitebait fishery from the potential over-exploitation associated with a commercial fishery.			
Action	<ul style="list-style-type: none"> Maintain the closure of the commercial fishery for whitebait. 	IFS		

E. Aquaculture			Time Frame	
Goal	Protect whitebait species and populations from impacts resulting from aquaculture.	Responsibility	Short Term (1-2 years)	Medium Term (1-5 years)
Objective	Ensure that any potential whitebait aquaculture will not have negative effects on wild populations.			
Action	<ul style="list-style-type: none"> Examine the implications of commercial whitebait aquaculture for wild whitebait species and populations, prior to any aquaculture venture being permitted. 	IFS/Industry		
Action	<ul style="list-style-type: none"> Support aquaculture research and development if anticipated effects of commercial aquaculture on wild populations are demonstrated to be not significantly negative. 	IFS		