

**SCOPING STUDY OF THE
POTENTIAL SPREAD AND IMPACT OF THE
EXOTIC FISH ORIENTAL WEATHERLOACH
IN THE MURRAY-DARLING BASIN,
AUSTRALIA:**

A Draft Management Strategy

Funded under the
Murray-Darling 2001 FishRehab Program

(A program of the Natural Heritage Trust)

Produced by
Freshwater Ecology
Arthur Rylah Institute for Environmental Research

2002



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Title **Scoping study of the potential spread and impact of the exotic fish Oriental weatherloach in the Murray-Darling Basin, Australia: A draft management strategy.**

Produced by **Wayne M. Koster, Tarmo A. Raadik and Pam Clunie**

Freshwater Ecology, Arthur Rylah Institute for Environmental Research

PO Box 137 Heidelberg Victoria 3084

Telephone: (03) 9450 8600

Facsimile: (03) 9450 8730

Produced for **Agriculture, Fisheries and Forestry – Australia.**

Contact **Sue Grant**

Murray-Darling Basin Policy and Programs

Telephone: (02) 6272 5922

Facsimile: (02) 6271 6448

Date **August 2002**

ACKNOWLEDGMENTS

We wish to thank the following people who contributed to the production of this document:

First and foremost, the steering committee which comprised:

- Peter Gillard and Sue Grant, AFFA, Canberra
- Mark Lintermans, Environment ACT, Canberra
- Rachel Mackenzie, Queensland DPI, Brisbane
- Bob Faragher, NSW Fisheries, Cronulla, Sydney.

A copy of a draft of this document was also forwarded to the Pest Animal Control Cooperative Research Centre for review.

The following people from Freshwater Ecology, Arthur Rylah Institute for Environmental Research, provided comment on an earlier version of this document: Belinda Cant, Paul Close, Sabine Schreiber and John Koehn.

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1 INTRODUCTION

As part of the Murray-Darling 2001 FishRehab Program, the *Freshwater Ecology Section* of the Victorian Department of Natural Resources and Environment (DNRE) was commissioned by Agriculture, Fisheries and Forestry Australia (AFFA), to undertake a scoping study to determine the potential spread and impacts of the exotic fish Oriental weatherloach (*Misgurnus anguillicaudatus*) within the Murray-Darling Basin (MDB). This study was based on a thorough collation of available information on the biology, ecology and distribution of the species within and outside of the MDB, including overseas.

The specific tasks of this project were to:

1. Define the potential risk and impacts of Oriental weatherloach to aquatic ecosystems in the MDB;
2. Define factors or conditions influencing the spread of Oriental weatherloach within the MDB;
3. Document the rate and pattern of spread of Oriental weatherloach;
4. Form the basis for a management strategy for the species within the MDB;
5. Scope potential pest species management strategies for containment, reduction or eradication programs;
6. Identify knowledge gaps and priorities for research and management;
7. Increase awareness of the species in the MDB with community groups, government agencies such as fisheries and water managers, other basin users, and the aquarium industry; and
8. Develop a program to allow for community input in monitoring the future spread of Oriental weatherloach in the MDB.

The project included input from key representatives from NSW Fisheries (Bob Faragher), Queensland Department of Primary Industries (Rachel Mackenzie), Environment ACT (Mark Lintermans), Victoria's DNRE and other relevant personnel. The states and territories listed above are those where established populations of Oriental weatherloach have previously been recorded.

A literature review was conducted to define the biology and ecology of Oriental weatherloach, identify factors responsible for the continued spread of the species, determine the distribution and potential range of the species, and assess the potential risks and impacts

of the species. A resource document was developed based on the review of literature: *Scoping study of the potential spread and impact of the exotic fish Oriental weatherloach in the Murray-Darling Basin, Australia: A resource document* (Koster *et al.* 2002).

A draft strategy was also developed to provide a framework to guide future management of Oriental weatherloach in the MDB by the community and resource managers. This report represents the draft strategy.

2 SCOPE OF STRATEGY

This document proposes a framework to guide development of a management strategy for Oriental weatherloach in the MDB. It is based on a review of literature and current understanding of the risks and impacts of Oriental weatherloach to aquatic ecosystems in the MDB.

The Strategy should seek to achieve the following outcomes:

- A coordinated approach to the management and control of Oriental weatherloach. This includes preventing the further spread of Oriental weatherloach and application of control/eradication programs.
- Increased community awareness of Oriental weatherloach and its ecological/social/economic impact.
- Increased understanding of the distribution and potential spread of Oriental weatherloach.
- Increased understanding of the impact of Oriental weatherloach on native fish and the aquatic environment.

The Strategy should apply the following principles based on those used in the *Draft Native Fish Strategy for the Murray-Darling Basin 2001-2012* (MDBC 2002), *Control of exotic pest fishes – an operational strategy for Queensland freshwaters 2000-2005* (DPI 2000) and *National Management Strategy for Carp Control 2000-2005* (MDBC 2000):

- The 'Precautionary Principle'.
- The presence of Oriental weatherloach is not conducive to the maintenance of biodiversity.
- The spread of Oriental weatherloach through human activities should be minimised.
- Control should be based on pest management principles, which aim to reduce any impacts, rather than on complete eradication of numbers.
- Control should be based on best practice management and underpinned by scientific evidence.
- Management measures should focus on the containment of Oriental weatherloach within their present range and control measures in priority areas of infestation.

- It is important to increase awareness of the problems associated with the spread of Oriental weatherloach.
- Legislation must be consistent between states/territories.

The document is divided into two parts. The first part (Background Information) provides a context for the management and control of Oriental weatherloach in the MDB. A more detailed assessment of the biology, ecology, physiology, behaviour, previous invasions, and potential risks and impacts of Oriental weatherloach are provided in the accompanying resource document (Koster *et al.* 2002). The second part (The Strategy) establishes goals and discusses the actions that may be required to achieve them.

3 BACKGROUND INFORMATION

3.1 Distribution

Worldwide

Oriental weatherloach has a broad distribution worldwide. The species naturally occurs in Thailand, southeastern Russia, China, Japan, Korea, Taiwan, Vietnam and Burma. Established feral populations are known to exist in the USA, Mexico, Palau, the Philippines and Australia.

Australia

Once a popular aquarium fish in Australia, the importation of Oriental weatherloach was banned in 1986 because of concern over its potential spread into the wild. The first population of Oriental weatherloach was recorded in the Yarra River in 1984; the population was probably the result of dumping unwanted aquarium fish.

Since initial records of Oriental weatherloach in the wild in the early 1980s, the species has now established in many parts of New South Wales (NSW), Victoria and the Australian Capital Territory (ACT). There have also been limited records of this species in Queensland. Oriental weatherloach are now established in both the MDB and several coastal drainages in southeastern Australia.

Murray-Darling Basin

It is believed Oriental weatherloach initially escaped into the MDB when an ornamental dam at Wandiligong on the Ovens River flooded in 1980. Populations of Oriental weatherloach currently exist in the south and southeastern part of the MDB in the Murrumbidgee River system (NSW and ACT) and upper Murray River and tributaries (NSW and Victoria). There is also an unconfirmed anecdotal report of Oriental weatherloach in the lower River Murray in South Australia from the late 1980s.

3.2 Movement

Since its release into the wild, Oriental weatherloach has spread relatively rapidly across a number of areas both within and outside the MDB in NSW and Victoria. The spread of Oriental weatherloach in Australia has probably been facilitated by several factors.

These include:

- Dumping of unwanted aquarium fish,
- Water diversion schemes for irrigation supply and the associated creation of modified habitats such as ricefields,
- Illegal use as baitfish by anglers and,
- Natural dispersal.

3.3 Characteristics

Oriental weatherloach is considered to have a range of characteristics that make it a successful invader. These include longevity, high reproductive potential, flexible diet, broad tolerances to particular environmental conditions such as temperature and oxygen, and low vulnerability to predation because of its burrowing habit.

3.4 Impact

The introduction of a species into an area outside its natural range may result in a number of direct and indirect impacts. Oriental weatherloach have established feral populations in several countries, although evidence for the adverse impact of the species is largely speculative. Possible impacts may include competition with native fish species for spawning sites, disturbance or predation of eggs and juveniles, competition for food and shelter, and alteration of habitat (eg. stirring up sediment and uprooting plants).

Whilst we know little about the potential impact of Oriental weatherloach, experience in pest management in Australia suggests a precautionary approach should be applied. For example, there is growing evidence of the detrimental impact of carp (*Cyprinus carpio*), though much research is still being conducted 30 years after their rapid expansion in the MDB. Oriental weatherloach possess many of the characteristics that have aided in the successful spread and establishment of exotic species such as carp, including environmental adaptability, high competitive ability, high reproductive output, high survivorship and high dispersal ability. Precautionary approaches to minimise the risk of future introductions, and pest management principles to address existing introductions (MDBC 2002), should be applied within and outside of the MDB.

Oriental weatherloach is listed in the *Draft Native Fish Strategy for the Murray-Darling Basin 2001-2012* (MDBC 2002) as a key threat to native fish management in the MDB with four other exotic species (trout, redfin *Perca fluviatilis*, gambusia *Gambusia holbrooki* and carp). Oriental weatherloach was ranked the 5th most significant aquatic pest species out of a total of 13 species in the MDB as part of a questionnaire sent to experts to obtain information on

pest species in the MDB (Clunie *et al.* 2002). Surprisingly, goldfish (*Carassius auratus*) was ranked 3rd, which may reflect this species being well known compared to Oriental weatherloach and other species. Based on the information collated in *Scoping study of the potential spread and impact of the exotic fish Oriental weatherloach in the Murray-Darling Basin, Australia: A resource document* (Koster *et al.* 2002), it is suggested that the ranking applied to Oriental weatherloach should be higher.

3.5 Existing Legislation

Oriental weatherloach is banned from importation into Australia under Part 13A of the *Environment Protection and Biodiversity Conservation Act 1999* and declared noxious in Queensland (*Fisheries Act 1994*) and Victoria (*Fisheries Act 1995*), and classed as exotic in South Australia (*Fisheries Regulations 2000*).

4 THE STRATEGY

Goal 1. A coordinated approach to the management and control of Oriental weatherloach

A range of public authorities are responsible for the management and control of pest species such as Oriental weatherloach. Programs for the management of pest species often tend to be highly variable in their approach, methodology and success. While Oriental weatherloach are commonly recorded in fish surveys in particular areas, there is no documented evidence of any large scale attempts to contain, reduce or eradicate this species. A range of existing and approved control techniques should be trialed under different environmental conditions and habitats to identify their practicality, specificity and effectiveness. Improved liaison and information transfer is also required to enable better planning of control programs. There is also a need to develop consistency in legislation, particularly in areas such as the use of live bait. A rapid response plan to investigate and manage new reports of Oriental weatherloach locations is also required to prevent further spread of Oriental weatherloach populations.

Objective:

- *Develop consistency in the management and control of Oriental weatherloach across the MDB.*
- *Facilitate a rapid and coordinated response to range expansions or new incursions of Oriental weatherloach in the MDB (see also Goal 3).*

A consistent set of guidelines for best management practice to ensure management programs are undertaken effectively and efficiently will contribute to the coordinated management and control of Oriental weatherloach in the MDB. These guidelines could be incorporated into an easily accessible information package for managers, as well as other interest and user groups responsible for Oriental weatherloach control. To improve communication between Oriental weatherloach management projects within the MDB, the information package could include contact details for relevant government bodies and individuals experienced in control of biological invasions. A rapid response system to ensure a standard plan is implemented as soon as there is a new record of Oriental weatherloach will ensure that the chances of successful eradication are maximised. This plan should include information on control techniques including details of the costs and benefits of each technique, their applicability and practicality for a range of areas and conditions, relevant controls and legislation relating to techniques, standard methodology, and reporting and documentation requirements. The establishment of a national body with responsibility for coordinating exotic fish issues is also considered a key management issue.

Goal 2. Increased community awareness and understanding of Oriental weatherloach

Community awareness and increased understanding of the potential impacts of the spread of Oriental weatherloach is an important component of the management of this species. The spread of exotic fish is often inadvertent or the result of a lack of understanding of their impacts on native species and aquatic ecosystems (DPI 2000). For example, two key factors thought responsible for the spread of Oriental weatherloach in the MDB are water diversion schemes and the use of Oriental weatherloach as live bait by anglers (Koster *et al.* 2002). Anecdotal reports of the continuing sale of Oriental weatherloach in aquarium shops suggest that the aquarium trade may also still represent a factor assisting the dispersal of this species into the wild. Reports of Oriental weatherloach infestations at new sites near residential areas may indicate that the release of unwanted aquarium fish still occurs (eg. Maribyrnong River, Melbourne).

An education campaign is required to inform the community (in particular anglers and aquarists) and natural resource management agencies (in particular water authorities) of the potential impacts of Oriental weatherloach, factors leading to their spread (eg. use as bait, water transfer schemes), and the role the public can play in minimising their spread (eg. detecting and reporting Oriental weatherloach to appropriate authorities). Educational material to enable communities to accurately identify Oriental weatherloach would also be required (see also Goal 3).

Objective:

- *To increase awareness amongst the community and natural resource managers of the potential impacts and spread of Oriental weatherloach in the MDB.*

An educational strategy to inform the community and natural resource management agencies of the potential impacts and spread of Oriental weatherloach may involve targeted information packages designed for a range of groups and a coordinated media campaign (eg. television, newspaper and radio advertisements). The focus of the campaign could include encouraging the community to assist in monitoring the distribution and spread of Oriental weatherloach, increasing understanding of how and why Oriental weatherloach are identified as 'pests' and increasing public involvement and ownership of the issue of Oriental weatherloach.

Goal 3: Determine the distribution and spread of Oriental weatherloach

The effective management and control of Oriental weatherloach requires information on distribution and their rate of spread. Although survey and anecdotal information have been collated to define the distribution of Oriental weatherloach in the MDB, most of this existing data comes from miscellaneous surveys across the species' range rather than those that specifically target Oriental weatherloach. There is a need to clarify the distribution and abundance of Oriental weatherloach in the MDB, by either adding value to existing survey programs or initiating strategic targeted surveys, particularly in areas at the edge of its suspected range and in the vicinity of unconfirmed reports. Individuals and communities can also contribute to an improved knowledge of the distribution and spread of Oriental weatherloach in the MDB by helping to detect and report Oriental weatherloach to appropriate authorities.

Objective:

- *To clarify the distribution and abundance of Oriental weatherloach in the MDB.*

To increase the information provided by existing survey programs on the distribution of Oriental weatherloach, it may be necessary to provide input into the planning stages of such programs to ensure Oriental weatherloach are considered and identified.

A program to increase the information provided by the community on the distribution of Oriental weatherloach is outlined below.

□ Part 1. Community Involvement

Promote the role the public can play in helping to detect and report Oriental weatherloach. The *Draft Native Fish Strategy for the Murray-Darling Basin 2001-2012* (MDBC 2002) highlights the importance of community engagement in controlling and managing alien fish species. In the case of Oriental weatherloach this is particularly relevant. For example, during a recent community awareness campaign to inform the community and responsible agencies of the project *Potential spread and impact of Oriental weatherloach in the Murray-Darling Basin* (Koster *et al.* 2002), many reports of Oriental weatherloach were obtained from anglers, water managers, fisheries biologists and other community members. This information has contributed to an improved understanding of the distribution and factors leading to the spread of Oriental weatherloach.

□ Part 2. Species Identification

Develop and disseminate material to enable communities to accurately identify Oriental weatherloach. Oriental weatherloach are sometimes confused with freshwater catfish (*Tandanus tandanus*), blackfish (*Gadopsis* spp.) and eels (*Anguilla australis*). Educational material should clearly outline the distinguishing attributes of Oriental weatherloach (eg. size, colour, five pairs of barbels around the mouth). Information could be displayed in recreational fishing guides, magazines, bait and tackle shops, local newspapers, and fisheries and natural resource management offices.

□ Part 3. Reporting and Response.

Once Oriental weatherloach is detected it needs to be reported to appropriate authorities. This may involve a phone service where people can provide details such as name, contact number, capture date, location and total length, and a follow-up service to confirm the presence of the species (eg. an on-site visit or sending specimens to relevant authorities). As soon as there is a report of a new population a standard plan should be implemented to maximise chances of successful control. There is also a need to develop a database to incorporate information obtained from survey programs and community monitoring. This will assist in determining how widespread Oriental weatherloach are and assist in planning control measures.

Goal 4. Research on the biology and ecology of Oriental weatherloach

The factors that influence the distribution and abundance of Oriental weatherloach are not well known. Oriental weatherloach are apparently absent from estuarine and saline waters. Salinity levels may represent a physiological barrier to the species' spread. Evidence from Australia and overseas suggests that irrigation channels and high flows may assist the dispersal of Oriental weatherloach, although the significance and timing of these movements are unclear. An improved understanding of how environmental conditions affect population density, structure, dynamics, growth rates and dispersal will assist in improving management of aquatic systems to control the species.

Little is known about the impacts of Oriental weatherloach on aquatic ecosystems. Oriental weatherloach may compete with native species for food, shelter and breeding sites, prey upon eggs, juveniles or adults of native species, or spread disease. Oriental weatherloach are reported to have a mutually exclusive distribution with the native mountain galaxias (*Galaxias olidus*) in Halls Creek, ACT (Lintermans *et al.* 1990). Lintermans *et al.* (1990) suggests that this may represent exclusion by Oriental weatherloach or exploitation of habitat unsuitable to mountain galaxias. Oriental weatherloach may also indirectly affect native species and the aquatic environment by modifying conditions such as altering water quality. There is a need for targeted research to clarify and quantify any impacts of Oriental weatherloach on native species and aquatic environments.

More research is also required on the methods to contain and control Oriental weatherloach. Very few methods to control Oriental weatherloach have been trialed in Australia, or overseas. Available information on trials on these trials confirm that they are generally 'one off' events, rather than systematic evaluations of various methods under different conditions.

Objectives:

- *To investigate the dispersal behaviour of Oriental weatherloach.*
- *To determine the impacts of Oriental weatherloach on native species and the aquatic environment.*
- *To investigate the spawning behaviour and ecology of Oriental weatherloach.*
- *Determine the tolerance of Oriental weatherloach to a range of environmental variables.*
- *To determine the applicability and practicality of Oriental weatherloach control techniques.*

An improved understanding of the factors that limit the range of Oriental weatherloach in the MDB could be provided by:

- ❑ Surveys comparing the distribution and abundance of Oriental weatherloach with habitat characteristics.
- ❑ Investigation of spawning habitats, factors influencing spawning success (eg. floods), and critical times and conditions for reproduction.
- ❑ Investigation of how Oriental weatherloach may invade different habitats and factors that influence the effectiveness of dispersal (eg. triggers, critical times and conditions for movement).
- ❑ Experiments to test for tolerance of Oriental weatherloach to a range of environmental variables.

To determine the nature of interactions between Oriental weatherloach and native fish species, a range of short and long-term behavioural and coexistence experiments could be conducted. Experiments to determine the dietary preference of Oriental weatherloach and native fish species could also provide some indication of potential impacts. Changes caused by Oriental weatherloach to aquatic macroinvertebrate communities and water quality could also be investigated using short and long-term experiments.

To determine the applicability and practicality of Oriental weatherloach control techniques, a range of potential control techniques would need to be trialed. Different habitats will need to be tackled in different and innovative ways. For example, discrete small waterbodies may be effectively treated with chemicals such as rotenone and lime or can be dried out; however, not all of these techniques can be used for larger lakes or rivers. In creeks, rivers and waters which may only be infrequently linked (such as wetlands and billabongs during floods), control techniques will need to be approached differently and further evaluation made of the range of options available, particularly for the more feasible options such as habitat manipulation. There is also a need to evaluate whether sustained control programs are a more worthwhile long-term solution for Oriental weatherloach.

4.1 Conclusion

Development of the information contained in this document into a full strategy and its implementation will involve links and collaboration between numerous groups including key federal government groups, state natural resource agencies, river management committees, catchment management authorities, councils and fishing groups. This document represents a draft management strategy for Oriental weatherloach for potential adoption at a national and state/territory level. Further development of the strategy, including wider input from natural resource managers and the community, is however required.

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