

photo courtesy of Evizel Seymour



## Module 6:

# How to eradicate or control tilapia

### Objectives

- Participants will gain knowledge on currently available eradication or control methods and how to plan a management strategy on a case-by-case basis
- Participants will be able to review and adjust current management plans or develop new plans

### Intended participants

- Members of natural resource management (NRM) groups or local/state government agencies who perform field work and may intend to implement their own pest fish eradication or control programs

### Key messages

- Each case of pest fish infestation must be thoroughly investigated and the appropriate response (i.e. either eradication or control) decided after carefully considering all possibilities
- Eradication of a pest fish population is rarely possible. Although in some circumstances it could be considered as a possibility, most efforts should focus on controlling the population by preventing its spread and minimising its impacts
- Field workers involved in eradication and control actions require in-depth training and must carefully follow correct procedures

### Learning resources

- PowerPoint
- Case studies
- Learning activities
- Material safety data sheet (MSDS) for the use of rotenone (Appendix G)





## Introduction

Once a new pest fish incursion has been identified and investigated, the appropriate response actions must be determined. This can be done by discussing with key stakeholders the feasibility of possible management actions. Such actions can fall under the headings of eradication, containment, sustained control and environmental control. A management plan is prepared, showing the pros and cons of each proposed action, as well as identifying any risks and concerns. Actions can be rated by considering the:

- cost and effectiveness of the action based on information about the species' biology and ecology
- nature of the infestation
- characteristics of the infested habitat
- likely impacts
- likelihood of the pest spreading.

The following information describes some of the pest fish management actions currently available, along with some of the factors that need to be considered to assess their suitability and feasibility.

## Eradication of pest fish

Eradication involves the total removal of the species from the waterbody in question. This approach involves many difficulties, is usually too costly and is only effective in a very small number of cases. Nevertheless, it should be considered as an option when responding to a new pest fish incursion. Apart from hand removal, in the case of aquariums and small ponds, the only eradication options currently available are draining and poisoning.

### Draining

Draining and drying of the waterbody is an eradication option for small areas such as farm dams. In this case, the water needs to be drained away from any watercourse onto surrounding land at a rate that allows it to be absorbed. This needs to be done in such a way that the drained water does not pool somewhere else (to essentially create another dam), as fish larvae and eggs could survive and create a new breeding population. In cases where the water potentially drains into a watercourse, a screen that prevents pest fish from spreading needs to be included. The size of the screen needs to be suitable for the species of pest fish (e.g. the screen size for tilapia needs to be 50 µm or smaller to stop eggs and larvae from escaping).

Once the waterbody is drained, fish need to be removed by hand and disposed of appropriately (see instructions p. 82). The drained dam needs to be left completely dry for a significant length of time (approximately one month) before refilling to ensure any remaining pest fish, eggs and larvae have not survived.

### Poisoning

In waterbodies that cannot be drained, current technology limits options for total eradication to the use of the fish poison (piscicide) rotenone. However, rotenone can only be considered as an option if the following criteria are met:

- There is a reasonably high chance of success.
- The waterbody is not used directly or indirectly (after treatment) for human consumption.
- There is minimal impact on endangered or rare aquatic species present in the waterbody (these can be removed effectively and held in a safe place until the rotenone is neutralised, and then returned to the area).

- The waterbody is lowered sufficiently (if possible) to counteract effects of overflow in the case of high rainfall events around the time of treatment and to minimise the amount of rotenone required.
- All necessary permits and consents have been obtained.

Rotenone is a plant-derived poison that rapidly degrades when exposed to light and moisture and is generally considered to have short-term environmental impacts. It is however a non-selective poison, which means that native fauna are also affected by its application. Before applying rotenone, a thorough investigation into the ecology of the waterbody is therefore required to assess the ability of native fauna to recolonise; this should include a review of environmental factors (REF) and public consultation.



Figure 6.1 Rotenone in powdered form

The use of rotenone to eradicate a pest fish population requires various permissions. A permit from the Australian Pesticides and Veterinary Medicines Authority (APVMA) is required by anyone (including Queensland and New South Wales fisheries officers) using rotenone, with separate permits necessary for powdered and liquid forms of the piscicide. The use of rotenone for eradication also requires either a Fisheries Queensland general fisheries permit or a New South Wales collection permit, in addition to the APVMA permit. These additional permits cover the collection of noxious fish using rotenone, as well as the subsequent possession of the fish.

Depending on the case, additional permits may also be required from agencies such as the Department of Environment and Resource Management <[www.derm.qld.gov.au](http://www.derm.qld.gov.au)> or the Wet Tropics Management Authority (WTMA) <[www.wettropics.com.au](http://www.wettropics.com.au)>. Permits must be granted by all relevant organisations and may include (but are not limited to) approval from:

- the Deputy Director-General of Fisheries Queensland and the Deputy Director-General of Biosecurity Queensland
- NSW DPI and NSW Office of Environment and Heritage
- relevant water authorities
- the Chief Executive Officer (or equivalent) of the local council/s
- the landholder/s, who must sign a consent and indemnity form.

Before granting permits, the authorities will review environmental factors and consider each case thoroughly. The process can be very lengthy and exhaustive due to the complexity and risks of using rotenone. The use of rotenone is therefore only a feasible option for councils and large natural resource management groups with the appropriate training, permits and resources in place.

### Health and safety

As well as being familiar with the permit conditions imposed by the relevant authorities, users of rotenone must also be familiar with relevant occupational health and safety factors. The material safety data sheet (MSDS) for the use of rotenone can be found in Appendix G. This outlines all the hazards associated with the poison. Individuals are most likely to be exposed to the health hazards of rotenone when they are involved in activities such as:

- removing the concentrated formulations from their original containers
- diluting and mixing the formulations
- filling application containers
- applying the rotenone formulations.

To prevent contamination through the skin, ingestion or inhalation, users must wear the required personal protective equipment when mixing or applying rotenone. This includes:

- full-length apron
- coveralls
- unlined nitrile gloves
- face shield or goggles
- head protection
- respirator
- gumboots.



Figure 6.2 Rotenone treatment

All those involved in the application of rotenone must also be familiar with the correct procedures for storage, management of spills, disposal, transport and first aid. For example, Fisheries Queensland staff who participate in rotenone eradication activities have achieved competencies in the preparation and application of chemicals (Certificate III in Horticulture RTF30103, subject RTC3704A: Prepare and Apply Chemicals).

### Limitations of eradication methods

Although the preferred outcome for the management of a pest fish incursion is total eradication of the population, this is often unachievable with the technology currently available. Rotenone can be useful for enclosed bodies of water; however, rotenone is generally not a long-term solution to pest fish infestations on a local or state scale and its use can harm the environment. For example, if an enclosed artificial lagoon is treated using rotenone within the Brisbane River catchment, the operation could only be deemed successful until subsequent flows from the river connected with the lagoon again and allowed the movement of tilapia into the system once more. Furthermore, total eradication is currently considered impossible once a pest fish population is well established in a large or uncontained waterway.

## Control of pest fish

Due to the limitations and complications involved in the eradication of pest fish using rotenone or by draining a waterbody, it is usually more beneficial and practical to focus efforts on:

- minimising the impacts of pest fish on the environment, economy and society
- preventing their spread into neighboring catchments.

Controlling existing pest fish populations can be achieved in several ways, usually through the integration of many techniques. The most suitable control options are determined through location-specific analysis and can be described as containment, sustained control or environmental control.

### Containment

Options are available that restrict the ability of a pest fish to naturally disperse throughout a catchment. Dam water levels are often lowered as an ongoing maintenance measure to help minimise the risk of flooding. This action, however, only controls the natural spread of pest fish if the process does not involve draining water into another waterway or waterbody. It is also effective only if the pest fish species has not already spread downstream of the dam wall.

The construction of screen barriers between infested and uninfested areas is another action that is often used to contain pest fish populations. This is usually undertaken on irrigation channels and pipelines where native fish dispersal is also not desirable. Screen barriers are, however, very costly to establish and require careful planning and ongoing maintenance and monitoring to ensure fish are being contained.

Unfortunately, the majority of new pest fish incursions are believed to be the result of human-mediated dispersal rather than natural migration. This fact makes the containment of pest fish populations extremely difficult. The most effective containment method is therefore considered to be increasing community awareness by distributing a range of pest fish educational material in identified areas.

## Sustained control

Sustained control involves continued management actions to reduce and maintain pest fish at levels where the damage they cause to the local environment, economy and society is minimal. Currently, the commonly used approaches to sustained pest fish control are netting, trapping, electrofishing and line fishing or a combination of approaches (for details of these methods, please refer to the information provided in Module 5). These control methods would be implemented in the same way as they are used for surveys.

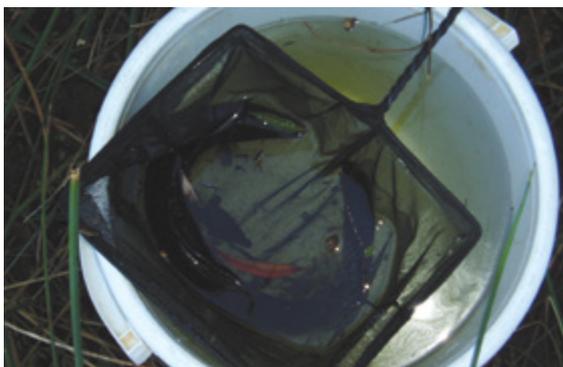


Figure 6.3 Dip net and holding bucket



Figure 6.4 Two fyke nets set adjacently in a waterbody



Figure 6.5 Bait trap



Figure 6.6 Backpack electrofishing equipment



Figure 6.7 Line fishing

Some of these methods target breeding individuals in the pest fish population. This can be effective in reducing numbers, as removing larger breeding fish increases the period between recruitment and retards the pest fish population. There can be considerable pressure on the pest fish population if sustained control actions are combined with a healthy population of native predatory fish.

Research is being carried out to refine control and detection methods for tilapia. For example, thermal imagery is being used to exploit tilapia's intolerance for cold water. During South East Queensland winters, water temperatures in large water storage facilities approach the lower limit of tilapia tolerance and mass die-offs can result. To cope, the fish seek out pockets of warm water. Thermal mapping is being used to identify these areas, so that control measures can be concentrated there, thereby increasing the efficiency of the operation.

Tilapia's intolerance for cold water can also be exploited by using thermal attractants in conjunction with fish traps. For example, fish traps can be placed in warm water pockets of dams where tilapia may already be accumulating. Fish can be further attracted by heating water and pumping it into the trap. This method is still very much at an experimental stage and further testing is required before conclusions can be reached about its effectiveness.

### Important information!

An effective way of targeting tilapia for capture is to exploit habitats that consist of the invasive wetland weed, para grass (*Urochloa mutica*), in which tilapia are known to thrive. Any para grass habitats present in the management site should therefore be included in the management design.



Figure 6.8 Para grass (*Urochloa mutica*) infestation



Figure 6.9 Para grass (*Urochloa mutica*)

## Environmental control

Environmental control is sometimes used in conjunction with other methods. It involves changing the environment to improve the health and survival of native species, thus promoting increased competition with pest species, and reducing the pest species' population size.

Rehabilitation is the key to boosting the diversity and abundance of native fish species and reducing the impact of pest fish species. Native fish populations in Queensland and New South Wales are being affected by eight key threats, as outlined in the following table.

### Key threats to native fish management

#### Flow regulation

Loss of water to other uses, critical low flows, loss of flow variation, loss of flow seasonality, loss of low to medium floods, permanent flooding and high water, increased periods of no flow

#### Habitat degradation

Damage to riparian zones, removal of in-stream habitats, sedimentation

#### Lowered water quality

Increased nutrients, turbidity, sedimentation, salinity, artificial changes in water temperature, pesticides, acidity and other contaminants

#### Barriers

Impediments to fish passage resulting from the construction and operation of dams, weirs, levees, culverts, etc., and non-physical barriers such as increased velocities, reduced habitats, water quality and thermal pollution (changes in water temperature)

#### Pest fish

Competition with and/or predation by carp, gambusia, oriental weatherloach, redfin perch, pearl cichlid, climbing perch, tilapia, goldfish and trout

#### Exploitation

Recreational and commercial fishing pressure on depleted stocks, illegal fishing

#### Diseases

Outbreak and spread of EHN (epizootic haematopoietic necrosis virus) and other viruses, diseases and parasites

#### Translocation and stocking

The loss of genetic integrity and fitness caused by inappropriate translocation and stocking of native species

Fortunately, a range of environmental management interventions are available to address these key threats to native fish populations. These include riparian rehabilitation, resnagging, improving fish passage and improving water quality. These interventions can help slow and reverse declines in native fish numbers as well as lead to an increase in overall river health. This, in turn, will act to minimise the impacts of pest fish.

### Riparian rehabilitation

Riparian areas and vegetation provide habitat and nutrients essential for healthy fish populations, together with shade and a buffer for waterways. Riparian rehabilitation activities could include weed management and revegetation, as well as the protection of remnant riparian vegetation.

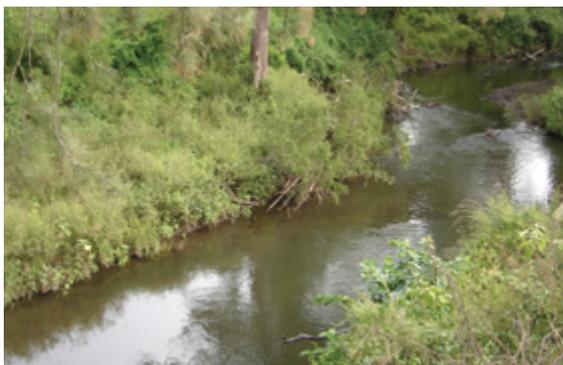


Figure 6.10 Well-vegetated river

### Resnagging

Snags are trees, logs, branches and root masses that are found in waterways. Snags provide extremely important habitat for native fish as they offer them:

- sites to attach adhesive eggs during breeding
- sites to rest from fast river flows
- shelter from predators
- landmarks to define territories and aid navigation
- ambush sites during feeding
- feeding opportunities (fish regularly and sometimes primarily feed on macroinvertebrates that commonly inhabit snags)
- pockets of deep water (snags increase and maintain water depth).

In the past, extensive desnagging operations have impacted greatly on native fish populations in many rivers. The removal of snags largely came about because of several misconceptions, such as the belief that snags caused erosion of river banks and increased the incidence of flooding.

Resnagging is a sound management intervention that can be used to restore snags to our rivers; early indications suggest that native fish respond strongly as a result. It can, however, be an expensive and labour-intensive option and sourcing good quality trees for snags can be difficult. The key is to better manage riparian vegetation, trees in particular, so that there will be a constant supply of snags in the future.



Figure 6.11 Snags in a waterway



Figure 6.12 Snags in a waterway



### Improving fish passage

Many species of native fish have evolved to move large distances throughout river systems for the purpose of breeding, feeding and escaping unfavourable conditions. However, many structures, such as dams, weirs and culverts, currently prevent fish passage in many areas. Fishways that are designed to suit Australian river conditions and the swimming abilities of Australian native fish can be built to overcome these sorts of barriers.



Figure 6.13 Goondiwindi Weir, Queensland

### Water quality

Salinity, excess nutrients, thermal pollution, acidity, turbidity and inadequate water flow are all issues that impact on native fish populations, and which therefore have to be managed appropriately. Rehabilitation and protection of riparian vegetation, management of stock access and changes to land management are some of the ways that water quality may be improved.

### Integrated approach

It is important to remember that native fish populations can be subjected to a combination of threats at once, e.g. habitat degradation, poor water quality and barriers that impede fish movement. Therefore, it is vitally important to use an integrated approach by implementing a range of environmental control methods simultaneously. The cumulative benefit for native fish populations and communities will be much greater when a holistic approach is implemented. Figure 6.14 shows the expected cumulative benefit (in regard to the restoration of native fish communities) of applying a suite of environmental control methods. The graph shows that by integrating seven strategies, native fish communities could be restored to an estimated 60 per cent of their pre-European level in about 40 years.

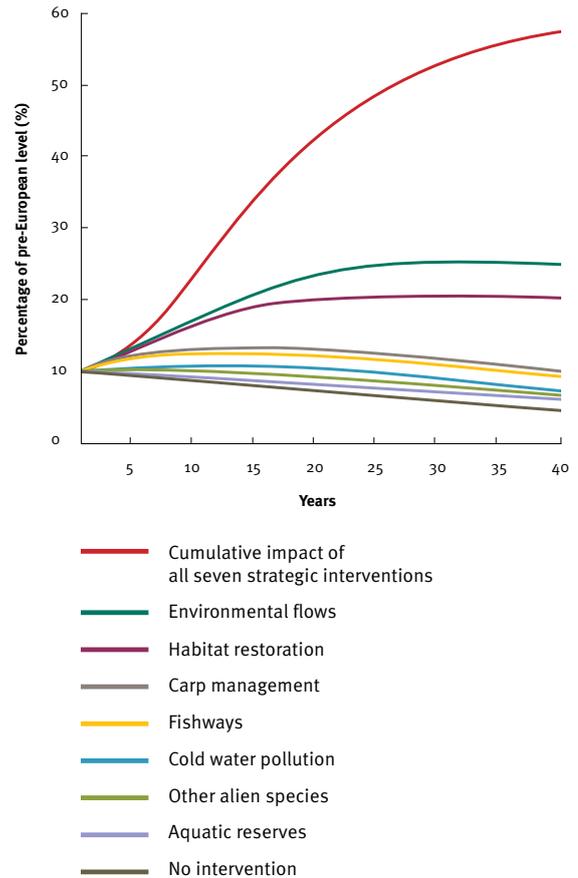


Figure 6.14 Expected cumulative benefit of applying a suite of environmental control methods courtesy of MDBA

Demonstration reaches have been put in place as part of a current plan to sustain native fish populations in the MDB. These are intended to show the community the benefits of applying a suite of well-integrated methods of river rehabilitation (e.g. provision of fish passage, resnagging and pest fish management) to conserve native fish populations. The establishment of a demonstration reach involves a range of individuals and community groups, thereby enhancing community awareness and support. A detailed long-term plan for a demonstration reach is developed along with on-ground activities, which are refined as successes and new challenges arise.

**Important information!**

State government authorities do not support all control and eradication methods outlined in this module in all cases of pest fish incursion. The following table summarises the methods that each state would consider for an initial response to new incursions or for long-term sustained control. Some control options may only be considered for new pest fish incursions and only if they are deemed as feasible options.

**Likelihood of support for available pest fish control/management methods**

Control or sustained management method	May be supported in	
	Qld	NSW
Containment	✓	✓
Draining	✓	✓
Electrofishing	✓	✗
Environmental control	✓	✓
Line fishing*	✓	✓
Netting—scoop/hand nets	✓	✗
Netting—seine nets, fyke nets and cast nets	✓	✗
Poisoning	✓	✗
Sustained control	✓	✗
Trapping	✓	✗
Visual observation	✓	✓

\*Although line fishing in New South Wales does not require a collection permit, line fishers are required to carry a receipt showing payment of the NSW Recreational Fishing Fee.

**Collecting, destroying and disposing of pest fish**

Pest fish should be collected and destroyed using methods that cause the least stress possible. In the case of electrofishing, only the minimum power necessary to attract and stun the fish effectively should be used and direct contact of fish with live anodes should be avoided.

The most humane method for euthanising fish is to follow the ethical euthanasia protocols recommended by the Australian and New Zealand Council for the Care of Animals in Research and Teaching (ANZCCART). The 2001 ANZCCART publication—*Euthanasia of animals used for scientific purposes*—states that the most appropriate method is to kill the fish with a sharp blow to the back of the head just above the eyes, causing brain destruction. When applied correctly the fish's gill covers should stop moving rhythmically and the eyes should remain still.

Pest fish should be disposed of as soon as possible in a way that avoids any risk of the fish being released back into the waterway (water from the container used to hold the fish should also be disposed of away from the waterway to prevent juvenile reintroduction). This is usually achieved by burying the fish above the tidal influence and at least 50 m from surrounding watercourses, at a minimum depth determined by local council guidelines.

**Important information!**

It is sometimes very difficult to distinguish small native fish from juvenile pest fish. Therefore, before euthanising, fish should be identified by someone who has undergone sufficient training and has proven to be proficient at freshwater fish identification.



# Haig Street Quarry, Ipswich, Queensland

## Background

Tilapia (*Oreochromis mossambicus*) were first reported in the Haig Street Quarry by Ipswich City Council (ICC) in May 2001. The infestation was confirmed when a specimen was formally identified by the Queensland Museum as Mozambique tilapia. Subsequent stakeholder meetings discussed options for control or eradication of the tilapia. At that time, the infestation was considered to be low priority as the quarry was isolated from nearby waterbodies and tilapia infestations were already confirmed in the Brisbane catchment.

## Site description

Haig Street Reserve is an abandoned quarry that is isolated from the closest watercourse, the Bremer River. The following statistics were provided by ICC:

Surface area of waterbody: 2500 m<sup>2</sup>

Average depth: 1.4 m

Deepest point: 1.8 m

Despite a relatively low risk that tilapia could escape from the quarry as a result of natural events such as high rainfall, there was a risk that the infestation could act as a point source for further spread of the species into other nearby catchments. The quarry has been incorporated into a park reserve that is heavily used for recreation.

Following a site inspection in January 2004, a decision was taken to pursue eradication of tilapia at the quarry. The site was considered to be a suitable candidate for rotenone treatment because:

1. The waterbody is not used as a drinking water supply.
2. Swimming is not permitted.
3. The site can be closed to public access.

However, at that time the Department of Primary Industries and Fisheries (DPI&F) did not possess a valid permit for the use of rotenone. This permit was not obtained until February 2005. Once the permit was secured, preparations recommenced with a view to treating the quarry.

The site was considered to be suitable for testing rotenone delivery equipment that had been obtained by DPI&F in 2004 and for providing a training exercise for staff. Permission to undertake the exercise was obtained from the Chief Executive Officer of ICC and the Deputy Director-General of Fisheries. Protocols for the exercise were developed according to the requirements of the DPI&F manual for the use of rotenone. A pre-treatment survey was conducted by DPI&F to establish the species of fish present in the quarry and document other aquatic species using the site.

This survey revealed the following species list:

- tilapia (noxious) (*Oreochromis mossambicus*)
- gambusia (noxious) (*Gambusia* spp.)
- fork-tailed catfish (native) (*Arius graeffei*)
- freshwater catfish (native) (*Tandanus tandanus*)
- redclaw crayfish (nonindigenous) (*Cherax quadricarinatus*)
- freshwater prawns (native) (*Macrobrachium* spp.)
- purple-spotted gudgeon (native) (*Mogurnda adspersa*)
- cane toads and their tadpoles (introduced) (*Bufo marinus*).

A variety of waterbirds were also observed around the margins of the quarry. No native frog species or freshwater turtles were recorded.

## Treatment

A schedule of actions was developed as follows.

### Schedule of actions

Date	Action	Responsibility
Prior to 21 March 2005	Notify the public that Haig Street Reserve will be closed for maintenance	ICC
21 March 2005	Close the reserve and provide security guards	ICC
21 March 2005	Apply the recommended dose of rotenone to the waterbody	DPI&F
21–23 March 2005	Remove dead fish	ICC and DPI&F
5 April 2005	Survey for tilapia	DPI&F
May 2005	Reapply rotenone if initial treatment was unsuccessful	DPI&F
Spring 2005	Restock reserve with indigenous native fish	To be discussed between ICC, DPI&F and Wivenhoe Somerset Fish Stocking Group

More fish species were present in the waterbody than suggested by the original survey. A list of fish species and their relative abundance is provided in the following table. Moulting redclaw crayfish (identified by their soft shell and/or moulted shell still attached) were also killed by the rotenone. Non-moulting crayfish and shrimps were unaffected by the treatment.

### Fish species identified in the waterbody after poisoning and their relative abundance

Common name	Species name	Abundance
Eel	<i>Anguilla</i> spp.	2 specimens
Firetail gudgeon	<i>Hypseleotris galii</i>	Rare to common
Spangled perch	<i>Leiopotherapon unicolor</i>	Rare to common
<b>Exotic species</b>		
Platy	<i>Xiphophorus maculatus</i>	Common
<b>Noxious species</b>		
Gambusia	<i>Gambusia holbrooki</i>	Very common
Mozambique mouth-brooder (tilapia)	<i>Oreochromis mossambicus</i>	Extremely common

Tilapia was the most abundant species collected from the waterbody, with approximately two tonnes of fish present. Water samples collected after the treatment indicated that no rotenone residue was present in the water.

### Post-treatment surveys

A post-treatment survey was conducted on 5 April 2005. No fish were found alive, and the treatment was therefore deemed to have been successful. Crayfish and shrimps were observed and unaffected by the rotenone. Restocking with a range of native fish was subsequently carried out in September 2005.

Despite this initial success, fish surveys since this time have confirmed that the Haig Street Quarry is now reinfested with Mozambique tilapia. It should be noted that no communication campaign was delivered to the community around the time of the eradication other than erecting a DPI&F 'Stop the Spread' tilapia information sign at the site.



## Boondooma Dam to Tarong Power Station pipeline

In May 2000, during a routine post-stocking survey of the Boondooma Dam, Fisheries Queensland staff detected two specimens of the noxious fish species Mozambique tilapia, previously unrecorded in this dam or anywhere within the Burnett River catchment.

Follow-up surveys and investigations indicated that the pest fish was only present in Boondooma Dam and some upstream waterholes and no other parts of the Burnett catchment. Consultation between Tarong Energy, the community and government agency representatives concluded that there was a definite risk of accidentally translocating the pest fish via the water supply pipeline from Boondooma Dam to Tarong Power Station, and ultimately to other parts of the Burnett system.

In November 2002, Tarong Energy coordinated the installation of mechanical self-cleaning screens of 500  $\mu$  on the water-supply pipeline from Boondooma dam to prevent movement of tilapia. Fisheries Queensland has since been committed to undertaking annual survey work to help determine the effectiveness of the screens. This ongoing monitoring has indicated that tilapia are being effectively contained within Boondooma Dam; the tilapia exclusion screens continue to be considered a success.

## The Green Pool

In 2004, Jack Dempsey cichlids were discovered in the Green Pool near Angourie in New South Wales. The cichlids were considered an ideal target for a pest fish eradication program because the pool was relatively small, confined and contained few native fish. However, there were also some limits on the methods that could be used because the pool is a popular local swimming hole.

After considering the options available, it was decided to trial explosives—a novel technique that had been used with some success in Western Australia. Three eradication attempts, using lines of detonation cord laid out across the pool's surface by a qualified explosives expert, were carried out between September 2004 and June 2005 (several successive attempts were necessary as eggs and larvae are not killed by the shock waves). After the use of explosives, 36 large Australian bass were released into the pool to prey on any remaining larvae or juveniles.



Unfortunately, follow-up monitoring has found that Jack Dempseys still remain in the pool. It is possible that the fish are very hardy and that some survived the blasts, or that some were deliberately reintroduced. NSW DPI is not planning any further eradication work at the Green Pool.

*photo courtesy of Gunther Schmida*

## Brewarrina to Bourke Demonstration Reach

The Brewarrina to Bourke Demonstration Reach project was a collaborative agreement between the Western Catchment Management Authority and Industry & Investment New South Wales. The project aimed to enhance native fish habitat in the 207 km stretch of the Barwon–Darling River between Brewarrina and Bourke, north-western New South Wales, through on-ground works and community awareness activities. The project involved:

- remediation of barriers to fish passage
- reintroduction of large woody habitat (snags)
- targeted riparian vegetation program within selected reaches, including revegetation and weed management
- carp management and ‘outback carp muster’ events
- erosion control and gully stabilisation
- protection of riparian vegetation through fencing and stock access control.

Planned outcomes from the combination of these on-ground activities included:

- improved aquatic habitat condition of the Barwon–Darling River
- improved river health in priority areas as indicated by aquatic biodiversity and prevalence of aquatic species
- a contribution to the recovery of species, populations and communities listed as threatened in either state or Commonwealth law.

One of the most significant outcomes will be the construction of a fishway on Brewarrina Weir. Fishways, also known as fish ladders or fish passes, are structures placed on or around constructed barriers (such as dams or weirs) to give fish the opportunity to migrate. Fish undertake migrations for a number of reasons including to spawn, feed and seek refuge. The new fishway will allow fish uninterrupted access to a 324 km reach of the Barwon–Darling river system.





# Learning activities

## Rotenone use

**Purpose:** To outline the complications and processes involved in using rotenone as an eradication method and to provide an example of the sort of situation where the use of rotenone would be suitable.

Discuss among the group the case study of tilapia in the Haig Street Quarry.

- What factors made this waterbody suitable for rotenone treatment?
- Can you identify some of the complications associated with rotenone treatment in this case?
- How do you think reinfestation occurred? (Hint: an infestation was already confirmed in the neighbouring Bremer River, a tributary of the Brisbane River.)
- Can you think of additional management actions that might have prevented the reinfestation?
- Can you think of other eradication or control techniques that could have been used in this specific situation instead of rotenone treatment?

## Quiz

1. Response actions for pest fish incursions can fall under the headings of:
  - a) Draining, poisoning and control
  - b) Eradication, containment, sustained control and environmental control
  - c) Hand removal, draining and poisoning
  - d) Sustained control and environmental control
  
2. Which of the following statements is false?
  - a) Hand removal is only effective in the case of aquariums and small ponds
  - b) Eradication using rotenone is generally very costly, has negative impacts on native species and has only been effective in a limited number of cases
  - c) Intense line fishing is an effective way for total eradication of pest fish
  - d) Eradication of pest fish can only be achieved by hand removal, draining or poisoning
  
3. What is an APVMA permit required for?
  - a) The use of an electrofisher
  - b) The collection of pest fish for population control
  - c) The use of rotenone
  - d) The subsequent possession of pest fish after collection

## Answers

1. b) Eradication, containment, sustained control and environmental control
2. c) Intense line fishing is an effective way for total eradication of pest fish
3. c) The use of rotenone





## FAQs

### **How do I apply for a general fisheries permit or a collection permit?**

For a Queensland general fisheries permit, contact DEEDI on 13 25 23 or fill out a permit application form online by visiting [www.fisheries.qld.gov.au](http://www.fisheries.qld.gov.au).

For a New South Wales collection permit, contact NSW DPI on (02) 4982 1232 or fill out a permit application form online at [www.dpi.nsw.gov.au](http://www.dpi.nsw.gov.au).

### **Can recreational anglers target tilapia?**

Tilapia may be captured during recreational fishing; however, their possession in Queensland is illegal. Therefore, any tilapia captured must be euthanised and disposed of straightaway. The most humane way of euthanising is to stun the fish with a sharp blow to the head just above the eyes, causing brain destruction. It can be disposed of in an appropriate rubbish bin or buried well away from the water. The most important things for recreational anglers to remember are not to use tilapia as bait, alive or dead, and not to release tilapia back into a waterway.

### **Is it possible to organise some in-field training for some of the control techniques?**

This may be possible. For information please contact DEEDI on 13 25 23 or send an email to [pestfish@deedi.qld.gov.au](mailto:pestfish@deedi.qld.gov.au).