

Flora & Fauna Guarantee Action Statement

#38

This Action Statement was first published in 1993 and remains current. This version has been prepared for web publication. It retains the original text of the action statement, although contact information, the distribution map and the illustration may have been updated.

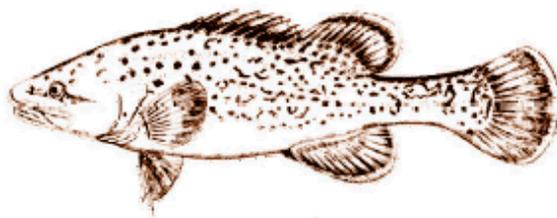
© The State of Victoria,
Department of
Sustainability and
Environment, 2003

Published by the
Department
of Sustainability and
Environment, Victoria.
8 Nicholson Street,
East Melbourne,
Victoria 3002 Australia

This publication may be of assistance to you but the State of Victoria and its employees do not guarantee that the publication is without flaw of any kind or is wholly appropriate for your particular purposes and therefore disclaims all liability for any error, loss or other consequence which may arise from you relying on any information in this publication.

ISSN 1448-9902

Trout Cod *Maccullochella macquariensis*

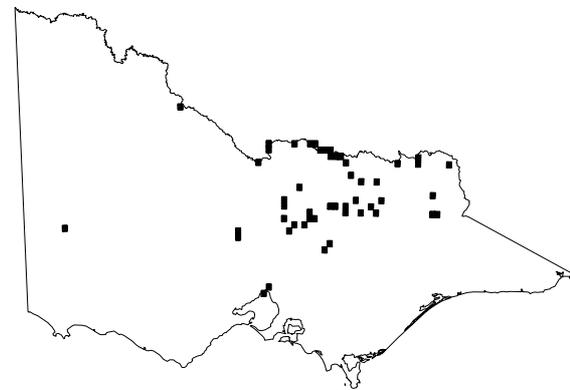


Trout Cod (*Maccullochella macquariensis*)

Description and Distribution

The Trout Cod (*Maccullochella macquariensis* (Cuvier 1829)), is a large, elongate, deep-bodied fish. They have an overhanging upper jaw, and usually a dark stripe through the eye. Their colouring is generally blue-grey with small dark-grey to black spots or dashes on the dorsal surface and upper sides, and light grey to white on the ventral surface. The maximum recorded weight is 16 kg, though there have been unconfirmed reports of fish twice this size being caught in the past. For a more detailed description see Cadwallader & Backhouse (1983).

The distribution of Trout Cod is more restricted than in the past (Cadwallader & Gooley 1984). They were once widespread in the Murray-Darling system, mostly in the upper reaches (e.g. Mitta Mitta, Ovens, King and Goulburn Rivers), though recorded as far downstream as Mannum in South Australia (Cadwallader & Backhouse 1983, Cadwallader & Gooley 1984). In Victoria the only known viable population occurs in Seven Creeks, upstream of Euroa between Gooram Falls and Polly McQuinns



Distribution in Victoria (DSE 2002)

Weir, and originates from fish translocated from the Goulburn River in 1921 and 1922. The Department of Conservation and Natural Resources (CNR) and its predecessors have released fish into Koetong, Hughes, Ryans and Buffalo Creeks and the Coliban and Broken Rivers. There are also unconfirmed reports of Trout Cod in a number of waters, including the King, upper Ovens, and lower Goulburn Rivers, and Cutting, Narial, Cudgewa, Morses and Broken Creeks.

In NSW, Trout Cod occur naturally in the Murray River from below Yarrawonga Weir down to the Barmah Forest. They have been released into the upper Murray River near Jingellic and Tintaldr, the Murrumbidgee River near Cooma and Narrandera, and into Talbingo and Cataract Dams. There are unconfirmed reports of Trout Cod in the Macquarie River. Trout Cod have also been released into Bendora Dam in the ACT.

The habitat of the Trout Cod at Seven Creeks in Victoria consists of deep pools separated by sections of fast-flowing waters with steep drops and rocky chutes. The substrata consist mostly of bedrock, boulders, gravel

and sand. Instream cover in the form of woody snags and overhanging banks is present (Cadwallader 1979, Cadwallader & Backhouse 1983, Newall & Mueck 1990). The habitat in the Murray River, where the only other known viable population in Australia occurs, generally consists of deeper, slower-flowing waters, with a mud or sand substratum.

Conservation Status

Current Status

Koehn & Morison (1990)	Endangered
Harris (1987)	Endangered
Scientific Advisory Committee (1991)	Threatened

The Trout Cod has been listed as a threatened taxon under Schedule 2 of the Flora and Fauna Guarantee Act 1988.

Reasons for Conservation Status

The population size and the distribution of Trout Cod have decreased (Cadwallader & Gooley 1984). They were once widespread in the Murray-Darling River system, but have declined markedly. In Victoria, only 170 fish were found in an intensive survey of Seven Creeks in 1991 (Anderson 1991).

Angling, introduction of trout, and activities that damage rivers, including sedimentation, dams, and river improvement works (e.g. desnagging and channel modification) are all thought to have contributed to the decline of Trout Cod (Scientific Advisory Committee 1991). In its final recommendation, the Scientific Advisory Committee (1991) determined that Trout Cod are:

- in a demonstrable state of decline which is likely to result in extinction;
- significantly prone to future threats which are likely to result in extinction, and
- very rare in terms of abundance or distribution.

Major Conservation Objectives

The long-term objective is to ensure that the species is secure and self-sustaining within its former range. Short term objectives are to:

- ensure that the population of Trout Cod in Seven Creeks is secure, increases or remains stable in numbers and/or distribution, and continues to produce young;
- expand the current range in Victoria by establishing breeding populations at other locations within their former range;
- initiate research into the ecological requirements of Trout Cod by 1993.

Management Issues

Ecological Issues Specific to the Taxon

Protection of the Trout Cod in the wild is difficult because:

- for the most part, its ecological requirements and tolerances are not known;

- the original distribution is not known accurately, since it was formally recognised as a species separate from Murray Cod only in 1972 (Berra & Weatherly 1972). The broad range is described in Cadwallader & Gooley (1984);
- a large proportion of Victoria's streams have been modified (Mitchell 1990), so that it is not possible to determine the conditions Trout Cod require by examining conditions in rivers in which they originally occurred; and
- As Trout Cod did not naturally occur in Seven Creeks in the stretch where they are now found, but were introduced from a population in the Goulburn River, extrapolation of habitat requirements from this area may not be very realistic.

There are so few Trout Cod remaining in Victoria that they should not be put at risk by activities likely to result in death or reduced viability. This restricts the types of research possible, which in turn limits the amount and type of information that can be obtained about their requirements.

Potential threats to Trout Cod arise from processes that damage the aquatic environment, including sedimentation, removal of riparian vegetation and instream habitat, changed flow or water temperature regime, and deterioration in water quality (e.g. reduction in dissolved oxygen concentration, increased turbidity, increased concentration of nutrients and biocides). A wide range of activities in catchments may cause these threats. Some of these are clearing, overgrazing, stock damage (especially in or near rivers or drainage lines), biocide spraying, roadmaking, weir or dam cleaning or construction, changes in the operation of existing dams, water extraction, runoff from construction sites, fire, and river management works such as desnagging or channel modification. Protection of Trout Cod habitat must also take into account activities that occur upstream of the actual stretch of river inhabited by the fish, including tributary streams. Trout may pose a threat through predation or other competitive interactions.

Angling for other species of fish in rivers where the Trout Cod occur may result in anglers accidentally hooking Trout Cod. The difficulty in distinguishing Trout Cod from Murray Cod may lead to anglers mistakenly killing Trout Cod if angling is permitted in waters where Trout Cod occur. Trout Cod have been found to hybridise with Murray Cod in Cataract Dam and the Murray River in NSW.

Seven Creeks Population

As this is the only viable population of Trout Cod in Victoria, the entire wild Victorian population could be lost through a catastrophic event such as a wildfire or toxic spill into the creek or through degradation of the habitat, for example by erosion from the catchment or the stream bed and banks, changed flow regime, or a deterioration in water quality. The Seven Creeks population, and thus its habitat, needs to be given a very high level of protection to ensure its safety as far as possible and reduce risk to an absolute minimum.

Changes in the management or use of the creek or catchment may affect Trout Cod, and thus should be assessed for potential impact prior to implementation. Potential threats

include forest clearing in the upper catchment, increased water abstraction from Seven Creeks, and cleaning out Polly McQuinns Weir.

The existing nutrient enrichment of Seven Creeks may threaten Trout Cod, especially in summer when there is little flow (Newall 1990).

Several natural and artificial barriers in Seven Creeks in effect divide the population into several sub-populations. Since Trout Cod can move downstream but not back up past these barriers, the upper reaches may eventually be uninhabited by Trout Cod.

The results of a survey in Seven Creeks in 1991 indicate that the population is moving downstream. The largest number of Trout Cod were found in the section two to three kilometres upstream of Watchbox Creek (Anderson 1991). Downstream movement may be detrimental, as the instream habitat downstream of Watchbox Creek is poorer than it is upstream (Newall & Mueck 1990), and conditions may not be suitable for Trout Cod survival. If future assessment of the habitat reveals that conditions are unsuitable, then translocation of the Trout Cod to other suitable locations until habitat has been improved should be considered.

Expansion of the population through translocation may be feasible if suitable habitat is found elsewhere (e.g. upstream of Polly McQuinns Weir). The population is small and physically isolated from populations in NSW. It could therefore become, or perhaps is already, genetically distinct from other populations in Australia.

Establishing Other Populations

Trout Cod are being bred in captivity and released into the wild, but it is not known how successful this will be, because:

- The reasons for the decline in the Trout Cod population are not fully understood, and the factors which caused their decline could still be active, so attempts to reintroduce the fish may well fail.
- The re-establishment of sustainable wild populations from animals bred in captivity is difficult and frequently unsuccessful (Griffith et al. 1989, Hopper & Coates 1990).

None of the populations that CNR is working towards establishing have been stocked for long enough to determine whether they are self-sustaining. A problem may arise in future due to the small numbers of parent stock from which the new populations are being established.

Wider Conservation Implications

Seven Creeks provides habitat for a large population of Macquarie Perch (*Macquaria australasica*), a species listed on Schedule 2 of the Flora and Fauna Guarantee Act 1988. Thus the protection of Trout Cod habitat in Seven Creeks will help conserve Macquarie Perch.

Many of the measures required to protect Trout Cod in Seven Creeks are those recommended in the Seven Creeks Catchment Project Planning Report to ensure stable, productive land use (Codd & Wood 1987). Carrying out

these recommendations over the entire catchment would, besides protecting the creeks and Trout Cod habitat, have beneficial effects by reducing soil erosion, and increasing productivity of the land in the long term (though it would also require extra work by landholders in the shorter term).

Measures required to protect Trout Cod in all creeks where it becomes established will protect the habitat of other aquatic species and communities.

Care will need to be taken when establishing other populations of Trout Cod in relation to the potential for hybridisation with Murray Cod.

Social and Economic Issues

As the ecological requirements for protection of Trout Cod are not well understood, caution needs to be taken with human activities that could result in habitat disturbance. Given the large area of catchment involved, the constraints needed on particular activities and developments could be significant, but most human activity probably will not be affected or can be easily modified to allow for Trout Cod requirements. Activities or developments will be treated case by case.

When assessing activities and developments which may affect Trout Cod, the long-term implications and cumulative effects of multiple activities will be taken into account. Estimates of increased costs and opportunities foregone will be weighed up against the likely negative impact on the Trout Cod and other components in the ecosystem.

Catchment management practices required to protect Trout Cod habitat where creeks pass through agricultural land will benefit landholders in the long term through reduced economic losses associated with improved land management. This is in line with the trend towards whole catchment-management throughout Victoria. In some cases, protecting Trout Cod will require faster or more stringent action than might otherwise occur to achieve appropriate revegetation, fence frontages, or other conservation measures.

Individual landholders may face increased short-term costs if the area available for grazing is reduced, fencing has to be provided or modified, or alternative watering points need to be provided. Impacts will vary from case to case.

Landholders and others may perceive problems with fire hazards, weed invasion and rabbit harbouring if grazing is excluded from certain areas.

The fungal disease Pine Needle Blight (*Dothistroma*) is well advanced in pine plantations in the Koetong Creek catchment, upstream of a site where CNR is attempting to establish a population of Trout Cod. Copper-based chemical control of this disease may have adverse impacts on stream systems, particularly by disrupting litter decomposition, a process that relies in part on aquatic fungi, which are probably susceptible to copper-based fungicides. The protection of Trout Cod habitat may require prescriptive changes, such as increased buffer strips or no chemical use at all (requiring research into biological control methods).

Harvesting methods in the Koetong plantations may need to be revised to take into account Trout Cod habitat protection. The stands are even aged, and would normally be harvested over one to two years. To avoid potential changes to hydrology and the risk of erosion and stream sedimentation, harvesting may

need to be spread over a longer period and different harvesting methods may need to be used (e.g. selective logging, strip thinning).

Future proponents of instream works in any streams where Trout Cod occur will probably be affected, including the Euroa Water Board should it wish to increase water abstraction from Seven Creeks or clean out Polly McQuinn's Weir. Protecting Trout Cod was one of the considerations in the then Department of Conservation and Environment's refusal of an application to build a dam and modify flows for a micro-hydroelectricity scheme in Koetong Creek.

There are no existing proposals for instream works in streams where Trout Cod occur.

The benefits from protecting Trout Cod include the long-term benefit of catchment and stream protection, and the possibility that Trout Cod might again become a species available to anglers. The intangible benefits to people arising from the knowledge that Trout Cod are being protected are also important.

Management Action

Previous Management Action

Seven Creeks Population

The Seven Creeks Catchment Project Planning Report (Codd & Wood 1987) has been produced. It outlines current land-use problems in the catchment and how the catchment can be protected by involving the landholders.

Implementing this plan would help protect Trout Cod in Seven Creeks by protecting the creek system. The recommendations from this report have been taken into account in preparing this action statement.

The Seven Creeks Catchment Management Group has been established, and, in consultation with CNR, has performed extensive works in the catchment, concentrating especially on replanting, fencing, and rabbit control. Using funding provided from a Rural Water Commission Rivers and Streams grant, the stretch of Seven Creeks from Gooram Falls down to Galls Gap Road was revegetated, but was later burnt out by wildfires.

A Trout Cod management plan (Ncwall & Mueck 1990), has been prepared as part of a M.Env.Sci. thesis, and its recommendations regarding the critical habitat and management of the population in Seven Creeks have been taken into account in preparing this action statement.

The water quality and riparian vegetation in the stretch of Seven Creeks where Trout Cod occur have been studied and reported (Mueck 1990, Newall 1990, Newall & Mueck 1990). This information may be of use in determining the range of conditions over which Trout Cod can exist, and in monitoring changes in Seven Creeks over time.

The Seven Creeks Wildlife Reserve has been proclaimed. The reserve is 25 to 30 km long, extending from Galls Gap Road bridge over Seven Creeks (about 15 km from Euroa) upstream to Creek Junction (about 14 km upstream of Polly McQuinn's Weir), and incorporates about 20 metres of land either side of Seven Creeks. Much of the river frontage within this reserve is leased to graziers under annual

licences. While not proclaimed specifically to protect Trout Cod, appropriate management of the reserve would help protect Trout Cod habitat.

Following a fire in the Seven Creeks catchment in December 1990, sixteen Trout Cod were captured by Departmental staff and moved upstream from a badly damaged stretch of creek to a less affected stretch a short distance downstream of Polly McQuinn's Weir. This was to reduce the risk of losing the entire population if there was a reduction in dissolved oxygen and pH in Seven Creeks caused by an input of organic material from the catchment in the next rainstorm. As the translocated fish were not tagged, it is not known if they survived. CNR regularly surveys the Trout Cod population in Seven Creeks. An intensive survey in March 1991 provided information on the distribution of Trout Cod between Strathbogie and the Galls Gap Road bridge (Anderson, in prep.). It found that the Trout Cod population was small (170 fish were caught), and that most occurred within a 2 to 3 km section upstream of Watchbox Creek, that was the lower limit of the section of Seven Creeks closed to angling at that time. The section of Seven Creeks closed to angling to protect Trout Cod is regularly patrolled by Authorised Officers of CNR to ensure compliance with the closure.

Establishing Other Populations

A Trout Cod breeding program at CNR's Snobs Creek Freshwater Fisheries Research Station and Hatchery has been producing Trout Cod since 1987.

Native Fish Australia (NFA) keep and breed Trout Cod, and provide the fry to Snobs Creek Hatchery to augment the stock to be released.

Trout Cod have been released at six sites in Victoria:

- Hughes Creek near Avenel in September 1988 and 1989,
- Koetong Creek near Koetong in January 1989, January 1990 and December 1990,
- Ryans Creek near Mollyullah in January 1988, March 1989, January 1990 and December 1990,
- Buffalo Creek in January and December 1990,
- the Coliban River in January 1991, and
- the Broken River near Swanpool in December 1990.

Surveys found Trout Cod in Hughes, Koetong and Ryans Creeks in 1990, and Hughes Creek in 1992, but none in Buffalo Creek in 1992.

CNR refused an application for construction of a hydroelectricity scheme on Koetong Creek, upstream of a site where the Department is attempting to establish a population of Trout Cod. The presence of Trout Cod was one of the reasons for the proposal being refused, as it was seen as having the potential to pose an unacceptable threat to the Trout Cod.

Planning

A National Trout Cod Recovery Plan funded by the Australian National Parks and Wildlife Service is being formulated by CNR, and is expected to be completed in 1992. The plan will include:

- a review of all current information on Trout Cod, including identification of the range of environmental conditions which Trout Cod can tolerate (obtained

from studying sites in Victoria and NSW where Trout Cod have previously occurred, and where they presently occur), and information on the success of previous stockings;

- a review of propagation and rearing techniques;
- formulation of a stocking strategy (including recommendations on frequency of stocking, ages to stock, and density);
- development of a set of criteria to identify waters suitable for stocking, and a prioritised list of waters to be stocked;
- management recommendations.

Legal Controls

Taking, trading and keeping of Trout Cod without appropriate authorisation is prohibited under the Flora and Fauna Guarantee Act 1988, and under the Fisheries Act 1968 through the Fisheries (Recreational) Regulations 1992. Seven Creeks is closed to angling from Polly McQuinns Weir downstream to the crossing of Galls Gap Road below Watchbox Creek under the Fisheries (Recreational) Regulations 1992. This is an extension of the closure from Polly McQuinns Weir to Gooram Falls that existed before 1992.

Under Section 66 and Schedule 3 of the Conservation, Forests and Lands Act 1987, water boards and other public authorities must submit a plan of works to the Secretary of CNR before building dams, weirs or other structures in or across watercourses if they could interfere with the passage of fish or the quality of aquatic habitat.

Community Information

Infosheet No.27, produced by the Department's Fisheries Management Division, explains why Trout Cod are protected, and provides a guide for anglers for distinguishing between Trout Cod and Murray Cod, which are very similar in appearance.

NFA displays Trout Cod each year, along with other fish, at the Melbourne Boat Show, and provides information on threats to the species from habitat degradation.

Other Listings

Five potentially threatening processes which relate to the freshwater environment have been listed on Schedule 3 of the Flora and Fauna Guarantee Act 1988:

- alterations to natural flow regimes of rivers and streams,
- alteration to natural temperature regimes of rivers and streams,
- increase in sediment input to Victorian rivers and streams due to human activities,
- introduction of live fish into waters outside their natural range within a Victorian river catchment after 1770, and
- removal of wood debris from Victorian streams.

The input of toxic substances into Victorian rivers and streams has received a preliminary recommendation for listing by the Scientific Advisory Committee.

Management of these threats within Trout Cod habitat will be of benefit to Trout Cod.

Murray Cod and Macquarie Perch have also been listed under the Flora and Fauna Guarantee Act 1988. The appropriate management of these species is also likely to benefit Trout Cod, as their range is very similar to Trout Cod's original range. Macquarie Perch and Murray Cod occur with Trout Cod-Macquarie Perch in Seven Creeks, and Murray Cod in the Murray River.

Intended Management Action

Habitat Protection

All Sites

- Ensure that all catchment and water management agencies in catchments of rivers where Trout Cod have established viable populations or have been released are aware of the presence of Trout Cod and take into account requirements for ensuring their protection (e.g. River Management Authorities, Catchment Co-ordinating Groups, EPA, RWC, Shire Councils).
- In accordance with Section 66 of the Conservation, Forests and Lands Act 1987, monitor proposals for any works or activities in river and their catchments where Trout Cod have either established viable populations, or have been released. These will include activities upstream, such as forestry, spraying biocides, roading, cleaning or constructing weirs or dams, changing the operation of existing dams, abstracting water, or removing runoff from construction sites. Any proposals should be fully assessed for their potential impacts on Trout Cod before they are implemented. CNR will not approve activities which may adversely affect Trout Cod, for example through changes to the flow regime, discharge, temperature regime, water quality or instream habitat. Proposals will be assessed by CNR staff who will ensure that the protection of Trout Cod habitat is taken into account and will consult with the Freshwater Ecology Section of the Flora and Fauna Branch if the river system is likely to be affected.
- Negotiate with proponents where modifications to works or activities would be required to ensure protection of Trout Cod.
- Develop action plans for dealing with catastrophic events such as toxic spills or wildfires which would threaten populations of Trout Cod. Plans may include arranging for volunteer assistance where it is necessary to move Trout Cod.

Seven Creeks

- Identify all areas within the Seven Creeks Wildlife Reserve which require action to ensure that the entire reserve has a cover of native vegetation, and that sediment sources are stabilised. Identify areas requiring stock exclusion or management (e.g. swamps, riparian zone), as a prerequisite to negotiating with landholders.

- Initiate actions required in the Seven Creeks Wildlife Reserve to protect the Seven Creeks system.
- Manage the entire Seven Creeks catchment upstream of the Galls Gap Road bridge to ensure that water quality and instream habitat in the Seven Creeks system does not deteriorate, and work towards protecting the creek system by:
 - a. protecting remaining catchment vegetation, and revegetating where feasible. The riparian zone, swampy areas and any eroding areas should be priorities;
 - b. identifying and stabilising any sediment sources, such as eroding banks or swampy areas, erosion gullies, or road crossings with inappropriate drainage;
 - c. maintaining an unbroken buffer of riparian vegetation throughout the Seven Creeks system upstream of Galls Gap Road, including tributaries to Seven Creeks, and creeklines which do not have permanent surface water flow such as headwater creeks. The buffer of vegetation should be 100 m wide on each side of the creeks. Where insufficient public land is available, CNR will negotiate with landholders with an aim to protecting this width by appropriate management on private land, using incentives and assistance schemes where possible. Priority should be given to stabilising and replanting the section of the creek between Gooram Falls and Galls Gap Road, as the Trout Cod population appears to be moving downstream and is likely to move into this area.
 - d. removing or otherwise managing stock in the riparian zone to prevent damage to vegetation, soil erosion, stream sedimentation, and degradation of water quality through stock trampling and defecating in the creeks;
 - e. controlling rabbits throughout the catchment.
- Negotiate with landholders when changes to land or stock management practices are needed to protect Seven Creeks or its tributaries.
- Continue to support the Seven Creeks Catchment Management Group in working toward protection of the Seven Creeks catchment, focusing on protection of riparian vegetation, swamps and springs, and erosion control.
- Investigate the potential for Trout Cod habitat downstream of Watchbox Creek, and upgrade the habitat if it is too poor to support Trout Cod. Give consideration to translocating the Trout Cod population from the vicinity of Watchbox Creek to other suitable areas until downstream habitat is suitable, to reduce risk to the fish should they move downstream.
- Erect sign posts at major access points or other strategic locations to inform the public of the angling closure in Seven Creeks.

- Continue patrolling for anglers along the closed section of Seven Creeks.

Koetong Creek

Negotiate with the proposed Plantations Authority to determine an appropriate management and harvesting regime in the Koetong Pine Plantations, to avoid threats to Trout Cod. Attention must be paid to impacts from spraying biocides for pest control, appropriate harvesting intensity to avoid potential changes to hydrology, and management of erosion and stream sedimentation.

Critical Habitat

- Determine the Trout Cod's critical habitat.
- Protect all areas identified as critical habitat. The necessary protective measures will be determined for each area identified as critical habitat, and will include protecting and maintaining vegetation, stabilising all sources of sediment for the critical habitat (e.g. erosion gullies, road crossings, damaged river banks) and maintaining the appropriate water quality, temperature, and flow regime by preventing or appropriately managing any activities which may have an effect.
- Negotiate with landholders or catchment or water management agencies where they would be affected by measures required to protect the Trout Cod.
- Encourage the formation of LandCare groups for all sites identified as critical habitat to help protect the catchments, particularly the riparian zone. Encourage landholders along frontages to join Land for Wildlife, and to establish other catchment protection groups similar to the Seven Creeks Catchment Management Group.
- LandCare groups may wish to consider developing a Code of Agricultural Practice specifying standards for private land under agriculture, where these are currently less rigorous than standards for Crown Land (e.g. use of biocides).

Establish Other Populations

- Continue Trout Cod breeding program at Snobs Creek.
- Maintain close liaison between CNR and NFA with regard to NFA's Trout Cod breeding program, and use fry produced to augment the fish bred at Snob's Creek for release. Continue to work towards establishing populations in the wild by identifying rivers suitable to be stocked, rehabilitating or protecting these rivers as required, and releasing Trout Cod into them.
- Continue to stock Trout Cod in Koetong, Hughs, Buffalo and Ryans Creeks and the Broken and Coliban Rivers until the four cohorts have been released, then commence monitoring prior to making further decisions about viability of the sites, and the usefulness of stocking as a conservation measure. Liaise with NSW Fisheries Department

regarding Trout Cod populations which they are attempting to establish.

Research and Monitoring

- Hold discussions between CNR Regions where Trout Cod occur, Flora and Fauna Branch, and Fisheries Management Branch to reach agreement on monitoring schedules for Trout Cod populations.
- Monitor stocked populations regularly (on an agreed schedule) to ascertain whether the fish are breeding, and to determine distribution and size classes. Use the data to assess whether the sites are worth maintaining as Trout Cod habitat.
- Monitor the Trout Cod population in Seven Creeks annually.
- Initiate research into the habitat requirements of Trout Cod adults, juveniles, and eggs, with the priorities being:
 - determining the breeding requirements, such as substrata required to lay eggs, breeding cues, and appropriate sex ratio;
 - determining tolerances of eggs and fry to water quality parameters, including suspended sediment and dissolved oxygen;
 - investigating movements of Trout Cod, by tagging and monitoring; and
 - collecting water quality and other biophysical data from Seven Creeks, to use in detect changes in water quality, and to identify conditions which Trout Cod are currently able to tolerate.
- Initiate research into factors that would affect stocking success and the development of viable populations at new sites, such as territorial behaviour, features affecting size of territories, carrying capacity of streams and appropriate stocking regimes.

Community Education

- Disseminate information to anglers about the prohibition of taking, trading in and keeping of Trout Cod and on the angling closure in Seven Creeks, and provide information to assist in distinguishing Trout Cod from Murray Cod.
- Produce a threatened species pamphlet on Trout Cod, in line with CNR's current threatened species management series.

Other

- Finalise and publish the report of the most recent survey in Seven Creeks, presently in draft form (Anderson 1991).
- Complete the National Trout Cod Recovery Plan, and implement its recommendations.
- Develop guidelines for issuing licences to take and keep Trout Cod for such purposes as display, research, or breeding.

- Where appropriate, recovery actions should be dealt with under the State Disaster Plan (DISPLAN) to avoid development of a potentially dangerous situation in cases where there is an overall coordinated disaster response.

Other Desirable Management Actions

Seven Creeks Population

- Develop and implement a management plan for the Seven Creeks Wildlife Reserve, with a major objective being the protection of Trout Cod.
- Continue to review the Seven Creeks Catchment Planning Report (Codd & Wood 1987).
- Exclude stock from the riparian zone by fencing. Construct limited stock access points to the water, and maintain these to prevent erosion.
- Assess potential Trout Cod habitat elsewhere in Seven Creeks, including upstream of Polly McQuinns Weir, and consider translocating some individuals if suitable habitat is available.

Other Populations

- If monitoring demonstrates that any introduced populations of Trout Cod are breeding, work towards increasing the area of suitable habitat by protecting riparian vegetation, stream banks and water quality; by providing any necessary additional instream cover; and by following any recommendations which arise from research into Trout Cod's ecological requirements.
- Fence off the riparian zone to exclude stock from any sites where Trout Cod form breeding populations.

Research and Monitoring

- Investigate:
 - a. flow velocities at the streambed, including boundary layer flows, which may be particularly important for small fish;
 - b. the Trout Cod's response to perturbations such as changes in suspended sediment concentration, water temperature, flow velocity, or discharge;
 - c. its environmental flow requirements;
 - d. the population genetics of the Trout Cod, to determine whether the population in Seven Creeks is genetically distinct from NSW populations;
 - e. the feasibility of constructing fishways which could be used by Trout Cod in creeks where the populations are likely to be fragmented by steep drops, such as Koetong and Sevens Creeks, and monitor the use of any that are constructed;
 - f. the feasibility and usefulness of providing additional instream cover, in particular in Seven Creeks from Watchbox Creek downs to the Galls Gap road crossing, and monitor any additional cover to determine whether it is used;
 - g. the effect of Redfin virus on Trout Cod, and whether Redfin in Seven Creeks carry the virus;
 - h. whether Trout pose a threat to Trout Cod.

- Monitor the movements of Trout Cod by tagging and surveying, and of Redfin in Seven Creeks to detect whether they have Redfin virus;
- Assess whether stocking is a useful conservation tool at present, or whether effort should be directed into other areas first, such as developing suitable habitat.

Legislative Powers Operating

Legislation

Fisheries Act 1968: Provides for the closure of waters to fishing, and regulates the taking of fish. The Fisheries (Recreational) Regulations 1992 made under the Act establish the closure of Seven Creeks to angling from Polly McQuinn's Weir down to the Galls Gap Road bridge downstream of Watchbox Creek. Regulation 35 establishes that possessing or taking Trout Cod anywhere in Victoria is an offence.

Flora and Fauna Guarantee Act 1988: provides for listing Trout Cod, preparing the action statement, and determining the critical habitat. Taking, trading in or keeping Trout Cod is prohibited without a licence under this Act or an authorisation by an Order of the Governor-in-Council.

Water Act 1989: provides for the allocation of water for environmental requirements.

Land Act 1958: Provides for the issuing of licences for grazing stock on public land. Several water frontage licences have been issued under this Act for frontages along Seven Creeks.

Crown Land (Reserves) Act 1978: for reservation of Crown Land, which may be useful for areas determined to be 'critical habitat'.

Environment Protection Act 1970: for preventing water pollution and protecting beneficial uses of river, which includes maintaining natural aquatic ecosystems and associated wildlife.

Soil Conservation and Land Utilization Act 1958: provides for preventing and mitigating soil erosion and promoting soil conservation and proper water management.

Relevant Guidelines

Department of Water Resources (1989) Guidelines for the incorporation of environmental water requirements in planning new water projects. DWR Report No. 48. VGPO, Melbourne.

Department of Conservation, Forests and Lands (1989) Codes of Forest Practices for Timber Production: Revision No 1. Department of Conservation, Forests and Lands, Victoria.

Department of Conservation and Environment (1990) Environmental guidelines for river management works. Office of Water Resources, Melbourne.

Environment Protection Authority (1991) Construction techniques for sediment pollution control. Publication No. 275. EPA, Melbourne.

Licence or Permit Conditions

A Governor-in-Council Order has been made which allows the Secretary to the Department of Conservation and

Natural Resources to take and keep fish which are members of a listed taxon or community for the purposes of research, breeding, education, exchange with other scientific organisations, and special management actions where required for conservation management.

A licence is being drafted under the Flora and Fauna Guarantee Act 1988 to allow NFA to keep Trout Cod for breeding, in close cooperation with CNR. NFA holds a permit to keep Trout Cod, issued under the Fisheries Act 1968. This permit expires in December 1993.

Licences will only be issued to allow Trout Cod to be displayed for educational purposes subject to close supervision by CNR or NFA.

Licences for research by organisations other than CNR will be assessed individually, and will only be granted if CNR is confident that the facilities and expertise are adequate, that the research will help the long-term conservation and management of the species, and that it is unlikely to cause harm to the fish.

Consultation and Community Participation

Groups consulted outside CNR were Native Fish Australia Inc., Victorian Piscatorial Council and the Council of Victorian Fly Fishing Clubs. A high-level of community involvement in fulfilling the actions in this action statement is envisaged through the continued operation of the Seven Creeks Catchment Management Group and the formation of LandCare groups in areas determined to be Trout Cod Critical Habitat. The Seven Creeks Catchment Management Group already plays an extremely important role in protecting the Seven Creeks catchment, and thus the Trout Cod population.

Implementation, Evaluation and Review

CNR's Flora and Fauna Branch and Fisheries Management Branch will be responsible for implementing the breeding, release and monitoring programs, identifying the Trout Cod's critical habitat, determining (in consultation with relevant CNR Regions) the protective measures required, developing and implementing research programs into Trout Cod's ecological requirements, developing an action plan for dealing with catastrophic events, determining guidelines for issuing of licences to take and keep Trout Cod, providing advice and recommendations to Regions where required, and assessing the status of Trout Cod each year, to determine whether extra protective measures need to be adopted.

The CNR Regions where Trout Cod are released, and those where the critical habitat occurs, will be responsible for informing catchment or water management agencies of the presence of Trout Cod, monitoring works and activities within these catchments and consulting with Flora and Fauna Branch where required, negotiating with landholders or other groups effected by protective measures, carrying out works to protect the critical habitat, and working with Flora and Fauna Branch on determining protective measures within the critical habitat. The effectiveness of actions taken to protect Trout Cod in Seven Creeks will be determined by:

- increased or stable numbers of Trout Cod in Seven Creeks,
- increase in Trout Cod range in Seven Creeks between Gooram Falls and Galls Gap Road,

- presence of juvenile fish (0+ age class) in Seven Creeks, and
- development of breeding populations of Trout Cod at release sites, determined by the presence of Trout Cod at these sites that are too young to have arrived through stocking.

The action statement will be reviewed annually by the Freshwater Ecology Section to evaluate progress made in implementing the intended actions. If the Trout Cod population appears to be declining, then the Section, in consultation with relevant Regions and the Fisheries Management Branch, will immediately review all action taken, and determine more appropriate measures to ensure the protection of the species.

The action statement will be evaluated in 1995 to determine whether the actions are meeting the conservation objectives, and any necessary revisions will be made.

Contacts

Management

CNR Benalla Region, North East Region, Alexandra Region, and Bendigo Region.

CNR Flora and Fauna Branch, Freshwater Ecology Section.
CNR Fisheries Management Branch.

Biology

CNR Flora and Fauna Branch, Freshwater Ecology Section.
CNR Fisheries Management Branch.

References

- Anderson, J. (1991) Status of the protected populations of Trout Cod (*Maccullochella macquariensis*) and other native fish in the upper reaches of Seven Creeks, Victoria, in 1991. Department of Conservation & Environment (unpublished).
- Berra, T.M & Weatherly, A.H. (1972) A systematic study of the Australian freshwater Serranid fish genus *Maccullochella*. *Copeia* 1: 53-64.
- Cadwallader, P.L. (1979) Distribution of native and introduced fish in the Seven Creeks river system, Victoria. *Aust. J. Ecol.* 4: 361-385.
- Cadwallader, P.L. & Backhouse, G.N. (1983) A guide to the freshwater fish of Victoria. VGPO, Melbourne.
- Cadwallader, P.L. & Gooley, G.J. (1984) Past and present distributions and translocations of Murray Cod *Maccullochella peelii* and Trout Cod *M. macquariensis* (Pisces: Percichthyidae) in Victoria. *Proc. R. Soc. Vict.* 96: 33-43.
- Codd, P.R. & Wood, J.F. (1987) Seven Creeks Catchment Project Planning Report. Department of Conservation, Forests and Lands, Benalla Region (unpublished).
- Department of Water Resources (1989) Guidelines for the incorporation of environmental water requirements in planning new water projects. Report No. 48. VGPO, Melbourne
- Department of Conservation, Forests and Lands (1989) Codes of Forest - Practices for Timber Production: Revision No 1. Department of Conservation, Forests and Lands, Victoria.
- Department of Conservation & Environment (1990) Environmental Guidelines for River Management Works. Office of Water Resources, Melbourne.
- DSE (2002) Atlas of Victorian Wildlife (Electronic Fauna Database). Parks, Flora & Fauna, Department of Sustainability & Environment, East Melbourne.
- Environment Protection Authority (1991) Construction techniques for sediment pollution control. Publication No. 275, EPA, Melbourne.
- Griffith, B., Scott, J.M., Carpenter, J.W., & Reed, C. (1989) Translocation as a species conservation tool: status and strategy. *Science* 245: 477-480.
- Harris, J.H. (ed.) (1987) Proceedings of a Conference on Australian Threatened Fishes, Melbourne, 15-16 August 1985. Australian Society for Fish Biology, Sydney.
- Hopper, S.D. & Coates, D.J. (1990) Conservation of genetic resources in Australia's flora and fauna. *Proc. Ecol. Soc. Aust.* 16: 567-577.
- Koehn, J.D. (1987) Artificial habitat increases abundance of two spined blackfish (*Gadopsis bispinosus*) in the Ovens River, Victoria. ARI Technical Report Series No. 56, Department of Conservation, Forests & Lands.
- Koehn, J.D. & Morison, A.K. (1990) A review of the conservation status of native freshwater fish in Victoria. *Vict. Nat.* 107: 13-25.
- Mitchell, P. (1990) The Environmental Condition of Victorian Streams. Department of Water Resources, Victoria.
- Morison, A.K. & J.R. Anderson 1987: Status of Trout Cod (*Maccullochella macquariensis*), Macquarie Perch (*Macquaria australasica*), and other fish populations in the upper reaches of Seven Creeks based on surveys between 1981 and 1987. ARI Technical Report No. 59. Department of Conservation & Environment, Victoria.
- Mueck, S.G. (1990) Remnant indigenous vegetation of the Seven Creeks catchment and its importance as critical habitat for the Trout Cod *Maccullochella macquariensis*. M. Env. Sci. thesis, Department of Geography & Environmental Science, Monash University, Melbourne (unpublished).
- Newall, P.R. (1990) Water quality in relation to catchment activities in the Seven Creeks catchment. M. Env. Sci. thesis, Department of Geography & Environmental Science, Monash University, Melbourne.
- Newall, P.R. & Mueck, S.G. (1990) Habitat Evaluation and a Management Plan for the Survival of the Trout Cod (*Maccullochella macquariensis*) in Victoria. M. Env. Sci. thesis, Dept of Geography and Environmental Science, Monash University, Melbourne.
- Oswood & Barber (1982) Assessment of fish habitat in streams: goals, constraints and a new technique. *Fisheries* 7(4): 8-11.

Compiler

Julia Reed

Further information

Further information can be obtained from Department of Sustainability and Environment Customer Service Centre on 136 186.

Flora and Fauna
Guarantee Action

Statements are available from the Department of Sustainability and Environment website:
<http://www.dse.vic.gov.au>

References (cont.)

- Scientific Advisory Committee, Flora and Fauna Guarantee Victoria (1991) Final recommendations on a nomination for listing: *Maccullochella macquariensis* (Nomination No. 4). Department of Conservation & Environment, Victoria.
- Wesche, T.A. (1975) Stream channel modifications and reclamation structures to enhance fish habitat in Gore, J.A. (ed.) The restoration of rivers and streams. pp. 103-164. Butterworths, Stoneham, USA.