

Eastern Freshwater Cod

Maccullochella ikei

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Illustration by Pat Tully

Introduction

The Eastern Freshwater Cod (*Maccullochella ikei*), often called Eastern Cod or Clarence River Cod, is similar in appearance to Murray Cod (*Maccullochella peelii*). It belongs to the family Percichthyidae and is native to the Clarence and Richmond River systems of north-eastern NSW. Another similar species, the Mary River Cod (*Maccullochella peelii mariensis*), occurs in Queensland and is also considered threatened.

Although once prolific in the Clarence and Richmond Rivers, remnant (non-stocked) populations are now only found in parts of the Clarence River and its tributaries. No remnant populations remain in the Richmond River system.

Between 1988 and 1997, hatchery bred Eastern Freshwater Cod were stocked throughout parts of the Clarence and Richmond Rivers. While Fisheries' surveys and angler reports indicate that stocked fish have survived, the populations remain relatively small in these areas.

The Eastern Freshwater Cod is listed as an **endangered species** under both NSW and Commonwealth law. There are heavy penalties for harming, buying, selling or possessing them, or for harming their habitat, without appropriate authority (see 'Legal implications').

A recovery plan has been developed for Eastern Freshwater Cod and work on recovery actions is well underway.

Description

The Eastern Freshwater Cod is a large, elongated, deep-bodied fish with relatively small eyes. It has a short, rounded, depressed snout with a distinctly concave profile. The Eastern Freshwater Cod has a protruding lower jaw and a large mouth that extends to below the back of the eye. The species has been recorded to weigh 41 kg but is more commonly less than 5 kg and 660 mm.

The Eastern Freshwater Cod is generally a yellow green to golden colour, with a speckled pattern of black to very dark green spots.

Habitat and ecology

- The Eastern Freshwater Cod was once abundant in both the Clarence and Richmond River systems downstream of tablelands waterfalls, with fish weighing up to 27 kg frequently caught in the Clarence and Orara Rivers. The species apparently declined in the Richmond River and much of the Clarence River system from the late 1920s and 1930s.
- Prior to the commencement of the conservation stocking program in the late

1980's, the species was considered to have become locally extinct in the Richmond River catchment and only small numbers were recorded from remnant populations in tributaries such as the Nymboida, Guy Fawkes, Boyd, Mann and Washpool Rivers where some pristine habitat remained.

- The distribution and abundance of the remnant populations of Eastern Freshwater Cod has increased significantly over the last 20 years since their protection. The species is now relatively common in the Nymboida and Mann Rivers and patchily distributed in other major tributaries of the Nymboida/Clarence system.
- The Eastern Freshwater Cod is often found in clear, flowing streams with rocky beds and deep holes. The species is generally found in areas that have plenty of boulders or large woody debris (snags). Riparian vegetation, large boulders and snags provide a complex array of habitats for each stage of the Eastern Freshwater Cod life cycle and influence the quality and quantity of food and shelter.
- The Eastern Freshwater Cod is sexually mature when 4 or 5 years old, and between 700 g to 1.5 kg. The breeding season occurs in spring and spawning takes place from September to November.
- Breeding fish are territorial and aggressive. Eastern Freshwater Cod lay large (3 mm) strongly adhesive eggs onto hard surfaces such as rocks and logs. The number of eggs produced is relatively low and similar to Murray Cod (3.2 - 7.6 eggs/gram of female bodyweight). Hatching begins after 8 days, and is complete 12 days after fertilisation at 17° - 20° C. Larvae start feeding on zooplankton 12 days after hatching.
- The adult Eastern Freshwater Cod is a territorial and aggressive fish with no distinct migration pattern. The species is known to prey upon fishes, frogs, crustaceans and a variety of terrestrial animals such as snakes, birds and mice. Zooplankton and aquatic insects are the main food source for larvae.

Why are Eastern Freshwater Cod threatened?

- Historical decline of Eastern Freshwater Cod is thought to have been caused by a combination of over-fishing, including by the use of explosives, with a series of catastrophic natural events where heavy rains followed severe bushfires, causing a deterioration of water quality and leading to widespread fish kills.

- Releases of contaminated water from tailings dams at gold and tin mines are thought to have caused the death of Eastern Freshwater Cod in parts of the Clarence system.
- River regulation and water extraction reduce flows, alter water temperatures, and can affect seasonality of flows, detrimentally impacting on the Eastern Freshwater Cod.
- Habitat degradation including sedimentation of deeper holes, changes to stream substrates, and reduction of aquatic vegetation.
- Loss of riparian vegetation contributing to reduced bank stability, reduction in water quality, reduced shading, increased water temperatures, and reduced habitat quality for Eastern Freshwater Cod and their food sources.
- Introduced species such as Banded Grunter (*Amniataba percooides*) may pose threats from disease, competition, predation and habitat degradation.
- Illegal fishing practices directly reduce Eastern Freshwater Cod numbers, remove breeding age adults and disturb breeding activities including egg and larvae guarding, leading to increased predation of eggs and juveniles by other fish, eels and turtles.

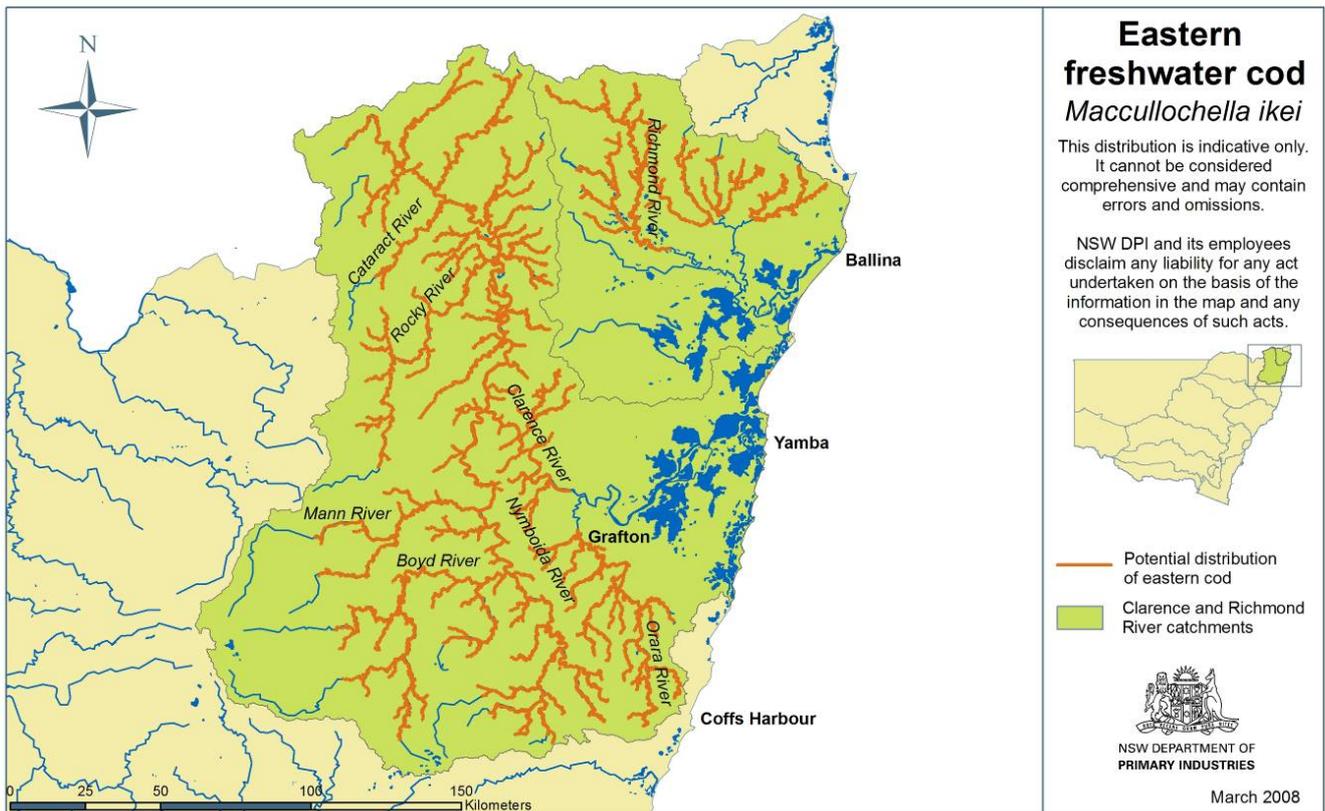
Artificial breeding and stocking

The NSW Department of Primary Industries (NSW DPI) developed artificial breeding techniques for Eastern Freshwater Cod at the Grafton Research Centre in 1988 and the first release of hatchery bred stock soon followed.

A stocking program involving a commercial hatchery commenced in the late 1990's and ceased in 2003. NSW DPI is currently assessing the effectiveness of the stocking program and other recovery actions and undertakes regular monitoring of Eastern Freshwater Cod populations.



Eastern Freshwater Cod habitat. Photo: NSW DPI



Conservation and recovery actions

- Allocate and manage environmental flows in regulated rivers to lessen the impacts of unnatural flow and temperature patterns, and to maintain natural flow seasonality.
- Educate fishers about the identification and protected status of Eastern Freshwater Cod.
- Develop and implement control programs for, and prevent translocation of, pest species such as Banded Grunter.
- Modify stream and river crossings on farms and public roads in accordance with NSW DPI guidelines for fish passage.
- Enhance compliance with fishing regulations.
- Prevent sedimentation and poor water quality by improving land management practices, conserving and restoring riparian vegetation and using effective erosion and sediment control measures.
- Evaluate the need for fishways and removal of redundant weirs to improve fish passage and reconnect aquatic habitats.
- Monitor Eastern Freshwater Cod populations to assess the effectiveness of recovery plan actions.
- Continue targeted research on key aspects of the biology of Eastern Freshwater Cod to improve understanding of the species.

- Implement the Protected, Threatened and Pest Species Sighting Sheet Program: **Report any sightings of the species on the NSW DPI 24 hour automated message-taking service by calling (02) 4916 3877.**

Legal implications

It is illegal to attempt to catch, buy, sell, possess or harm Eastern Freshwater Cod (or any other threatened species in NSW) without a specific permit, licence or other appropriate approval, and significant penalties apply. For endangered species, these penalties can include fines of up to \$220,000 and up to 2 years in prison.

There can also be significant penalties for causing damage to the habitat of a threatened species through actions such as dredging riverbeds, removing large woody debris and constructing barriers that block the free passage of fish without approval.

Clearing activities authorised by a property vegetation plan approved under the *Native Vegetation Act 2003* are permitted provided the native vegetation reform package had the benefit of biodiversity certification at the time the property vegetation plan was approved.

Clearing that constitutes a routine agricultural management activity, and certain routine farming practice activities (other than clearing) are permitted, provided the activities are to the

minimum extent reasonably necessary and all other relevant statutory approvals or authorities have been obtained.

The impacts of developments or activities that require consent or approval in accordance with the *Environmental Planning and Assessment Act 1979* must be assessed and considered by consent or determining authorities. Where such actions are likely to result in a significant impact on a threatened species or its habitat, a detailed Species Impact Statement must be prepared.

Strategies to be adopted for promoting the recovery of Eastern Freshwater Cod to a position of viability in nature must be set out in the NSW DPI Priorities Action Statement.

A recovery plan has been prepared for Eastern Freshwater Cod in accordance with the provisions of the *Fisheries Management Act 1994* to promote the recovery of the species to a position of viability in nature.

Bibliography and further reading

- Harris JH & Rowland SJ 1996. Family Percichthyidae: Australian Freshwater Cods and Basses. Pp. 150-163 in: McDowell, R.M. (ed.), *Freshwater Fishes of South-Eastern Australia* (second edition). Reed Books, Sydney, 247pp.
- Butler GL & Rowland SJ 2009. Using underwater cameras to describe the reproductive behaviour of the endangered eastern freshwater cod *Maccullochella ikei*. *Ecology of Freshwater Fish*. 18:3 pp.337-349.
- Nock JR, Ovenden JR, Butler GL & Wooden I 2011. Population structure, effective population size and adverse effects of stocking in the endangered Australian eastern freshwater cod *Maccullochella ikei*. *Journal of Fish Biology*. 78:1 pp. 303-321.



Eastern Freshwater Cod habitat. Photo: NSW DPI

NSW Fisheries 2004. Eastern (Freshwater) Cod (*Maccullochella ikei*): Recovery Plan. Threatened Species Unit, NSW Fisheries, Port Stephens Fisheries Centre 37pp. Available at <http://www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what/recovery/efc>.

Rowland SJ 1993. *Maccullochella ikei*, an endangered species of freshwater cod (Pisces: Percichthyidae) from the Clarence river system, NSW and *M. peelii mariensis*, a new subspecies from the Mary river system, Qld. *Records of the Australian Museum*, 45: 121-145.

For further information

See the NSW DPI website: www.dpi.nsw.gov.au

Contact NSW DPI Threatened Species Section:

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