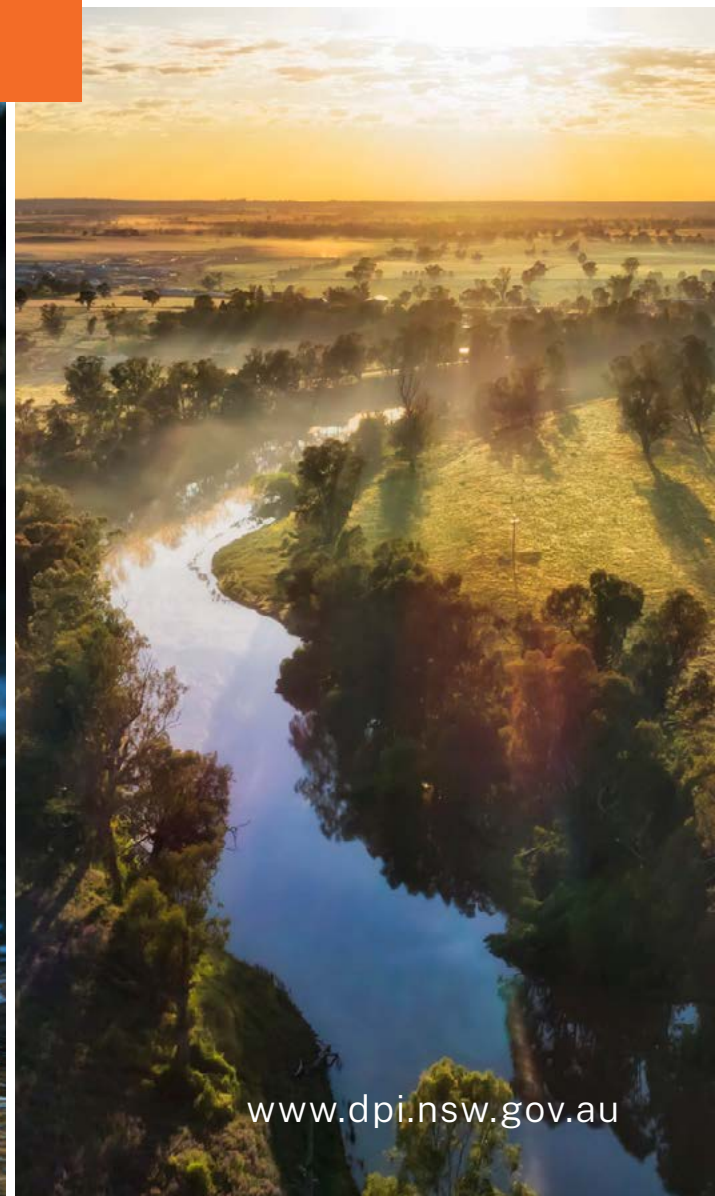


Trout Cod Action Plan

2023-2033





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Vision

Re-establish viable Trout Cod populations in priority habitats across their former range, that can once again support ecological, cultural and recreational values



Trout Cod distribution map

Evidence Base

The population of Trout cod are in significant decline across New South Wales, now limited to a single self-sustaining population in the Murray River between the Yarrawonga Weir and Barmah and several reintroduced populations. All of these populations are at serious risk from a number of threats and without significant effort and dedicated resources to protect, recover and support range expansions, these populations will continue to decline to the point of eventual extinction of the species from NSW waters.

Current status & conservation stocking efforts

Trout cod target locations NSW			
Population	Type	Stocking Summary	Established*
Mid Murray River including the Trout Cod Protection Area (Between the Yarrawonga Weir and Barmah)	Natural	Broodstock collection	Yes
Murray River (Between Barmah and Swan Hill)	Natural	N/A	No
Upper Murray River	Conservation Stocking	Stocking between 1986 & 1997	No
Upper Murrumbidgee River	Conservation Stocking	Stocking between 1988 & 2008	No
Mid and Lower Murrumbidgee River	Conservation Stocking	Stocking between 1992 & 2008	Yes
Upper Macquarie River (Above Burrendong Dam)	Conservation Stocking	Stocking between 1991 & 2018	No
Lower Macquarie River (Below Burrendong Dam)	Conservation Stocking	Stocking between 1998 & 2004	No
Goodradigbee River	Conservation Stocking	Stocking between 2020 to present	In development phase
Talbingo Dam	Recreational Stocking	Stocking between 2020 to present	In development phase
Cataract Dam	Translocated population	1914-1916	Yes (major hybridisation with Murray cod)
Barwon River, Ophir Creek, Turon River, Abercombie River, Bumbuggan Creek, Crudine River	Conservation Stocking	1991-1993	No

*Established self-sustaining population

Action Plan Summary

Over a ten-year timeframe, this plan will deliver on specific outcomes via a suite of actions to transition Trout cod towards delisting as a threatened species.



Trout cod *Maccullochella macquariensis*

Snapshot of key actions

Short term priority actions (1-2 years)	Medium term priority actions (2-5 years)	Long term priority actions (5-10 years)
• Develop a reintroduction strategy that identifies and prioritises reintroduction sites • Develop a broodstock management plan, which includes genetic requirements and directs the collection of broodstock for future increased production • Initiate pond spawning trials	• Improved captive breeding technique – transition from hormone induction and stripping techniques to hatchery pond spawning • Comprehensive captive breeding program established with increased output capacity • Stocking commenced at two new riverine locations and one impoundment • Ongoing monitoring program established • Investigate the ramifications and long-term effects of hybridisation with Murray cod, including compliance actions	• Annual conservation stocking is undertaken at priority locations • Monitoring and evaluation undertaken to demonstrate an increase in the abundance, distribution, and genetic diversity of the existing wild population of Trout cod to ensure long term population viability • A minimum of three new viable populations of Trout cod established • Established a viable and valued catch and release fishery for Trout cod • Review of the Trout Cod Action Plan will be conducted in year 9 (2032)

Captive Breeding, Stocking & Translocations

Priority action

Maintain/expand/increase populations of Trout cod in NSW to support recovery, including establishing self-sustaining populations through stocking

National Recovery Plan Actions

- 1.1 Evaluate current reproductive status, fecundity, recruitment levels and longevity of natural and stocked populations.
- 9.1 Maintain captive adult breeding populations at Snobs Creek Fisheries Research Station and Narrandera Fisheries Research Station, and breed for reintroduction to the wild.
- 13.1 Continue with a national Recovery Team to coordinate recovery actions and exchange knowledge with local and interstate agencies to maintain communication, to assist with management and implementation.
- 13.4 Undertake a formal review and evaluation within five years from adoption.

Short term (1-2 years)

- Develop a Trout cod reintroduction strategy that identifies and prioritises stocking sites to optimise fish stocking outcomes for range expansion and reintroduction
- Develop a broodstock and genetic management plan including identification of source populations and increased production targets
- Investigate funding opportunities to support and/or expand Trout cod stocking in priority areas
- Increase genetic diversity of remnant populations
- Review and assess genetic management protocols for breeding of Trout cod
- Identify requirements needed to deliver increased production targets
- Trial pond spawning

Medium term (2-5 years)

- Increase production to 100,000 fingerlings annually
- Continue collaborative partnerships with VIC Fisheries

Long term (> 5-10) years

- Establish large scale production of Trout cod 250,000 fingerlings per year
- A minimum of three new viable populations of Trout Cod established

Outcome

- New stocking sites identified and prioritised
- Development of a Trout cod stocking strategy
- Trout cod genetic management plan
- Production of sufficient numbers of Trout cod to meet requirements
- Increased genetic diversity to ensure long term population viability

Research / Monitoring & Evaluation

- Implement/continue a monitoring program to assess stocking survival rates
- Investigate optimal spawning habitats for use in both hatchery and wild environments
- Explore if artificial spawning habitats improve wild spawning success and limit hybridisation
- Investigate skewed sex ratios in Trout cod broodstock
- Monitoring and evaluation undertaken to demonstrate an increase in the abundance, distribution, and genetic diversity of the existing wild population of Trout cod to ensure long term population viability
- Undertake genetic assessment of current and future broodstock to ensure best genetic outcome from captive breeding program
- Determine sustainable brood stock collection numbers from each population

Captive Breeding, Stocking & Translocations continued...

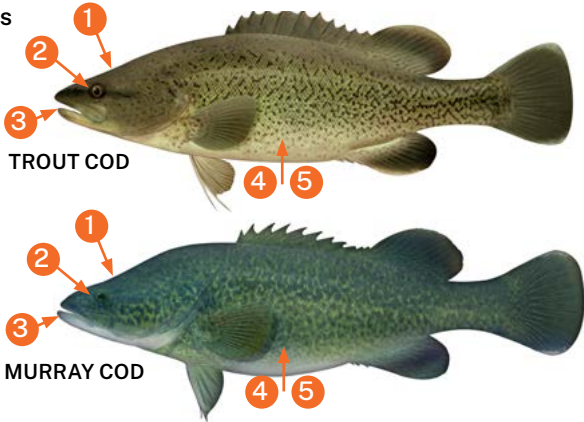
Priority action		
Secure existing populations		
National Recovery Plan Actions		
4.1 Monitor the range and status of the Trout cod population in the Murray River, particularly (a) identification of the area and extent of the population; (b) estimates of the size and structure and (c) inference or estimation of population change.		
4.5 Maintain fisheries compliance activity along the Murray River Trout Cod zone.		
Short term (1-2 years)	Medium term (2-5 years)	Long term (> 5-10) years
Undertake genetic assessment of the existing remnant and re-established populations	Undertake field surveys to accurately identify area of extent and population size and structure of existing populations	Boost populations with captive bred fish where needed
Outcome		
Secure and expand existing populations of Trout cod and foster self-sustaining populations		

Priority action		
Quantify the impacts and drivers of hybridisation between Trout cod and Murray cod		
Short term (1-2 years)	Medium term (2-5 years)	Long term (> 5-10) years
- Identify key research questions regarding the issue of hybridisation - Identify management options to reduce hybridisation in the wild	Commence research into the impacts and causes of hybridisation	Key research questions answered to inform ongoing management actions
Outcome		
Identify management options to reduce hybridisation in the wild		

Recreational Fishing

Priority action		
Increase community awareness of Trout cod status, threats, and recovery through education programs		
National Recovery Plan Actions		
11.3 Maintain/enhance education programs to assist anglers to distinguish between Trout cod and Murray cod. 11.4 Develop an education kit on Trout cod conservation and distribute to schools. 11.5 Encourage the involvement of community groups in the conservation program for Trout cod. 11.6 Ensure the results of research and management on Trout cod are publicised through scientific meetings, journal publications and articles for the popular press, including fishing magazines.		
Short term (1-2 years)	Medium term (2-5 years)	Long term (> 5-10) years
• Increase education regarding correct identification of Trout cod in all relevant jurisdictions (NSW & Vic) • Continue production of information brochures and advisory material for distribution to relevant stakeholders • Targeted community events to lift the profile of Trout cod in key areas • Develop online content to lift the profile of Trout Cod among rec fishers • Encourage community involvement in aspects of Trout cod recovery • Continue installation of signs regarding Trout cod identification at appropriate locations • Continue to build and promote the emerging fishery in Talbingo Dam	• Identify key areas for additional catch and release fisheries for Trout cod	• Have at least 2 viable and valued catch and release fisheries for Trout cod
Outcome	Research / Monitoring & Evaluation	
• Greater awareness of Trout cod in the community including understanding of their status, threats and correct identification.	• Quantify the impacts of catch and release fishing on Trout cod	

Comparison of Trout cod and Murray cod identification features

TROUT COD			MURRAY COD	
1 Head profile	Straight		1 Head profile	Concave
Head width	Narrow		Head width	Broad
2 Eyes	Larger, usually with eye stripe in all sizes		2 Eyes	Smaller, eye stripe usually absent in fish over 4kg
3 Jaws	Upper overhangs lower		3 Jaws	Equal or bottom jaw protrudes
4 Body colour	Blue-grey to dark brown on back, paler (grey to white) on ventral surface		4 Body colour	Pale green to creamy-yellow on back, paler on ventral surface
5 Body markings	Dark spots and irregular dashes, except on forehead or snout		5 Body markings	Green mottled or mosaic pattern, extending onto forehead and snout
Max reported weight: 16kg			Max reported weight: 114kg	

Recreational Fishing continued...

Priority action		
Reduce fishing related mortality and maximise angler compliance		
National Recovery Plan Actions		
3.3 Investigate the impact of incidental angling capture on Trout Cod. 4.5 Maintain fisheries compliance activity along the Murray River Trout Cod zone.		
Short term (1-2 years)	Medium term (2-5 years)	Long term (> 5-10) years
- Maintain regulations in the Trout cod protection area between Yarrawonga and Tocumwal - Implement targeted enforcement activities by NSW DPI Fisheries Officers, including joint cross jurisdictional operations - Maintain fisheries compliance activity in all known Trout cod populations	Investigate the ramifications and long-term effects of hybridisation, including compliance actions	Continue to deliver targeted educational material regarding identification, handling techniques and best practice catch and release methods to anglers
Outcome	Research / Monitoring & Evaluation	
- Improved public awareness of Trout cod protection regulations - Anglers are able to readily distinguish Trout cod from Murray cod and have an increased value and appreciation for Trout cod	Quantify the impact of angling on nesting fish and eggs during breeding season	



Trout cod (top) can hybridise with Murray cod (bottom).



Juvenile Trout cod

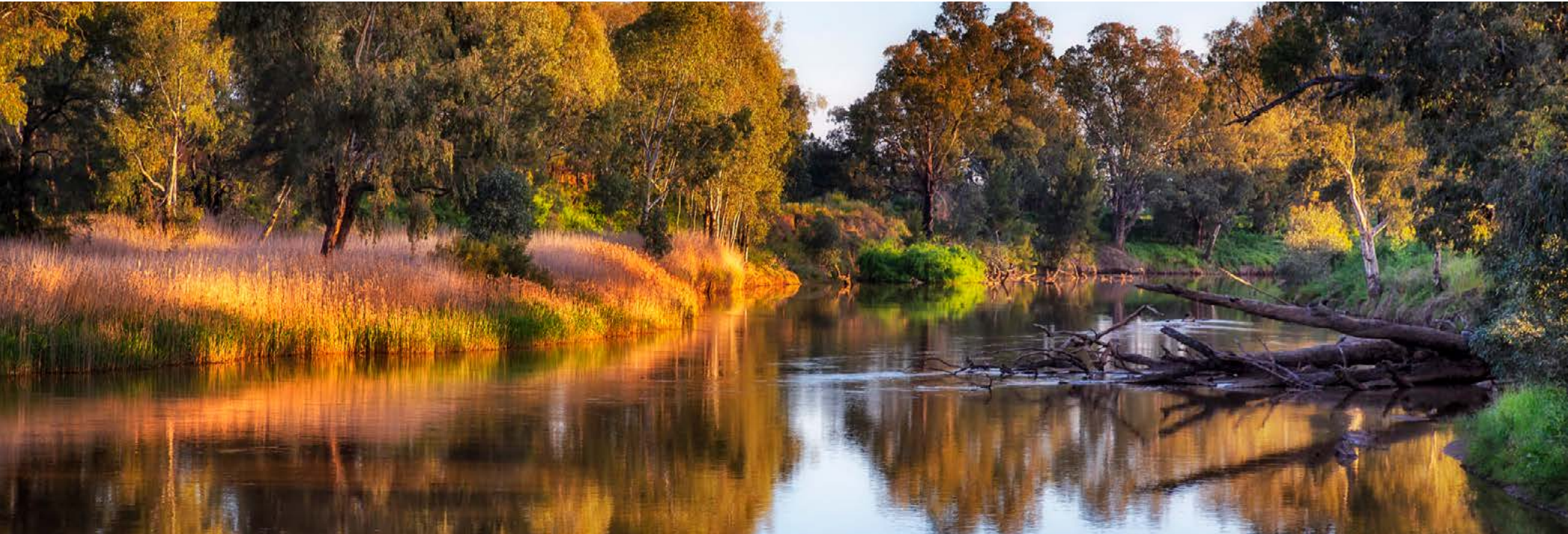
River health and habitat

Priority action		
Identify and prioritise reintroduction sites		
National Recovery Plan Actions		
2.1 Survey and map potential habitat, using ecological and bioclimatic information that may indicate habitat preference. 10.2 Identify and prioritise new sites for stocking Trout cod to establish new populations, in consultation with stakeholders.		
Short term (1-2 years)	Medium term (2-5 years)	Long term (> 5-10) years
Undertake GIS desktop assessments to predict potential habitat sites based on habitat suitability, climate change projections and waterway health	Identify 2 riverine and one impoundment expansion / reintroduction sites	Identify a further 2 riverine and one impoundment expansion / reintroduction sites
Outcome	Research / Monitoring & Evaluation	
- New potential Trout cod reintroduction sites identified - New populations established	Investigate and quantify natural habitat requirements including spawning sites, flow requirements and structural habitat preferences	

Priority action		
Identify known and potential threats to key Trout cod population locations and habitat		
National Recovery Plan Actions		
3.1 Investigate the precise impacts of known and potential threats to Trout cod 3.4 Identify and remove barriers to movement of Trout cod populations, through the existing fishways programs in Victoria and NSW.		
Short term (1-2 years)	Medium term (2-5 years)	Long term (> 5-10) years
- Ensure councils and other government agencies are aware of important Trout cod areas - Provide information to stakeholders to support appropriate environmental planning and impact assessment procedures	Encourage 'best practice' land use to assist in minimising adverse impacts on important Trout cod habitat.	Major threats in key locations identified and prioritised
Outcome		
Key Trout cod habitat is maintained and protected		

River health and habitat continued...

Priority action		
Identify and prioritise on-ground works and rehabilitation efforts at Trout cod populations and stocking locations		
Short term (1-2 years)	Medium term (2-5 years)	Long term (> 5-10) years
• Prepare a strategic plan for the protection and rehabilitation of key Trout cod habitats • Commence Stage 1 onground works to protect, enhance and improve instream and riparian habitats for Trout cod	• Undertake Stage 2 onground works to protect, enhance and improve instream and riparian habitats for Trout cod	• Undertake Stage 3 onground works to protect, enhance and improve instream and riparian habitats for Trout cod
Outcome	Research / Monitoring & Evaluation	
• Key Trout cod habitats are identified and restored/improved • Develop a strategic plan for protection and rehabilitation of key Trout cod habitat	• Evaluate the impact of artificial or introduced nesting habitat on population recovery in reintroduction areas	



Macquarie River near Dubbo NSW

Non-native / pest fish management

Priority action		
Minimise impact of stocked, translocated and non-native/pest fish species		
National Recovery Plan Actions		
3.1 Investigate the precise impacts of known and potential threats to Trout cod. 3.2 Investigate the interaction between Trout cod and introduced freshwater fish.		
Short term (1-2 years)	Medium term (2-5 years)	Long term (> 5-10) years
• Ensure the Freshwater Fish Stocking Fishery Management Strategy (FMS) is updated and impacts on Trout cod populations from stocking is taken into account • Identify risks of non-native/pest fish at stocking locations and management options	• Monitor non-native fish populations at key sites and undertake management or control programs if required	• Continue to monitor and manage non-native fish at key sites
Outcome	Research / Monitoring & Evaluation	
• Less impact from non-native species on Trout cod populations	• Research interactions between introduced species and Trout cod to establish the level of threat posed by each species. • Monitor non-native fish populations at key sites and undertake eradication or control programs if required	



Non-native species can compete with Trout cod for resources and impact water quality. Images on this page © Gunther Schmida



Introduced and stocked species can negatively impact on Trout cod

Communication and Engagement

Action

- Develop an action plan communication strategy
- The plan will include targeted community engagement in key focus areas and the development of a stakeholder management system
- Identify and engage Trout Cod champions (fishing identities) to promote the species and champion the cause
- Provide opportunity for involvement of recreational fishers in Trout Cod activities, such as fish releases, broodstock collection and fish downs in release locations
- Continue seeking opportunities to engage with other jurisdictions and organisations, particularly around key learnings, broodstock /progeny exchange
- Deliver national recovery plan actions in collaboration with other jurisdictions and organisations
- Develop and distribute additional advisory and educational materials
- Specific advisory materials regarding the cultural significance of Trout cod will also be developed and distributed
- Foster long-term, two-way knowledge transfer with Aboriginal communities
- Incorporate Aboriginal knowledge and involvement into planning and actions for recovery
- Continue to encourage community reporting of Trout cod via the NSW DPIRD Threatened and Pest Species Sightings Program online form
- Trout cod displays at hatcheries, catch & release pond for Trout cod with appropriate approvals



Further research is required to assess stocking success



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