Submission No 145

INQUIRY INTO FLOODPLAIN HARVESTING

Organisation: The Recreational Fishing Alliance of NSW

Date Received: 20 August 2021

The Recreational Fishing Alliance of NSW

Promoting Sustainable Fishing

20 August 2021

Ms Cate Faehrmann, MLC
Chair— Select Committee on Floodplain Harvesting
Legislative Council
Parliament House
6 Macquarie Street
SYDNEY NSW 2000

Submission to Inquiry into Floodplain Harvesting (extension granted)

On behalf of the Recreational Fishing Alliance of New South Wales (RFA), thank you for your invitation to provide a written submission to your inquiry. I also thank you for allowing the RFA an extension of time to 20 August 2021.

The RFA is the peak representative body for recreational anglers in New South Wales. The RFA represents the interests of anglers in the management of the State's recreational fisheries.

The inquiry and its outcome are of interest to recreational anglers. Our members living in the Southern Basin have observed a decline in the health of the waterways and abundance of our native fish species since the introduction of cotton production in the Northern Basin. Many members are concerned that water management policies and practice appear to favour irrigators in the Northern Basin at the expense of other users and the health of the Murray Darling Basin.

Accordingly, we hope this inquiry considers the issue of floodplain harvesting against the bigger picture the NSW Government's overall water management policies and practices. With this in mind, the RFA considers it important to:

- Limit the over-harvesting of any natural water flows of water across a catchment that has significant impacts on a freshwater aquatic ecosystem, in particular aquatic plants, fish and the food web that supports so much life.
- Fully restrict floodplain harvesting until such time as all environmental assessments and modelling assessments are in place.
- Hear evidence from Dr Martin Mallen-Cooper and Rod Harrison, who can provide insights into the impacts of floodplain harvesting on the Murray-Darling Basin fishery.

I attach the RFA's submission, together with background information, for the Committee's consideration. If it pleases the committee, the RFA will welcome and opportunity to elaborate further on its submission or other matters of interest to the committee.

Yours sincerely,

Stan Konstantaras
President
Recreational Fishing Alliance of New South Wales

Submission of the Recreational Fishing Alliance of New South Wales Inc to the Upper House Inquiry into Floodplain Harvesting

1. Introduction

The RFA's concerns focus on the NSW Governments overuse of water and notion of water rights as a tradeable commodity. Historically water, has been separated from land title and that was supposed to stop over extraction by landholders to stop salt tables rising, birds and fish disappearing and trees drying.

Over time, this safeguard has been eroded and has led to water storage being used a tradeable commodity. Treating water as a tradable commodity puts the environmental and basic human rights in the hands of financial institutions and investors. It is often said that as water moves from one region to another, the economic consequences will flow. Where the water goes, the economy will follow. The same can be said for the environmental health and wellbeing and that of the community. A balance has to found.

Floodplain harvest intercepts over-land flows from the floodplains surrounding main river channels and stores the water in on-farm dams for irrigation of broadacre crops, mostly cotton.

Floodplain harvesting has never been regulated, monitored, or measured in NSW. The NSW Government is in the process of licensing floodplain harvesting for the first time and recreational anglers have significant concerns that need to be addressed. Over-harvesting of any natural water flows of water across a catchment has significant impacts on a freshwater aquatic ecosystem, in particular aquatic plants, fish and the food web that supports so much life.

The cumulative impact of floodplain harvesting on environmental, cultural and social assets has not been assessed under any meaningful or transparent process. It is vital that the full impact of floodplain harvesting on environmental assets and function, on cultural values and on downstream social assets is rigorously assessed prior to granting new, compensable private property rights in the form of Floodplain Harvesting Licenses. First flush flows must be protected through specific rules in Water Sharing Plans and opportunistic access to intermittent flood flows should not be a right.

2. About the Recreational Fishing Alliance of New South Wales (RFA)

The RFA is the peak representative body for recreational anglers in New South Wales. The RFA represents the interests of anglers in the management of the State's recreational fisheries, promote sustainable fishing practices, encourage the participation of children, help secure rights to fishing access, encourage recreational anglers to become involved in the well-being of the fishery, promote consultation and communication between government and anglers and promote fishing safety.

The RFA estimates that there are 430,000 recreational fishers in the MDB, which currently contribute around $1.3 billion each year to the Australian economy. The RFA represents the interests of these anglers, who are also members of the community that have an intrinsic and natural connection to the water and the life it supports.

The RFA members include the New South Wales Council of Freshwater Anglers and the South West Anglers Association. Both organisations cover NSW's inland waterways and advise governments on issues impacting recreational fishers, and in effect, the impacts to entire communities.

The RFA itself has previously written to Minister for Water and the Minister for Agriculture and Western New South Wales, expressing concerns about the adverse impacts of irrigation activities on New South Wales's inland fisheries and the ecosystems that support those fisheries. While the RFA's

correspondence with those Ministers and their departments is ongoing, the RFA remains unsatisfied with their responses to date. Accordingly, the RFA is grateful for the opportunity to present this submission.

3. The decline of the health of the Murray-Darling Basin and impact on its fishery

Before addressing the Terms of Reference, it is important to set out the context within which the RFA has based its submission: the decline of the Murray-Darling Basin's native fish species.

The importance of water flow and the diverse requirements of native fish

In their natural state, the rivers in the Murray–Darling Basin (MDB) are characterised by a seasonal pattern of winter/spring high flows and floods and summer/autumn periods of low flow. The 46 native fish species that live in the basin have each evolved differently to the boom and bust nature of flow in those rivers.

Some fish, such as Golden Perch, prefer to live in flowing streams where flow pulses are generally required to generate a spawning response, with some individuals migrating over 1000 kilometres upstream to breed. Their eggs and larvae also benefit from flowing water which carries them downstream enabling wider dispersal.

In contrast, Southern Pygmy Perch avoid flowing water. It prefers still pools or wetlands with lots of aquatic plants, in which they complete their life cycle.

For many native fish, water flow can act as a spawning cue, stimulating fish on to breed and find suitable habitat to lay their eggs.

Some native fish lay their eggs in hollow logs or on snags, others use undercut banks or aquatic vegetation. Others, like the Freshwater Catfish, make a nest from gravel and will return to the same nest year after year. When snags are removed it is like bulldozing a person's house, as fish call snags 'home'. Snags also stabilise the riverbed, so when they are taken away the gravel that catfish rely on gets swept away downstream.

Water flow also plays a role in the dispersal for pelagic eggs (egg which float freely in the water column and are often slightly positively buoyant), while some species reply on flow to protect their nests and prevent them from being dried out.

As the eggs hatch, larvae and juvenile fish often drift with the flow to more suitable nursery habitats where there is abundant food and optimal water quality, as well as refuge from potential predators. Juvenile fish also use water flow for re-colonisation movement cues.

For adult fish, flow allows for pre-spawning fitness, as well as movement to spawning habitats and suitable water quality for feeding and breeding.

The floodplains and wetlands play a vital role in the accumulation and processing of organic matter, which provides a key source of nutrients, energy and food for the micro and macro-invertebrates at the lower levels of the food chain.

Zooplankton and aquatic insects are important food items of larval and juvenile fish and their production is linked to inundation of the floodplain.

Recreational anglers have always had an interest in the history and health of the rivers and in a recent survey recreational anglers from across the MDB asked for better information on the way fish respond to changes in flow, and in turn what that could mean for fishing in their local rivers over both the short and long term.

This video provides an overview of how recreational anglers and scientists are working together to ensure fish get the 'good flows' they need to breed, feed and move.

https://www.youtube.com/watch?v=K2P6-ASzsYY

The video was largely filmed on location in Canberra as part of the Murray-Darling Basin Native Fish Forum in August 2017.

NSW DPI Fisheries, in partnership with the Murray-Darling Basin Authority, also worked with keen anglers from across the NSW Basin to develop five easy to read infographics (pictures which aim to present information quickly and clearly) which answer some common questions posed by fishers and lovers of our river systems.

Accordingly, the 46 species of fish in the MDB (and the ecosystems that support those fish) require variety of different flows experienced within the rivers, floodplains and wetlands in order to breed and thrive. Reduced water flows can result in settlement and consequent concentration of large numbers of drifting larvae in weir pools, leading to poor downstream dispersal. Water diversion

from weir pools can also potentially result in the removal of many eggs and larvae from the river system.

Due to this dependence on flow variability, most native fish in the MDB are suffering from changes humans have made in the river system.

Impact of changes to water availability and the flow of water

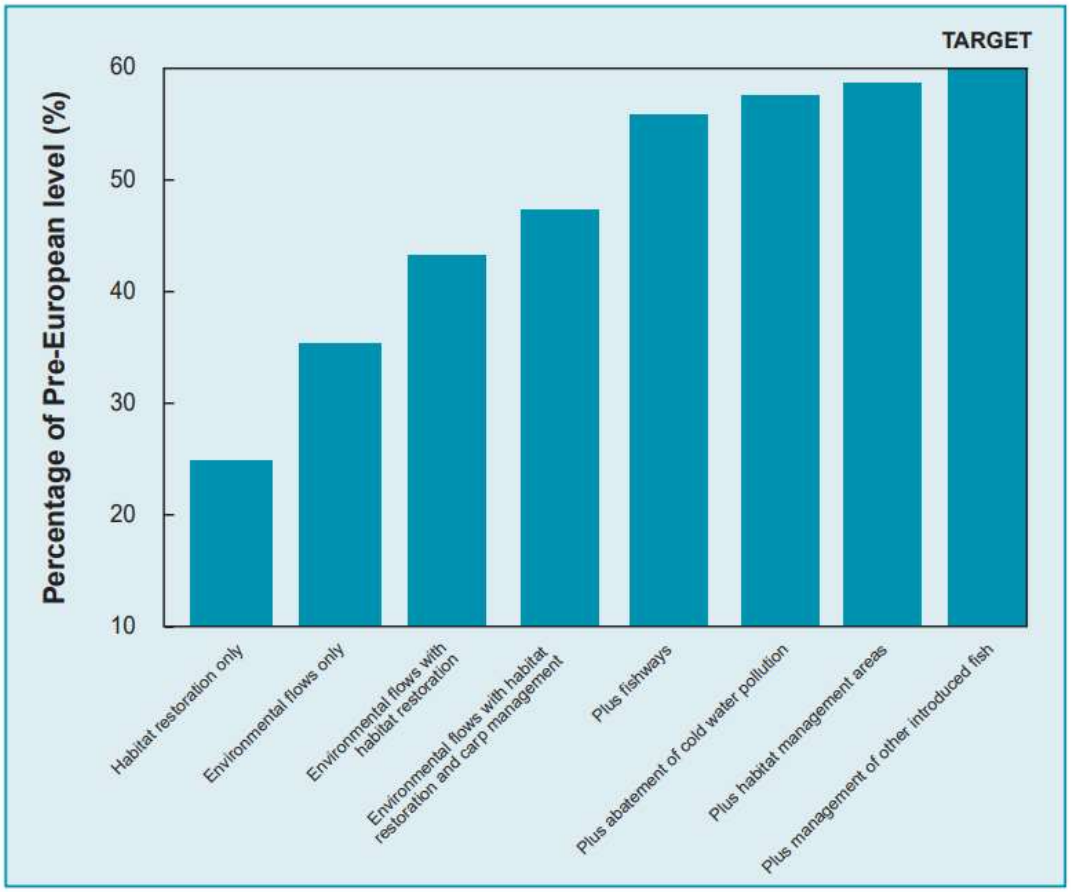
In 2003, an expert panel commissioned by the Murray-Darling Basin Commission estimated that native fish populations across the MDB were at approximately 10% of those existing prior to European settlement. In 2020, expert opinion commissioned by the Murray-Darling Basin Authority confirmed that native fish populations in the MDB have further declined since that 2003 assessment.

The loss of water and changes to the flow of water in the MDB is one of the major threats to its native fish species and the ecosystems that support those species.

The Murray Darling Basin Authority's *Native Fish Recovery Strategy* (June 2020) (at page 16) identified changes to water availability and flow patterns and changes to flowing water habitat availability as major threats to the MDB's native fish species.

The MDBA's predecessor, the Murray Darling Basin Commission, in its *Native Fish Strategy for the Murray-Darling Basin 2003-2013* (May 2003) reported that restoring environmental flows alone could see native fish populations return to 30% to 40% of pre-European levels:

Figure 2: Rehabilitation of native fish communities – cumulative impact of all interventions



This graph models expert advice showing the response of native fish communities to strategic rehabilitative interventions. Restoring environmental flows alone is predicted to return native fish populations at 30%-40% of pre-European levels (Murray Darling Basin Commission, *Native Fish Strategy for the Murray-Darling Basin 2003-2013*, Canberra, 2004, at page 11, Figure 2).

This should provide a fair indication of the extent to which changes to water availability and the flow of water has contributed to the 90% reduction of native fish populations in the MDB since European settlement.

How changes to water availability and the flow of water contributes to reduced fish populations

Floodplain harvest intercepts over-land flows from the floodplains surrounding main river channels and stores the water in on-farm dams for irrigation of broadacre crops, mostly cotton.

Ongoing floodplain harvesting has allowed irrigators in the Northern Basin to access flows that must be returned to the Barwon-Darling River and has allowed for significant extractions of water from a critically stressed river systems and the fish they support.

Over-harvesting of any natural water flows of water across a catchment has significant impacts on a freshwater aquatic ecosystem, in particular aquatic plants, fish and the food web that supports so much life.

Reduced floodplain and wetland inundation caused by the in-stream structures and levee banks has seriously affected the ecosystem. The morphological complexity of the system involving the main channel, floodplain and wetlands is critical for ecosystem health.

As mentioned earlier, the floodplains and wetlands play a vital role in the accumulation and processing of organic matter, which provides a key source of nutrients, energy and food for the micro and macro-invertebrates at the lower levels of the food chain. Water extraction for irrigation, industrial and domestic purposes has decreased flows to levels that may be detrimental to ecosystem functioning.

The RFA understands there is scientific evidence that floodplain harvesting has had adverse impacts on the MDB's fisheries due to changes to water availability and flow patterns and changes to flowing water habitat availability. However, the RFA is not in a position to quantify the extent to which this has occurred.

Part of the problem is that floodplain harvesting has not been regulated, monitored and measured to date (nor has it been paid for by the irrigators), making it difficult to quantify the full impact of floodplain harvesting. In addition, the environmental, ecological and socio-economic impacts of floodplain harvesting have never been fully assessed. It is hoped that the Committee will hear evidence from scientists, including Dr Martin Mallen-Cooper on this issue.

But isn't it nature's fault the rivers are all dry?

Politicians and other stakeholders resisting calls to increase protections to the environment or measures to mitigate environmental degradation will religiously chant the recital that

- '*Australia is a land of great extremes of drought and flood and bushfire* etc'
- '*it's an unavoidable drought*'
- '*it's climate change*', or
- '*it's nature's fault*'

Such assertions are often used to rationalise the poor state of our environment and to deflect responsibility how this occurred.

For example, in 2019, NSW Agriculture Minister Adam Marshall stated:

> "*I'm not going to mince words—the situation we are facing this summer is nothing short of a fish Armageddon, we're in the midst of the worst drought on record, with record low rainfall, record low inflows into our river systems and high temperatures predicted over the coming months. This is a perfect recipe for disaster and will inevitably result in wide-scale fish kill events this summer, even more significant than those we saw in Menindee earlier this year. While our region was largely spared the mass fish deaths which occurred in the lower half of NSW earlier this year, with the drought continuing and water becoming more scarce, we won't be as lucky this summer*."

He never once mentioned how much water had been removed legally or illegally from the northern NSW or western NSW watershed, or what was stored on enormous private dams, from Queensland to the Victorian border. This was the perfect recipe for disaster—irrigators taking more than they needed without looking at the long-term impacts. It was NOT all nature's fault.

However, the scientific and historical evidence and the accounts of recreational anglers who live in the Basin have exposed these assertions as nothing more than a myth.

The scientific and historical evidence, and the accounts of recreational anglers

Many scientists have previously given evidence in other inquiries exposing this myth and the RFA hopes the Committee will hear from those scientists. The RFA notes the scientific paper provided by Dr Martin Mallen-Cooper in his submission to the Murray-Darling Basin Royal Commission in 2018 that the natural state of the Murray River is a flowing river, and that it is now experiencing 1:1000-year event conditions on an annual basis.

The RFA has read a lot of historical accounts of how good the river once was. Recreational fishers also absorb these stories in wonderment and have heard oral accounts around campfires, at fishing clubs, at family BBQs and at their favourite water holes. Their ears prick up when an old timer starts a sentence with "let me tell you a tale of a once magnificent river which is now a mere shadow of its former self".

Our fishing old times are revered, admired, respected and celebrated and need to be an integral part of a process like this.

Anglers have watched their inland rivers continue to deteriorate despite efforts towards more coordinated management approaches and, as a result, are aware that most species of native fish in these waterways are under great pressure. Anglers have seen the massive and erratic fluctuations of many rivers that have been drastically altered and regulated before they have been fully understood.

Given the variability of inland river systems, forming a long view on ecological change is important, yet a major difficulty for ecologists studying these systems and their freshwater fish is their lack of access to information on their historic conditions from a fisher's perspective.

In addition, for anyone to utilise best management practices relating to native fish and the river ecosystem as a whole catchment, an understanding of what fishers have lost is essential. One of the many people the RFA has spoken to who can provide insight into this is Rod Harrison.

Rod Harrison is one of Australia's most enduring and accomplished angling identity and writer. So respected is his fishing body of work he is one of the only Australians in history to have the unique distinction of being appointed to the advisory staffs of major American fishing tackle companies. Fly fishing icon Bernard 'Lefty' Kreh, who has been invited by US presidents to show them his secrets labelled Harro a national treasure. "Rod is an Australian national treasure and one of my two favorite writers," Mr Kreh said.

A young Harrison fished and hunted to help out with a large and none well to do family scratching a living in the Australian outback. He continued those pursuits in a working life, firstly as a shearer travelling Australia's vast sheep stations, then as a cop in tough city neighborhoods, dusty inland towns and dream posting of Shellharbour then a sleepy fishing village on the outskirts of Wollongong.

Rod is referred to as "the Banjo Patterson of fishing writing and although not the only angler to be promoting Murray cod in years past, he was the one to make it legitimate. He added character and personality to a fish that was, up to that time, a somewhat tragic and mouldy head stuck up behind the bar in almost every western pub. Rod is, and always will be – one of the heroes that saved the Murray cod."

Rod's musings are poetic and are accurately reflect what life was like on the land and on the rivers from a time he calls, "*BC, Before Cotton and Before Cubie*":

> *"Soaking up the morning sun on wool bales out on a loading ramp overlooking a low and clear Darling River, chewing our way through a smoke-o of leathery mutton and pickle sandwiches on last week's bread, we were joined by the grazier. Alluding to big rains in Queensland and rejoicing in the foot of water across the Culgoa floodplain to rejuvenate the land he poured himself a pannikin of black tea.*
>
> *First out of bed on Saturday morning, I filled the open copper tub and got a fire going underneath. My greasy dungarees and sweat stained singlets had soaked overnight. After a heavy-handed rub with a cake of sunlight soap, consigned to the copper and allowed to boil, following a rinse hung out to dry on the top strand of the nearest fence.*
>
> *The laden vehicles parked outside waiting for Shindy Mitchell's pub to open indicated I wasn't the only fisherman on the move. A check on the river from the new bridge revealed no changes in the Darling - still low and clear.*
>
> *The Darling River, B.C., - Before Cotton, Before Cubbie, ran clear during dry spells. Parked nose-in under sprawly snags I'd climb out on, the Murray cod resembled passenger jets at a terminal. Golden perch mingled among the thick green strands of river weed waving in the current, parting for a lure like wedding guests at the arrival of the bridal carriage."*

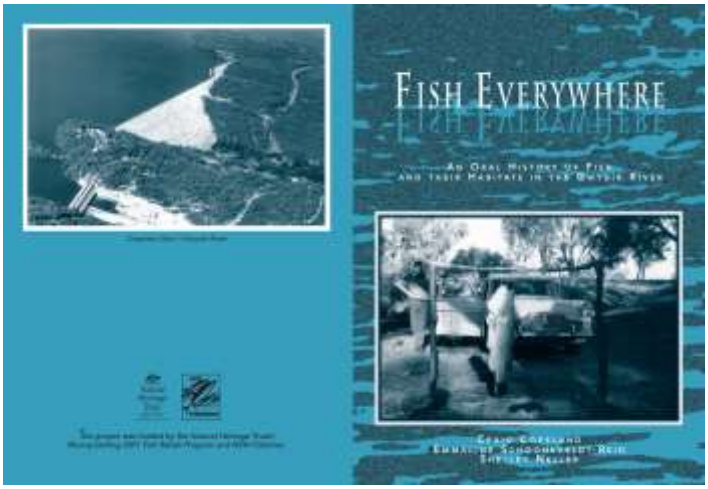
Rod Harrison is prepared to appear before the Committee to expand on these points and submit a series of photographs in support of those points.

Portrait of Rod Harrison with a Murray Cod.

Along with accounts from legends like Rod Harrison, many other projects have delved into the historical accounts of the natural state of the MDB. For example, Craig Copeland began hearing stories from various recreational fishers, particularly Richard Ping Kee, about the instream habitats that once existed in the Gwydir River, which runs into the Darling River. The Gwydir had deep holes, large areas of submerged vegetation, stream banks covered with rushes and lovely river banks covered with bottlebrushes, other shrubs and large overhanging trees.

The idea was developed that if the sites of these former key habitat areas could be identified then NSW Fisheries could assist local fishers and other interested residents to begin the task of restoring the river.

It was clear that this information was not available from documents or scientific papers and therefore the only way of finding out was to talk directly to those with an intimate knowledge of the river. The proposal, developed by NSW Fisheries and supported by the Murray-Darling 2001 Fish Rehab Program, was intended to identify areas where revegetation and other river restoration works could be carried out effectively. What emerged from the interviews of these residents was something much more important.



https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0017/634004/oral-history-gwydir-river.pdf

Like Rod Harrison, their stories brought the old river to life and highlighted the damage that it has suffered in recent years.

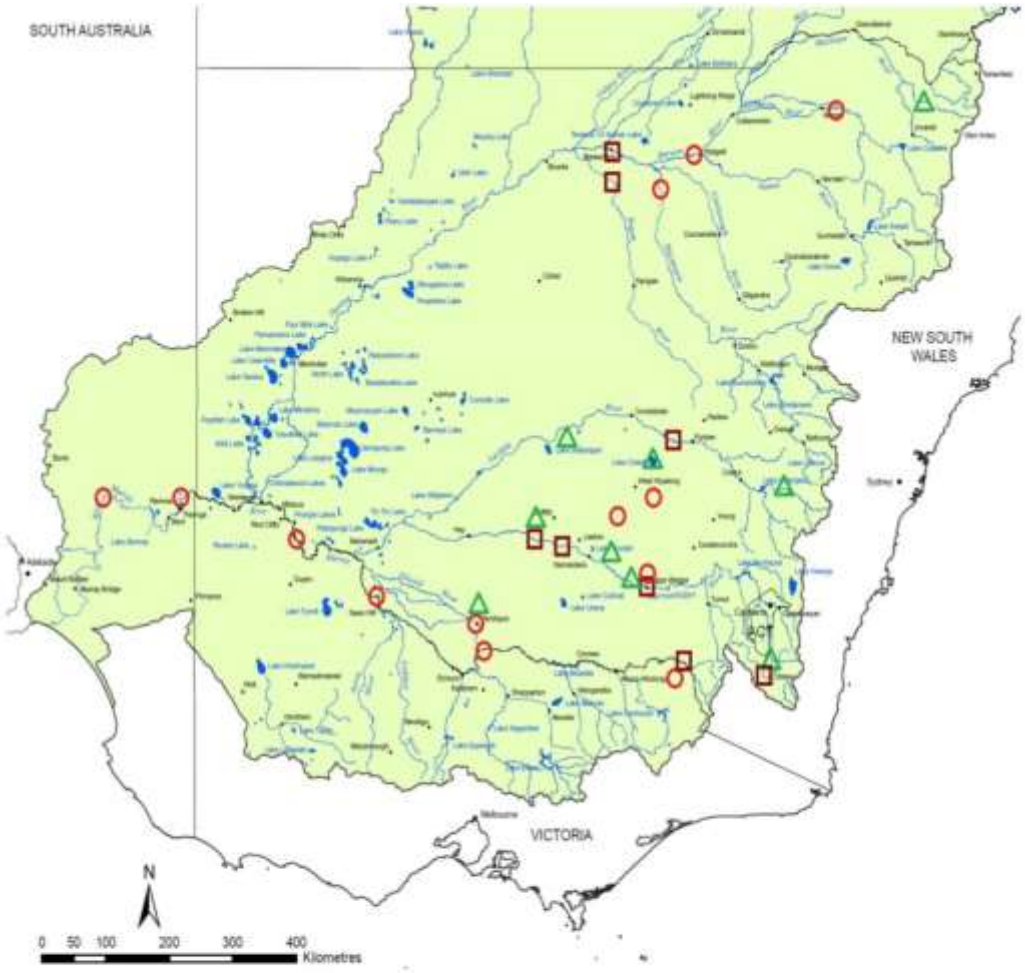
The RFA is also aware that:

> "*many early historical accounts written by European explorers and settlers described the fishing practices of Aboriginal people in the southern Murray-Darling Basin. Ethnologists concluded that they were a nomadic hunter-gather people living a subsistence existence, moving from place to place as resources became available or were depleted. A number of historical accounts, however, suggest a different assessment and indicate that some Aboriginal groups actively managed the native fishery and the aquatic environment*"[i]

The following is an account from Mary Gilmore (who spent many years living in the Riverina Region) reported in the *Sydney Morning Herald*, 8 November 1933 (article excerpt)

> *As I stood in the bed of the creek looking down at the dry saplings with their interlacing of desiccated twigs, I suddenly saw some bones, snow-white and unlike any I had ever seen before. I picked them up to examine them.*
>
> *"What a strange backbone for a snake" I said; "I never saw one like that before!"*
>
> *"That is not a snake" my father replied looking up from the fire. "Those are fish bones".*
>
> *"But how can they be fish bones when there is no water here?" I protested.*
>
> *"This is an old fish-trap that we are burning," answered my father.*
>
> *Then he went on to explain about the smaller fish-balks. And as I poked about among the debris I found not only more bones, I found bleached scales, and some of them still a little blue.*
> *– Mary Gilmore.*[ii]

[iii]



Locations of Historical Accounts of Aboriginal Fishing Structures & Conservation Areas

Wooden Weirs/Boughyards

Stone Fisheries

Native Sanctuaries

Like the rest of Australia and the world, the RFA saw horrendous sights in the Darling River, around one million fish dead from the river's degradation in 2018 - 2019. Around that time the RFA was aware of the work being undertaken by the likes of Dr Martin Mallen-Cooper.

The RFA considers Dr Mallen-Cooper's evidence would provide invaluable insight to the Committee on the issues raised in this submission. Accordingly, the RFA considers it would be worthwhile for the Committee to consider inviting Dr Mallen-Cooper to give evidence on these matters.

The RFA considers Dr Martin Mallen-Cooper one of Australia's best river ecologists; he is an aquatic scientist that has worked in the Murray-Darling Basin for 35 years. He completed his PhD on fish ecology on the Murray River in 1996. He was a government scientist (NSW Fisheries) for 10 years and has been an independent consulting scientist advising on fish ecology, fish migration, river and floodplain rehabilitation for over 25 years. He has worked on over 100 projects across the MDB in that time, including projects at every weir and most floodplains along the Murray River; and many weirs along the Barwon-Darling River and tributaries.

Dr Mallen-Cooper has written about the tributary rivers of the northern MDB that have highly variable river levels, from floods to droughts. As mentioned earlier, his submission to the Murray-Darling Basin Royal Commission in 2018 is that the natural state of the Murray River is a flowing river but while the river may have stopped flowing in the past and became a series of pools, this was more likely a 1:1000 year occurrence. However, his submission states that the impacts of weir pools and dams throughout the MDB has resulted in the Murray River now experiencing 1:1000-year event conditions on an annual basis.

Dr Mallen- Cooper was part of a series of public talks aimed to generate discussion and debate about the issues facing native fish in the Murry-Darling Basin.

THINKING FISH - Dr Martin Mallen Cooper, Our Darling and Macquarie Rivers 100yrs ago in drought
https://www.youtube.com/watch?v=Sxn2yCYrvDk

These talks were about fish and fishing from people who love both - thinking fish and thinking future.

The following videos and documents provide an indication on the evidence and insights Dr Mallen-Cooper could offer to the Committee if called to give evidence:

https://www.environment.sa.gov.au/files/sharedassets/public/river_murray/royal-commission/submissions/martin-mallen-cooper-charles-sturt-university-ozfish-unlimited-fishway-consulting-services-nsw-mdb-rc-gen.pdf

https://www.facebook.com/watch/?v=2807687106138872

https://www.facebook.com/watch/?v=195124248400141

https://www.youtube.com/watch?v=QToKO1fP8vw

https://www.parliament.nsw.gov.au/lcdocs/submissions/69211/0087%20Dr%20Martin%20Mallen-Cooper.pdf

https://www.facebook.com/MurrayDarlingBasinMyths/posts/dr-martin-mallen-cooper-is-not-a-fan-of-some-of-the-locks-below-mildura-particul/2082585528664650/

The RFA has also reviewed advice from the Fisheries Scientific Committee (FSC) that is relevant to the issues before the Committee. The FSC is an independent body established under Part 7A of the *Fisheries Management Act 1994* and that its main functions are related to:

- the listing of species, populations, ecological communities and key threatening processes in the schedules of the *Fisheries Management Act 1994*;
- advising the Minister on the identification of critical habitat;
- reviewing draft joint management agreements and the performance of parties under the agreements;
- Advising the Director-General on the exercise of Department of Primary Industries functions under threatened species legislation of the *Fisheries Management Act 1994*; and
- Advising the Minister and the Natural Resources Commission on matters relating to the conservation of threatened species, populations or ecological communities.

The FSC's ruling from 24 May 2002 on a *Key Threatening Process - Installation And Operation Of Instream Structures And Other Mechanisms That Alter Natural Flow Regimes Of Rivers And Streams* (**Attachment A**) stated that any process that alters the natural flow regimes is a Key Threatening Process.

It has also made determinations on other downstream effects that floodplain harvesting has made the following recommendations under Part 3 of Schedule 4 of the *Fisheries Management Act*:

- to list the Aquatic Ecological Community in the natural drainage system of the Lower Murray River Catchment as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 4 of the *Fisheries Management Act* (**Attachment B**)
- to list the Aquatic Ecological Community in the natural drainage system of the Lowland Catchment of the Darling River as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 4 of the *Fisheries Management Act* (**Attachment C**)

The FSC has also has made a final determination to list the Eel Tailed Catfish (*Tandanus tandanus*) in the MDB as an ENDANGERED POPULATION in Part 2 of Schedule 4 of the *Fisheries Management Act* (**Attachment D**).

With regards to the eel tailed catfish the FSC state the causes of the decline of it is not limited to and probably includes:

- loss of habitat (lakes, billabongs, lagoons) through river regulation;
- loss of habitat and spawning sites through siltation;
- reduced success of spawning and recruitment and loss of habitat due to alterations to flow patterns and flooding regimes; and
- loss of aquatic plants.

Accordingly, the RFA has written to the FSC and has asked it provide all of its advice (including minutes, meeting notes, briefs etc) to the NSW Government, the relevant Ministers whose portfolios are impacted by the 2002 ruling, the Director General and the Natural Resources Commission and the Natural Resources Access Regulator in relation to this ruling. In addition, we have asked the FSC provide copies of correspondence (including any formal responses) received from those parties in response to the 2002 ruling.

The RFA is setting about to determine if any regulation relating to water extraction has ever been enacted and if any new regulations relating to floodplain harvesting will ever be enacted or actioned to protect the environment.

4. Response to the Terms of Reference

(a) The legality of floodplain harvesting

It is interesting to note that from the previous Upper House Inquiry into floodplain regulations in 2020 that Minister Pavey had not sought any legal advice from the Crown Solicitor on the legality of floodplain harvesting. The Natural Resource Access Regulator also advised it had not commissioned any legal advice on floodplain harvesting.

In addition, witnesses from Namoi Water, Border Rivers Food and Fibre, and Gwydir Valley Irrigators Association Inc, NSW Irrigators Council confirmed they had not sought, nor received, any legal advice on the legality of floodplain harvesting.

Given the contentious nature of floodplain harvesting, it beggars belief that the Agency responsible for administering the *Water Management Act*, the regulator responsible for licencing and enforcement, and those most likely to fall foul of any illegality failed to seek legal advice in the twenty years since that Act was passed.

One could understandably infer a reckless indifference by the New South Wales Government and the irrigators in the Northern Basin as to the legality of floodplain harvesting, and further, that the Government and irrigators in the Northern Basin were waiting until the irrigators had achieved a desired level of capacity to capture and store water via floodplain harvesting before it was regulated and licensed.

Only recently has the New South Wales Government released advice indicating the contentious legal nature of floodplain harvesting, and that Claire Miller, CEO of the New South Wales Irrigators Council (when interviewed for a documentary 'Blood Water: the war for Australia's water') indicated she had her own legal advice affirming the legality of floodplain harvesting.

The RFA is not in a position to comment on the legality of floodplain harvesting. However, it does comment on what it believes the legal position should be.

Firstly, there should be no assumption of legality for any previous or current floodplain harvesting activities and works/infrastructure associated with floodplain harvesting. This activity has not been regulated, measured, and paid for to date. All current floodplain harvesting activities and existing works/infrastructure associated with floodplain harvesting needs to be assessed.

Secondly, there can be no assumption that the amount of water that irrigators can harvest under a FPH licence will be set at the current volumes they have become accustomed to harvesting. The amount of water that can be harvested must be assessed in accordance with the *Water Management Act,* including the Water Management Principles.

Thirdly, should floodplain harvesting be legalised, floodplain harvesting rights must not be tradeable. This is principle 6 set out in Advice No. 3 to Water Management Committees (**Attachment E**). In addition, there should be no de facto trading of rights. That is, irrigators must not use harvested floodplain waters to replace other water it has traded to other buyers.

Fourthly, floodplain harvesting should not be legalised and irrigators must cease all floodplain harvesting activities should a regulatory regime prove unmanageable to implement without cost to the environment and continued adverse impacts to the MDB's fisheries and aquatic ecology.

(b) The Water Regulations published on 30 April 2021

The RFA does not have the resources to comment on the Water Regulations passed on 30 April 2021. It will rely on the submissions of likeminded stakeholders who have a better knowledge of the operation of the *Water Management Act 2000* and the regulations and legislative instruments made under it.

However, the RFA will comment on its view of what principles should be applied when regulating floodplain harvesting under the *Water Management Act*. Those principles can be derived from the Second Reading Speech of the Act, as well as the Act itself.

The Hon. Richard Amery (then Minister for Agriculture, and Minister for Land and Water Conservation) introduced the Water Management Bill into Parliament on 22 June 2000 to provide better ways of ensuring the equitable sharing and wise management of the State's water. It formed part of the then Carr Labour Government's mandate to improve the way in which the State's natural resources are managed. In his second reading speech, Mr Amery stated the Act was

> '*to be the pivotal legislative mechanism for protecting and managing water. It will provide for the protection, conservation and ecologically sustainable development of the waters of New South Wales. The Act provides for explicit, strategic decisions for protection of water for the environment. Achieving this protection at the front line embraces the key concept of water management being achieved through a community/government partnership. It provides for community-based planning through representative committees and their work is to be supported by the expertise, resources and information of government agencies.*'

As indicated by the long title and the objects of the *Water Management Act 2000*, ('An Act to provide for the protection, conservation and ecologically sustainable development of the water sources of the State, and for other purposes') protecting waterways, conservation and ecologically sustainable development is front and centre of the Act.

This is reinforced by the water management principles set out in paragraph 5(2) of the *Water Management Act* as follows:

(a) water sources, floodplains and dependent ecosystems (including groundwater and wetlands) should be protected and restored and, where possible, land should not be degraded, and
(b) habitats, animals and plants that benefit from water or are potentially affected by managed activities should be protected and (in the case of habitats) restored, and
(c) the water quality of all water sources should be protected and, wherever possible, enhanced, and
(d) the cumulative impacts of water management licences and approvals and other activities on water sources and their dependent ecosystems, should be considered and minimised, and
(e) geographical and other features of Aboriginal significance should be protected, and
(f) geographical and other features of major cultural, heritage or spiritual significance should be protected, and
(g) the social and economic benefits to the community should be maximised, and

(h) the principles of adaptive management should be applied, which should be responsive to monitoring and improvements in understanding of ecological water requirements.

Importantly, when it comes to water sharing under the Act, paragraph 5(3) prioritise the protection of water sources and their dependent ecosystems over all other rights under the Act.

Another feature of the *Water Management Act* highlighted by Mr Amery MP in his Second Reading Speech was that the Act covers all New South Wales waters to provide an '*integrated management of water ecosystems and a culture of holistic water cycle management.*' This was necessary as it was '*the only way to ensure that all water management activities are able to be considered in a whole-of water catchment and in a water cycle basis.*'

Whether the Parliament intended to at the time it passed the *Water Management Act*, its all-encompassing nature makes collaboration between different agencies responsible for water management, fisheries, environmental protection etc a necessity to ensure the objectives of the Act and the Water Management Principles are achieved.

Accordingly, water management under the *Water Management Act* cannot occur in isolation of other legislation (and the agencies that administer those Acts) that also exercise jurisdiction over waterways, including the following legislation:

Fisheries Management Act 1994
This is the primary NSW statute relating to the management of fishery resources. The objects of this Act are to conserve, develop and share the fishery resources of the State for the benefit of present and future generations.

In particular, the objects of this Act include—
(a) to conserve fish stocks and key fish habitats, and
(b) to conserve threatened species, populations and ecological communities of fish and marine vegetation, and
(c) to promote ecologically sustainable development, including the conservation of biological diversity

Protection of the Environment Operations Act 1997
This is the primary NSW statute regulating pollution of the environment. Its objectives include the protection, restoration and enhancement of the environment, providing public access to information on pollution and reducing risks to human health and the environment.

Environmental Planning and Assessment Act 1979
This is the primary NSW planning legislation. Its focus is on ensuring development meets the needs of people, protects the environment and encourages the proper management, development and conservation of resources (natural and artificial).

Biodiversity Conservation Act 2016
This Act focuses on the maintenance of a healthy, productive and resilient environment consistent with the principles of ecologically sustainable development (as described in the *Protection of the Environment Administration Act 1991*).

So arguably, regulations and other legislative instruments made under the Act ought to be prioritising the protection of waterways (including its water quality), its dependent ecosystems (including the fishery in the waterways) over economic considerations when it comes to water use.

Further, this must be done in an integrated way that also ensures the objectives of other legislation such as the *Fisheries Management Act,* are also achieved.

With this in mind, the RFA would expect to see a reduction in the amount of water being captured and stored through floodplain harvesting, and a substantial increase of water being returned to the environment. The RFA would also expect to see other agencies including Fisheries from Department of Primary Industries being actively engaged. In addition, all key stakeholders (not just irrigators) will also be actively engaged.

Unfortunately, the RFA is concerned that, contrary to the objectives of the *Water Management Act*, economic considerations of a select group of stakeholders in the Northern Basis is taking priority over the protection of waterways and its dependent ecosystems.

(c) How floodplain harvesting can be licensed, regulated, metered and monitored so that it is sustainable and meets the objectives of the *Water Management Act 2000* and the Murray Darling Basin Plan

Floodplain harvesting must be licensed at the lower of the 1994 level of take in the Cap set by Murray-Darling Basin Ministerial Council in 1995, or the level of take prescribed in the current NSW Water Sharing Plans.

Despite the agreement that floodplain harvesting should form part of the cap, and that it should be set at 1994 levels, it is concerning to note that the Murray Darling Basin Commission's fact sheet on floodplain harvesting casually reports that the NSW Government is proposing that water harvested from floodplains will be limited to ensure that the amount of water taken in a valley does not exceed levels used in the year 2000.

The RFA has the following concerns about the licencing of floodplain harvesting:

- The volumes proposed exceed the lower of the legislated cap or the limits legislated in the NSW Water Sharing Plans.
- The four members of the Healthy Floodplain committee (in place to oversee the roll out of floodplain harvesting) are bound by confidentiality agreements, so members cannot reveal what the government is doing, or raise any concerns publicly.
- The hydrological modelling has insufficient data to adequately replicate or predict the impact of floodplain harvesting, cannot measure water returning from a floodplain into a river, and therefore cannot determine downstream impacts, and has not had its performance independently assessed or verified.
- Any floodplain inflow could be confidently expected to support threatened species, threatened populations or threatened communities should be protected under the provisions of Part 7 of the *Fisheries Management Act 1994*.
- Floodplain Harvesting that extracts water undoubtedly contravene many pieces of this and similar legislation.
- Once issued, floodplain harvesting licences will be compensable.
- The implementation of the floodplain harvesting regulation is complex and its impact is severe enough to justify either a Royal Commission or a Special Commission of Inquiry.

The RFA requests the committee investigate the following matters:

- Evidence of compliance with the Murray-Darling Basin Cap and Water Sharing Plan limits.
- Adherence to the *Water Management Act* and the Basin Plan.
- The workings and activities of the Healthy Floodplains Committee.

- The quality, effectiveness and usefulness of the hydrological models.
- Review of existing legislation and policies to ensure end-of-system flows.
- Other mechanisms to ensure end-of-system flows.

(d) Other related matters

The RFA understands that if and when floodplain harvesting is legalised, the Natural Resources Access Regulator (NRAR) may be charged with licensing and monitoring compliance. The RFA has not been satisfied with the NRAR's response to previous correspondence on other issues under the *Water Management Act*.

The RFA wrote to the NRAR seeking clarification on who is ultimately responsible for the death of fish due the adverse impact of irrigation activities. The RFA sought its advice on:

- whether the killing of fish and other aquatic organisms through irrigation pumps contravene existing laws, including the *Fisheries Management Act 1994*, *Water NSW Act 2014*, *Protection of the Environment Operations Act 1997*, *Environmental Planning and Assessment Act 1979*, *Biodiversity Conservation Act 2016* and the *Local Land Services Act 2013*;
- who is liable for any offences associated with the killing of fish and other aquatic organisms through irrigation pumps;
- whether the use of recreational fishing trust funds under section 233 of the *Fisheries Management Act* to meet the cost of installing screens on irrigation pumps to prevent the killing of fish and other aquatic organisms is permitted under that Act, and
- what remedies are available to prevent further killing of fish and other aquatic organisms through irrigation pumps.

The RFA is trying to determine who is responsible for the millions of fish that die each year, and is concerned how this is allowed to continue, considering multiple legislations that ostensibly protect fish and habitat. The unregulated killing of fish and aquatic animals has impacts for the recreational anglers of NSW who pay a fee to fish, and it will continue to have environmental impacts if it not addressed immediately.

The NRAR indicated in its response to the RFA that it has no powers to intervene in the killing of fish. The advice from NRAR states "The issues and legislation are within the remit of the Department of Primary Industries (Fisheries)".

Floodplains and NSW rivers are being adversely impacted by water diversions, with wetlands alienated by such diversions, leading to a loss of connectivity to the river system and, in turn, a declining population of fish.

The RFA is concerned the NRAR is overlooking the environmental objectives of the *Water Management Act* and the Water Management Principles by not having adequate environmental assessments or reviews of any environmental factors when it comes to removing, restricting or blocking the natural flow of water downstream and the impacts of irrigators' pumps. These irrigators' pumps can have adverse impact on the aquatic environment, the freshwater aquatic ecosystem, in particular aquatic plants, fish and the food web that supports so much life right down to the micro and macro-invertebrates at the lower levels of the food chain.

The issue under this inquiry that needs to be adequately addressed is how the NRAR will manage floodplain harvesting into the future and how all environmental assessments and downstream impacts will be measured as part of this process.

The NRAR seems to only focuses on the theft and or regulation of water in its purest form of an inorganic, transparent, tasteless, odourless, and nearly colourless chemical substance - H2O.

However, H2O is the main constituent of Earth's hydrosphere and the fluids of all known living organisms. It is vital for all known forms of life.

5. Conclusion

The RFA has endeavoured to highlight that the cumulative impact of floodplain harvesting on the environment and the social economic well-being of other stakeholders and uses especially those in the southern Murray Darling Basin has never been assessed and before we legalise, regulate and license floodplain harvesting we must assess its impact.

We must know what the environmental, ecological and social economic costs are before deciding how much we allow irrigators to take under their licences.

The RFA is concerned that the current and future fish kills and downstream impacts will still be attributed to nature's fault/climate change/unavoidable droughts/romantic notions of Australia being the land of extremes when scientific and historical evidence refute this.

Historical eyewitness accounts demonstrate that the prolonged periods of time when river stopped flowing and the current degraded state of our rivers and ecosystems is not due to climate change or unavoidable droughts or this romantic notion of Australia being a land of extremes.

The RFA feels that the real impacts are due to poor water resource management and a failure to manage water in accordance with the *Water Management Act* that was partially caused by the unregulated free-for-all approach to floodplain harvesting.

The scientific and historical evidence available indicates that the rivers in the MDB flowed most of the time, even during severe drought and the rivers only stopped running for short periods of time. The people who lived in the MDB region over many years are also able to fill in the blanks with historical records on what the natural state of our river systems were over many years

These are the reasons why the RFA needs a proper assessment of the cumulative impacts of floodplain harvesting is that the MDB ecosystem is very complex and the 46 species of fish that live there and the ecosystems that support this population have diverse needs.

Water management under the *Water Management Act* cannot occur in isolation of other legislation (and the agencies that administer those Acts) that also exercise jurisdiction over waterways, including the *Fisheries Management Act 1994*, *Protection of the Environment Operations Act 1997*, *Environmental Planning and Assessment Act 1979*, and the *Biodiversity Conservation Act 2016*.

So arguably, regulations and other legislative instruments made under the Act should be prioritising the protection of waterways (including its water quality), its dependent ecosystems (including the fishery in the waterways) over economic considerations when it comes to water use. Further, this must be done in an integrated way that also ensures the objectives of other legislation such as the *Fisheries Management Act*, are also achieved.

With this in mind, the RFA would expect to see a reduction in the amount of water being captured and stored through floodplain harvesting, and a substantial increase of water being returned to the environment. The RFA would also expect to see other agencies including Fisheries from Department

of Primary Industries being actively engaged. In addition, all key stakeholders (not just irrigators) must also be actively engaged.

The RFA recommends that:

- Key Threatening Processes should be reviewed and the Fisheries Scientific Committee revisit and update all of its previous advice.
- The objectives of the *Water Management Act* and water management principles be reviewed and focused on the need for an integrated approach to manage water under the *Water Management Act*.
- Fish and the environment take priority over the economic considerations of irrigators.
- Floodplain harvesting must be brought into line with 1994 levels.
- Floodplain harvest regulations must take into account a full assessment of the impact of floodplain harvesting.

Finally, the RFA notes that licences under the *Water Management Act* are licences to take a water. They are not a licence to kill fish.

INDEX TO ATTACHMENTS

Attachment	**Document**
Attachment A	*Key Threatening Process - Installation And Operation Of Instream Structures And Other Mechanisms That Alter Natural Flow Regimes Of Rivers And Streams, Fisheries Scientific Committee*, 24 May 2002.
Attachment B	*Endangered Ecological Community - Aquatic Ecological Community In The Natural Drainage System Of The Lower Murray River Catchment*, *Fisheries Scientific Committee*, 4 July 2003.
Attachment C	*Endangered Ecological Community- Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River- Fisheries Scientific Committee*, 21 Dec 2001.
Attachment D	*Endangered Population -Eel tailed catfish - Tandanus tandanus in the Murray/Darling Basin- Fisheries Scientific Committee,* 10 July 2009.
Attachment E	Advice No. 3 Floodplain Harvesting, *Advice to Water Management Committees*, NSW Government

Attachment A

Ref. No. FR21
File No. FSC 01/06

RECOMMENDATION

INSTALLATION AND OPERATION OF INSTREAM STRUCTURES AND OTHER MECHANISMS THAT ALTER NATURAL FLOW REGIMES OF RIVERS AND STREAMS

The Fisheries Scientific Committee, established under Part 7A of the *Fisheries Management Act 1994* (the Act), has made a recommendation to list the Installation And Operation Of Instream Structures And Other Mechanisms That Alter Natural Flow Regimes Of Rivers And Streams as a KEY THREATENING PROCESS in Schedule 6 of the Act.

Listing of a Key Threatening Process is provided for by Part 7A, Division 2 of the Act.

The Fisheries Scientific Committee has found that:

1. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands is recognised as a major factor contributing to loss of biological diversity and ecological function in aquatic ecosystems. Alteration to natural flow regimes can occur through reducing or increasing flows, altering seasonality of flows, changing the frequency, duration, magnitude, timing, predictability and variability of flow events, altering surface and subsurface water levels and changing the rate of rise or fall of water levels. Natural flow regimes are determined by the climate, run-off, catchment size and geomorphology without the impacts of dams, weirs, extraction and river management.
2. Structures that alter natural flow regimes include dams, weirs, canals, navigation locks, floodgates (including those at the freshwater/estuary interface), culverts, flow regulators, levee banks, erosion control structures and causeways. Thousands of such structures exist in NSW freshwater rivers and streams. Bridges and other similar structures that have minimal impact on flow are excluded from this recommendation. Structures within off-stream waterways such as man-made/artificial canals, farm dams, and reservoirs are excluded.

   Mechanisms that alter natural flow regimes include the operation of the above structures and water extraction, pumping, and diversion, and gravel and sand extraction.
3. Instream structures that alter natural flow regimes of rivers and streams have been installed and operated for a variety of reasons. Navigation locks were constructed to provide for navigation on large rivers, such as the lower Murray River, to facilitate commercial freight and other boating traffic. Many weirs have been installed to create weir pool environments for diversions into irrigation channels, stable pool heights for pump intakes, recreational boating, and other aesthetic reasons. Dams have been constructed for purposes such as storage of water for irrigation and domestic water

supply, and flood mitigation. Floodgates and levee banks have been constructed to control floodwaters on urban and agricultural land, and to prevent saltwater intrusion upstream. Culverts and causeways have been constructed to allow for traffic over waterways. The operation of all these structures alters the natural flow regimes of rivers and streams.

4. The installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams have several ecosystem impacts including:

- Cold water releases from low level outlets in large dams impair spawning, growth, recruitment, feeding and other life cycle processes in native fish species.
- Dams, weirs, culverts, navigation locks, floodgates and other instream structures present barriers to migration for native fish species. Weir pool environments provide ideal conditions for harmful algal blooms and the proliferation of non-native species such as carp and water hyacinth.
- Changes to natural seasonality and variability of flow regimes (duration, extent and rate), as a result of water regulation for flood mitigation and irrigation, impact on native species by disrupting natural environmental cues necessary for reproductive cycles (including migration, spawning, growth and recruitment).
- Reduction of habitat due to changes in the area, frequency and duration of inundation of floodplains and terminal wetlands limits distributions and reduces spawning successes. These areas are used by some fish and invertebrates during flood periods for the purposes of breeding and dispersal.
- Extraction of water at all scales, ranging from diversion into irrigation canals to pumping, reduces the total availability of water for riverine ecosystems.
- Extraction of gravel and alluvial sands and dredging destroys bottom habitat, changes natural flow regimes, and can cause decreases in water clarity, all of which negatively affect aquatic ecosystems.
- The natural processes of sediment deposition, erosion and transport are affected by instream structures in various ways. Weir pool environments enhance the deposition of sediments. Elevated water velocity in tailwater environments increases erosion. In addition, rates of rise and fall of river levels downstream of large dams are often unnaturally rapid, leading to bank slumping and other erosional impacts, and degradation of the riparian zone. These altered sedimentary processes have been shown to result in the loss of fish habitat including important breeding and feeding sites, causing declines in native fish numbers.
- Alteration to the natural flow regimes by instream structures and other mechanisms can cause changes in physical, chemical and biological conditions that in turn alter the biota. Species composition can change. For example, due to changes in natural flow regimes, algal biofilms have replaced bacterial biofilms in some rivers and as a result some invertebrates may no longer occur. Disruption of ecological processes may continue long after initial flow alteration, causing continued decline in biological diversity.

5. The Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment is listed as an Endangered Ecological Community in NSW. That listing identifies many of the undesirable outcomes of the alteration to natural river

flow regimes by the installation and operation of instream structures and other mechanisms, including barriers to fish migration, cold water pollution, and erosion.

6. The installation and operation of instream structures and mechanisms that alter natural flow regimes adversely impact the following Endangered Species: Murray hardyhead (*Craterocephalus fluviatilis*), southern pygmy perch (*Nannoperca australis*), river snail (*Notopala sublineata*), eastern freshwater cod (*Maccullochella ikei*), trout cod (*Maccullochella macquariensis*); Vulnerable Species: Macquarie perch (*Macquaria australasica*), and silver perch (*Bidyanus bidyanus*); and Endangered Populations: olive perchlet (*Ambassis agassizii)* and purple spotted gudgeon (*Mogurnda adspersa*). Many other protected or unlisted species of invertebrates and fishes are adversely impacted by the installation and operation of instream structures and mechanisms that alter flow.

7. The Prevention of Passage of Aquatic Biota, the Alteration of Natural Flows, the Alteration to the Natural Temperature Regime of Rivers and Streams and Increased Sediment Input into Rivers have been listed as either Potentially Threatening Processes or Threatening Processes under the *Victorian Flora and Fauna Guarantee Act, 1988*. These listings are all related to this proposed recommendation in that they are outcomes of the installation and operation of instream structures and mechanisms that alter natural flow regimes. The NSW Scientific Committee has made a complementary determination to list the Alteration to the Natural Flow Regimes of Rivers and Streams and Their Floodplains and Wetlands as a Key Threatening Process under the *Threatened Species Conservation Act 1995*.

8. The Committee acknowledges that actions have been taken to ameliorate some of the effects of the installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams. These include construction of fishways to provide for fish passage, construction of multi-level offtakes and/or mixing devices to provide for release of warmer surface waters, design improvements for culvert crossings and causeways, and, in some cases, removal of redundant weirs. However, the committee does not consider that the scale of these remedial actions, or their effectiveness, has led to a substantial reduction in the overall level of threat posed by the installation and operation of instream structures and mechanisms that alter natural flow regimes of rivers and streams.

9. In light of the above, the Fisheries Scientific Committee is of the opinion that the Installation and Operation of Instream Structures and Other Mechanisms That Alter Natural Flow Regimes of Rivers and Streams adversely affects more than two threatened species, populations or ecological communities, or could cause species, populations or ecological communities that are not threatened to become threatened. Therefore, this process qualifies for inclusion in Schedule 6 of the *Fisheries Management Act 1994* as a KEY THREATENING PROCESS.

Dr Patricia Dixon
Chairperson
Fisheries Scientific Committee

Attachment B

Ref. No. FR16(2)
File No. FSC 01/01

RECOMMENDATION

AQUATIC ECOLOGICAL COMMUNITY IN THE NATURAL DRAINAGE SYSTEM OF THE LOWER MURRAY RIVER CATCHMENT.

The Fisheries Scientific Committee, established under Part 7A of the *Fisheries Management Act 1994* (the Act), has made a recommendation to list the Aquatic Ecological Community In The Natural Drainage System Of The Lower Murray River Catchment as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 4 of the Act.

Included in the recommendation are all natural creeks, rivers, and associated lagoons, billabongs and lakes of the regulated portions of the Murray River (also known as the River Murray) downstream of Hume Weir, the Murrumbidgee River downstream of Burrinjuck Dam, the Tumut River downstream of Blowering Dam and all their tributaries anabranches and effluents including Billabong Creek, Yanco Creek, Colombo Creek, and their tributaries, the Edward River and the Wakool River and their tributaries, anabranches and effluents, Frenchmans Creek, the Rufus River and Lake Victoria. Excluded from this recommendation are the Lachlan River and the Darling River and their tributaries, and man made/artificial canals, water distribution and drainage works, farm dams and off-stream reservoirs.

Listing of Endangered Ecological Communities is provided for by Part 7A, Division 2 of the Act.

The Fisheries Scientific Committee has found that:

The aquatic ecological community of the lower Murray, Murrumbidgee, and Tumut Rivers is characterised by the following assemblage of native animal species:

CRUSTACEANS	
Austrochiltonia australis (water scud)	*Paratya australiensis* (freshwater shrimp)
Austrochiltonia subtennuis (water scud)	*Macrobrachium australiense* (freshwater prawn)
Bosmina meridonalis (water flea)	*Cherax destructor* (Yabbie)
Daphnia lumholtzi (water flea)	*Euastacus armatus* (Murray cray)
Boeckella fluvialis (copepod)	*Tachea picta* (shrimp lice)
Caridina mccullochi (fresh water shrimp)	*Heterias pusilla* (freshwater slater)

c\- NSW Fisheries, Private Bag 1, Nelson Bay, NSW 2315
Phone: (02)4916-3817 Fax: (02)4982-1107 Email: fsc@fisheries.nsw.gov.au

FISHES	
Mordacia mordax (Shortheaded lamprey)	*Nematalosa erebi* (Bony bream)
Galaxias olidus (Mountain galaxias)	*Galaxias rostratus* (Murray jollytail)
Retropinna semoni (Southern smelt)	*Tandanus tandanus* (Freshwater catfish)
* *Craterocephalus fluviatilis* (Murray hardyhead)	*Craterocephalus stercusmuscarum fulvus* (Nonspecked hardyhead)
Melanotaenia fluviatilis (Crimsonspotted rainbowfish)	* *Ambassis agassizi* (Olive perchlet)
* *Maccullochella macquariensis* (Trout cod)	*Maccullochella peeli peeli* (Murray cod)
Macquaria ambigua (Golden perch)	* *Macquaria australasica* (Macquarie perch)
* *Nannoperca australis* (Southern pygmy perch)	*Gadopsis marmoratus* (River blackfish)
* *Bidyanus bidyanus* (Silver perch)	*Hypseleotris klunzingeri* (Western carp gudgeon)
Hypseleotris sp. 4 (Midgleys carp gudgeon)	*Hypseleotris* sp. 5 (Lakes carp gudgeon)
* *Mogurnda adspersa* (Purplespotted gudgeon)	*Philypnodon grandiceps* (Flathead gudgeon)
Philypnodon sp. (Dwarf flathead gudgeon)	
INSECTS	
Antiporus femoralis (water beetle)	*Micronecta gracilis* (water bug)
Antiporus gilberti (water beetle)	*Microvelia paramoena* (water bug)
Chironomus cloacalis (midge)	*Xanthagrion erythroneurum* (dragonfly)
Coelopynia pruinosa (midge)	*Hemicordulia tau* (dragonfly)
Cryptochironomus grisiedorsum (midge)	*Austrogompus cornutus* (dragonfly)
Kiefferulus martini (midge)	*Notostricta solida* (dragonfly)
Procladius paludicola (midge)	*Anisocentropus latifascia* (caddis fly)
Tanytarsus fuscithorax (midge)	*Ecnomus pansus* (caddis fly)
Micronecta annae annae (water bug)	*Hellyethira eskensis* (caddis fly)
MOLLUSCS	
Alathyria condola (bivalve)	*Austropeplea lessoni* (snail)
Alathyria jacksoni (bivalve)	*Glyptophysa gibbosa* (snail)
Corbiculina australis (bivalve)	* *Notopala sublineata hanleyi* (snail)
Sphaerium problematicum (bivalve)	*Thiara balonnensis* (snail)
Sphaerium tasmanicum (bivalve)	*Velesunio ambiguus* (bivalve)
OTHER	
Ephydatia ramsayi (freshwater sponge)	*Brachionus falcatus* (rotifer)
Eunapius fragilis (freshwater sponge)	*Brachionus novaezealandia* (rotifer)
Heterorotula contraversa (sponge)	*Microscolex dubius* (oligochaete worm)
	Temnocephala chaeropsis (flatworm)

An * beside the species denotes a proposed or listed threatened species in the Act.

1. The total species list of the community is much larger than that given above. Only

fishes, most macro-molluscs and most macro-crustaceans have been listed comprehensively. With more than 400 aquatic invertebrate species recorded from the Murray, only representative species of each of the major invertebrate groups are included here. At any particular site, not all of the assemblage listed above may be present at any one time. The species composition of a site will be influenced by the size and ecological characteristics of the area and the level of threatening processes present.

2. In its natural state, the particular area occupied by this community was characterised by a seasonal pattern of winter/spring high flows and floods and summer/autumn periods of low flow. Many species rely on this seasonal flow pattern for successful reproduction. Regulation of the system by numerous dams and weirs has reversed the seasonal flow regime and has stopped migrations upriver because passageways over or around the barriers were few. The release of cold water from the bottom of dams and weirs has also upset the natural temperature regime, with further deleterious effects on fish reproduction by cold water pollution.

3. The presence of at least six different species of introduced fishes, (carp, goldfish, redfin perch, eastern mosquitofish, oriental weatherloach, and tench) is an additional threat to the community. Such introduced species can act as predators, competitors, disease carriers, and/or habitat modifiers. Carp, redfin perch, and eastern mosquitofish have all been identified as having deleterious effects on native species.

4. The clearing of riparian vegetation and continued stock access to the riparian zone, in addition to the removal of logs and snags from the river bottom, detrimentally increases erosion and sedimentation with the former and removes critical habitat, including reproductive sites, with the latter. Clearing of floodplain vegetation for agriculture also increases sedimentation and reduces carbon inputs to rivers that are an important food source for instream invertebrates.

5. Some types of agriculture can produce threatening processes to native aquatic animals. The reduction of river flow by irrigation and pollution through insecticide and fertilizer runoff are both detrimental to aquatic life. Salinisation of inland waters, exacerbated by both forest clearing and irrigation, is also detrimental to some freshwater species.

6. Overfishing has reduced populations of species such as Murray cod and the Murray Cray. For species listed as endangered or vulnerable, such as trout cod, Macquarie perch, and silver perch, targeted or incidental recreational catch must be considered as a threatening process.

7. Eight of the 23 native fish species of this community are listed in NSW and/or Victoria as endangered or vulnerable, with two of these endemic to the community. Two species are considered extinct in Victoria and one or two may be extinct in N.S.W. One species of freshwater snail is endangered. A further two species of fishes and the Murray Cray have documented declines. Some species, like the sponges, may no longer occur in the Lower Murray, owing to changes in the flow regime. The Lowland Riverine Fish Community of the Southern Murray-Darling Basin was listed as a Vulnerable Ecological Community by the State of Victoria in 2000.

8. The Committee recognises and greatly appreciates the initiatives undertaken by the Murray-Darling Basin Commission, State, Commonwealth and local governments, community

groups and private interest stakeholders to address concerns about the decline in the health of this aquatic community. Improvements have been, or are being, made in numerous areas, including water sharing allocations, riparian vegetation management, irrigation runoff and fish passage around smaller weirs. The Committee also recognises that changes to commercial and recreational fishing regulations have been made in the interests of protection of threatened species and stock conservation for exploited species. Restocking of angling species is also widespread and likely to be having an impact on the availability of fish for anglers. Where these programs are found to be of benefit, it is the wish of the Committee to see them incorporated into the recovery plan for the ecological community. However, the Committee does not consider that the benefits of these programs have, at this stage, reversed the decline of the aquatic community.

9. In light of the above, the Fisheries Scientific Committee is of the opinion that the Aquatic Community of the Lower Murray River Drainage is likely to become extinct in nature, unless the circumstances and factors threatening its survival cease to operate. Therefore, the community qualifies for inclusion in Part 3 of Schedule 4, as an ENDANGERED ECOLOGICAL COMMUNITY.

Dr Patricia Dixon
Chairperson
Fisheries Scientific Committee

Attachment C

Ref. Nos. FR 22
File No. FSC 01/10

FINAL RECOMMENDATION

AQUATIC ECOLOGICAL COMMUNITY IN THE NATURAL DRAINAGE SYSTEM OF THE LOWLAND CATCHMENT OF THE DARLING RIVER

The Fisheries Scientific Committee, established under Part 7A of the *Fisheries Management Act 1994* (the Act), has made a recommendation to list the Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River as an ENDANGERED ECOLOGICAL COMMUNITY in Part 3 of Schedule 4 of the Act.

Under Part 7A of the Act (Division 1, Section 220B), an ecological community means an assemblage of species of fish or marine vegetation (or both) occupying a particular area. Listing of Endangered Ecological Communities is provided for by Part 7A, Division 2 of the Act.

The area covered by this recommendation includes all natural creeks, rivers, streams and associated lagoons, billabongs, lakes, flow diversions to anabranches, the anabranches, and the floodplains of the Darling River within the State of New South Wales, and including Menindee Lakes and the Barwon River. This area includes:

- The main channels and tributaries of the lower Darling and Barwon-Darling Rivers from Mungindi (28°59'S; 149°30'E) on the Queensland border to the convergence with the Murray River at Wentworth (34°07'S; 141°55'E), and including the Menindee Lakes.

- The arid-zone intermittent rivers including the Warrego (29°00'S; 145°42'E), Culgoa (29°00'S; 147°22'E) and Narran Rivers (29°00'S; 148°05'E) and their tributaries south of the Queensland border.

- The border rivers including the MacIntyre River below Graman Weir (29°25'S; 150°58.8'E), Severn River downstream of Pindari Dam (29°23'S; 151°14'E) and the Dumaresq River below the junction with the Mole River (28°59.7'S; 151°31'E).

- The north-western slope rivers including the following: the Gwydir River from Copeton Dam (29°55'S; 150°55'E) downstream; the Namoi River from the junction of the Manilla River at Manilla (including Mehi River channel west of Moree) (30°46'S; 150°44'E) downstream; the Manilla River from Split Rock Dam (30°35'S; 150°42'E) downstream; the Peel River from Chaffey Dam (31°31'S; 151°08'E) downstream; the Macquarie River from Burrendong Dam (32°40'S; 149°10'E) downstream; the Cudgegong River from Windamere Dam (32°44'S; 149°46'E) downstream; the Castlereagh River from below Binnaway (31°30'S; 149°20'E) downstream; and the Bogan River from below Peak Hill (32°50'S; 148°00'E) downstream.

Excluded from this recommendation are the man made/artificial canals, water distribution and drainage works, farm dams and off-stream reservoirs, and also the Paroo River and Bulloo River Overflow with their associated lakes and tributaries. Other watercourses above 500m not specifically named in this recommendation are excluded.

The Fisheries Scientific Committee has found that:

1. The aquatic ecological community in the natural drainage system of the lowland catchment of the Barwon-Darling River is characterised by the following assemblage of native animal species:

WORMS (ANNELIDA)	
Heteroporodrilus mediterreus (water worm)	*Richardsonianus australis* (leech)
CRUSTACEANS	
Caridina mccullochi (shrimp)	*Alona macracantha* (water flea)
Chydorus hybrious (water flea)	*Celsinotum hypsilophum* (water flea)
Euastacus armatus (Murray cray)	*Daphnia carinata* (water flea)
Lepidurus viridis (shield shrimp)	*Euastacus suttoni* (Sutton's cray)
Tachaea picta (shrimp lice)	*Pleuroxus aduncus* (water flea)
Alona cambouei (water flea)	*Paratya australiensis* (shrimp)
Austrochiltonia subtenuis (water scud)	*Tachaea caridopluga* (shrimp lice)
Macrobrachium australiense (prawn)	*Heterias pusilla* (freshwater slater)
Holthuisana transversa (crab)	*Cherax destructor* (yabbie)
Apus australiensis (shield shrimp)	*Branchinella australiensis* (fairy shrimp)
FINFISHES (OSTEICHTHYES)	
Nematalosa erebi (Bony bream)	*Neosilurus hyrtlii* (Hyrtl's catfish)
Tandanus tandanus (Freshwater catfish)	*Retropinna semoni* (Australian smelt)
Craterocephalus amniculus (Darling River hardyhead)	*Craterocephalus stercusmuscarum fulvus* (Flyspecked hardyhead)
Melanotaenia fluviatilis (Crimsonspotted rainbowfish)	***Ambassis agassizi* (Olive perchlet/Agassizs glassfish)**
Gadopsis marmoratus (River blackfish)	***^Maccullochella macquariensis* (Trout cod)**
Maccullochella peelii peelii (Murray cod)	***^Macquaria australasica* (Macquarie perch)**
Macquaria ambigua (Golden perch)	***Bidyanus bidyanus* (Silver perch)**
Leiopotherapon unicolor (Spangled perch)	*Hypseleotris klunzingeri* (Western carp gudgeon)
Hypseleotris sp. 4 (Midgleys carp gudgeon)	*Hypseleotris sp. 5* (Lakes carp gudgeon)
***Mogurnda adspersa* (Purplespotted gudgeon)**	*Philypnodon grandiceps* (Flathead gudgeon)
Philypnodon sp. (Dwarf flathead gudgeon)	
INSECTS (COLEOPTERA)	
Adelotopus dytiscides (beetle)	*Allodessus bistrigatus* (beetle)
Antiporus decempunctatus (beetle)	*Antiporus femoralis* (beetle)
Antiporus gilberti (beetle)	*Apotomus australis* (beetle)
Arthropterus angulicornis (beetle)	*Arthropterus denudatus* (beetle)
Arthropterus westwoodii (beetle)	*Carenum interruptum* (beetle)
Carenum tinctilatum (beetle)	*Cenogmus waterhousei* (beetle)
Chlaenius australis (beetle)	*Chlaenius darlingensis* (beetle)
Coxelmis novemnotata (beetle)	*Cybister tripunctatum* (beetle)
Eudalia nigra (beetle)	*Geoscaptus laevissimus* (beetle)
Gnathaphanus pulcher (beetle)	*Helluo insignis* (beetle)
Helochares australis (beetle)	*Hydrobiomorpha tepperi* (beetle)
Hydrovatus armstrongi (beetle)	*Lecanomerus discoidalis* (beetle)
Megacephala cylindrica (beetle)	*Megalopmessus amplipennis* (beetle)

Octhebius australis (beetle)	*Pericompsus australis* (beetle)
Pogonoschema sloanei (beetle)	*Prosopogmus monochrous* (beetle)
Sarticus cyaneocinctus (beetle)	*Tachys monochrous* (beetle)
Tachys spenceri (beetle)	
INSECTS (DIPTERA)	
Cladopelma curtivalva (fly)	*Chironomus cloacalis* (fly)
Cryptochironomus grisiedorsum (fly)	*Coelopynia pruinosa* (fly)
Elassogaster linearis (fly)	*Dicrotendipes conjunctus* (fly)
Kiefferulus martini (fly)	*Kiefferulus intertinctus* (fly)
Procladius paludicola (fly)	*Polypedilum nubifer* (fly)
Tabanus particaecus (fly)	*Simulium ornatipes* (fly)
Tabanus strangmannii (fly)	*Tabanus queenslandii* (fly)
	Tanytarsus fuscithorax (fly)
INSECTS (HEMIPTERA)	
Agraptocorixa eurynome (bug)	*Micronecta annae annae* (bug)
Micronecta gracilis (bug)	*Micronecta robusta* (bug)
Microvelia distincta (bug)	*Microvelia paramoena* (bug)
INSECTS (ODONATA)	
Apocordulia macrops (dragonfly)	*Antipodogomphus acolythus* (dragonfly)
Austroaeschna parvistigma (dragonfly)	*Argiocnemis rubescens* (damselfly)
Austroagrion watsoni (damselfly)	*Austroaeschna unicornis* (dragonfly)
Austrogomphus amphiclitus (dragonfly)	*Austroargiolestes icteromelas* (damselfly)
Austrogomphus cornutus (dragonfly)	*Austrogomphus australis* (dragonfly)
Austrogomphus melaleucae (dragonfly)	*Austrogomphus guerini* (dragonfly)
Corduleplya montana (dragonfly)	*Austrogomphus ochraceus* (dragonfly)
Diphlebia coerulescens (damselfly)	*Corduleplya pygmaea* (dragonfly)
Diphlebia nymphoides (damselfly)	*Diphlebia lestoides* (damselfly)
Hemianax papuensis (dragonfly)	*Diplacodes bipunctata* (dragonfly)
Hemicordulia intermedia (dragonfly)	*Hemicordulia australiae* (dragonfly)
Hemicordulia tau (dragonfly)	*Hemicordulia superba* (dragonfly)
Hemigomphus heteroclytus (dragonfly)	*Hemigomphus gouldi* (dragonfly)
Nososticta solida (damselfly)	*Ischnura heterosticta* (damselfly)
Pseudagrion aureofrons (damselfly)	*Parasynthemis regina* (dragonfly)
Xanthagrion erythroneurum (damselfly)	*Synlestes selysi* (damselfly)
INSECTA TRICHOPTERA	
Orthotricia atraseta (caddis fly)	*Ecnomus pansus* (caddis fly)
Triplectides australis (caddis fly)	*Notolina spira* (caddis fly)
INSECTA EPHEMEROPTERA	
Atalophlebia australis (may fly)	*Tasmanocoenis arcuata* (may fly)
MOLLUSCA	
Alathyria condola (mussel)	*Alathyria jacksoni* (mussel)
Austropeplea lessoni (snail)	*Austropeplea tomentosa* (snail)
Bayardella cosmeta (snail)	*Bithynia affinis australis* (snail)
Corbicula australis (clam)	*Ferrissia petterdi* (limpet snail)
Ferrissia tasmanica (snail)	*Glacidorbis hedleyi (snail)*
Glyptophysa aliciae (snail)	*Glyptophysa gibbosa* (snail)
Gyraulus gilberti (snail)	*Gyraulus scottianus* (snail)
Isidorella newcombi (snail)	*Musculium problematicum* (clam)
Musculium quiriudi (clam)	***Notopala sublineata* (snail)**
Notopala suprafasciata (snail)	*Pisidium carum* (clam)
Pisidium hallae (clam)	*Pisidium ponderi* (clam)
Posticobia brazieri (snail)	*Thiara balonnensis* (snail)
Velesunio ambiguus (mussel)	

PORIFERA	
Eunapius fragilis (sponge)	*Eunapius crassissimus* (sponge)
Heterorotula capewelli (sponge)	*Eunapius sinensis stanleyi* (sponge)
Heterorotula contraversa (sponge)	*Heterorotula multidentata* (sponge)
ROTIFERA	
Asplanchna brightwelli (rotifer)	*Asplanchna priodonta* (rotifer)
Asplanchna sieboldi (rotifer)	*Asplanchnopus hyalinus* (rotifer)
Brachionus angularis (rotifer)	*Brachionus budapestinensis* (rotifer)
Brachionus calyciflorus amphiceros (rotifer)	*Brachionus calyciflorus anuraciformis* (rotifer)
Brachionus calyciflorus gigantea (rotifer)	*Brachionus dichotomus* (rotifer)
Brachionus falcatus (rotifer)	*Brachionus keikoa* (rotifer)
Brachionus nilsoni (rotifer)	*Brachionus novaezealandia* (rotifer)
Brachionus quadridentatus (rotifer)	*Brachionus rubens* (rotifer)
Brachionus urceolaris (rotifer)	*Cephalodella biungulata* (rotifer)
Cephalodella gibba (rotifer)	*Cephalodella mucronata* (rotifer)
Collotheca mutabilis (rotifer)	*Collotheca pelagica* (rotifer)
Colurella uncinata (rotifer)	*Conochilus dossuarius* (rotifer)
Conochilus hippocrepis (rotifer)	*Conochilus unicornis* (rotifer)
Dicranophorus hauerianus (rotifer)	*Diplenchlanis propatula* (rotifer)
Dissotrocha macrostyla (rotifer)	*Encentrum aquilis* (rotifer)
Eosphora najas (rotifer)	*Epiphanes clavulata* (rotifer)
Epiphanes senta (rotifer)	*Euchlanis dilatata lucksiana* (rotifer)
Euchlanis meneta (rotifer)	*Euchlanis oropha* (rotifer)
Euchlanis triquetra (rotifer)	*Filinia australiensis* (rotifer)
Filinia grandis (rotifer)	*Filinia longiseta* (rotifer)
Filinia opoliensis (rotifer)	*Filinia passa* (rotifer)
Filinia pejleri (rotifer)	*Hexarthra intermedia* (rotifer)
Hexarthra mira (rotifer)	*Keratella australis* (rotifer)
Keratella cochlearis (rotifer)	*Keratella procurva robusta* (rotifer)
Keratella slacki (rotifer)	*Keratella tropica* (rotifer)
Keratella volga (rotifer)	*Lacinularia elliptica* (rotifer)
Lecane aculeata (rotifer)	*Lecane closterocerca* (rotifer)
Lecane curvicornis (rotifer)	*Lecane flexilis* (rotifer)
Lecane hamata (rotifer)	*Lecane ludwigii (rotifer)*
Lecane luna (rotifer)	*Lecane lunaris* (rotifer)
Lecane signifera (rotifer)	*Lecane stenroosi* (rotifer)
Lepadella acuminata (rotifer)	*Lepadella monodactyla* (rotifer)
Limnias ceratophylli (rotifer)	*Macrotrachela multispinosa* (rotifer)
Platyias quadricornis (rotifer)	*Polyarthra dolichoptera* (rotifer)
Polyarthra vulgaris (rotifer)	*Pompholyx complanata* (rotifer)
Proales werneckii (rotifer)	*Rotaria macrura* (rotifer)
Rotaria neptunia (rotifer)	*Synchaeta litoralis* (rotifer)
Synchaeta longipes (rotifer)	*Synchaeta oblonga* (rotifer)
Synchaeta pectinata (rotifer)	*Synchaeta stylata* (rotifer)
Synchaeta tavina (rotifer)	*Synchaeta tremula* (rotifer)
Trichocerca chattoni (rotifer)	*Trichocerca insignis* (rotifer)
Trichocerca pusilla (rotifer)	*Trichocerca rattus carinata* (rotifer)
Trichocerca similis (rotifer)	*Trichocerca stylata* (rotifer)
Trichotria tetractis (rotifer)	*Wolga spinifera* (rotifer)

* denotes a listed threatened species in the Act.

^ denotes Australian Museum records from the late 1800's.

2. The total species list of the Darling River Drainages is larger than that given above. The above list is based on a combination of Australian Museum and literature records, and is data deficient for many areas of the Darling River Drainages. At any particular site, not all of the species listed above may be present. The species composition of a site will be influenced by the time of the year, the size and ecological characteristics of the area and the level of threatening processes present. The species listed in the above table are considered aquatic species, under the definition of the *Fisheries Management Act 1994*.

3. In its natural state, many of the water-bodies in this area are characterised by variable and unpredictable patterns of high and low flows. The natural morphology of the river systems includes deep channels, deep pool areas, suspended load depositional 'benches', higher floodplain 'benches', braided channels, terminal wetland complexes, gravel beds and riffle zones. The floodplain is also an integral part of this river system. Many fish species rely on the seasonal flow pattern and inundation of the floodplain for successful reproduction. The complex river morphology provides a multitude of habitats that play a critical role in the life cycles of the species making up this ecological community. Regulation of the system by numerous dams and weirs has reversed the seasonal flow regime, reduced frequency and extent of flooding, reduced channel complexity and has stopped fish migrations upriver. Fish passages over or around the man-made barriers are few. The release of cold water from the bottom of dams and weirs (cold water pollution) has also upset the natural temperature regime in the system, with further deleterious effects on fish migration and reproduction.

4. The Fisheries Scientific Committee has identified the following threats to the continued survival of the Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Darling River:

- Instream structures, such as weirs and dams, have regulated natural flows and thereby affected the normal reproductive and other biological cues for the aquatic community. Regulation of the system by numerous dams and weirs has altered the flow regime, reduced channel complexity and has stopped fish migrations upriver because passages over or around the barriers are few. Passage of the more mobile species has been interrupted by weirs and dams. Instream structures, particularly dams, have introduced thermal pollution. The release of cold water downstream of dams has altered the natural temperature regime, with further deleterious effects on fish reproduction.

  Altered floodplain and wetland inundation caused by the instream structures have further affected river productivity. The morphological complexity of the main channel and floodplain is critical for ecosystem health because they are major factors in the accumulation of organic matter, which provides the food source for many of the macro invertebrates at the bottom of the food chain. By simplifying and eroding the channel and alienating the floodplain, this complexity has been degraded.

  Water extraction has decreased flows in many parts of the system to levels detrimental to ecosystem functioning. The overall reduced flows cause increased erosion during flood events, with sand slugs developing in the upper reaches of some rivers. These changes decrease the available habitat for the aquatic ecological community and degrade that which remains.

The installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams has been listed as a Key Threatening Process in Schedule 6 of the *Fisheries Management Act 1994*. The alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands has been listed as a Key Threatening Process in Schedule 3 of the *Threatened Species Conservation Act 1995*.

- The clearing of riparian vegetation and continued stock access to the riparian zone increases erosion and siltation, and removes critical habitat, including reproductive sites for species in this aquatic ecological community. Clearing of the floodplain vegetation for agriculture also increases sedimentation and reduces carbon inputs to the river, which are important food sources for instream invertebrates. Degradation of native riparian vegetation along NSW waterways has been listed as a Key Threatening Process in Schedule 6 of the *Fisheries Management Act 1994*. The clearing of native vegetation has been listed as a Key Threatening Process in Schedule 3 of the *Threatened Species Conservation Act 1995*.
- The removal of snags reduces the amount of aquatic habitat and reproductive sites. For example, Murray cod (*Maccullochella peelii peelii*), river blackfish (*Gadopsis marmoratus*) and various species of gudgeons spawn adhesive eggs onto and in submerged logs. The removal of large woody debris has been listed as a Key Threatening Process in Schedule 6 of the *Fisheries Management Act 1994*.
- The presence of at least five introduced species (carp, goldfish, redfin perch, mosquitofish and the snail *Physa acuta*) is an additional threat to the native community. Such introduced species can act as predators, competitors, disease carriers, and habitat modifiers. Carp, redfin perch, and mosquitofish have all been identified as having deleterious effects on native species. The introduction of fish to fresh waters within a river catchment outside their natural range has been listed as a Key Threatening Process in Schedule 6 of the *Fisheries Management Act 1994*.
- Some types of agriculture can produce threatening processes to native aquatic animals. The reduction of river flow by water extraction, and pollution through insecticide and fertilizer runoff, are detrimental to aquatic life. This is especially evident during periods of low river flow when demand for irrigation and stock water is highest.
- Overfishing has reduced populations of species Murray cod and golden perch. For species listed as endangered or vulnerable, such as olive perchlet (*Ambassis agassizii*), purple-spotted gudgeon (*Mogurnda adspersa*), silver perch (*Bidyanus bidyanus*), Macquarie perch (*Macquaria australasica*) and trout cod (*Maccullochella macquariensis*) targeted or incidental collection and recreational catch must be considered as a threatening process.

5. Five of the 21 native finfish species included in this community are listed in the Threatened Species Schedules for New South Wales. One species of freshwater snail within the community, *Notopala sublineata*, is endangered. At least a further two species of fishes (*Tandanus tandanus* and *Gadopsis marmoratus*) have documented declines.

6. The Committee recognises and greatly appreciates the initiatives undertaken by the Murray-Darling Basin Commission, State, Commonwealth and local governments, community groups and private interest stakeholders to address concerns about the decline in the health of this aquatic community. Improvements have been, or are being, made in numerous areas, including water sharing allocations, riparian vegetation management, irrigation runoff and fish passage at smaller weirs. The Committee also recognises that changes to commercial and recreational fishing regulations have been made in the interests of protection of threatened species and stock conservation for exploited species. Where these programs are found to also be of benefit to conservation of this aquatic ecological community, it is the wish of the Committee to see them incorporated into the recovery plan for the ecological community. However, at this stage the Committee does not consider that the benefits of these programs have reversed the decline of the aquatic community.

7. In light of the above, the Fisheries Scientific Committee is of the opinion that the Aquatic Ecological Community in the Natural Drainage System of the Lowland Catchment of the Barwon-Darling River is likely to become extinct in nature, unless the circumstances and factors threatening its survival cease to operate. Therefore, the community qualifies for inclusion in Part 3 of Schedule 4, as an ENDANGERED ECOLOGICAL COMMUNITY.

Dr Alan Millar
Deputy Chairperson
Fisheries Scientific Committee

Attachment D

Fisheries Scientific Committee

November 2008

Ref. No. FD41
File No. FSC08/02

FINAL DETERMINATION

The *Tandanus tandanus* – Eel tailed catfish in the Murray/Darling Basin as an endangered population

The Fisheries Scientific Committee, established under Part 7A of the *Fisheries Management Act 1994* (the Act), has made a final determination to list the eel tailed catfish - *Tandanus tandanus* in the Murray/Darling Basin as an ENDANGERED POPULATION in Part 2 Schedule 4 of the Act.

Excluded from this determination are the listed impoundments; Ben Chifley Dam, Burrendong Dam, Chaffey Dam, Copeton Dam, Keepit Dam, Pindari Dam, Split Rock Dam, Windamere Dam, Wyangala Dam.

The listing of Endangered Populations is provided for by Part 7A, Division 2 of the Act.

The Fisheries Scientific Committee, with reference to the criteria relevant to this species, prescribed by Part 11B of the *Fisheries Management (General) Regulation 2002* (the Regulation) has found that:

Background

1. Eel tailed catfish – *Tandanus tandanus* (Mitchell, 1838) is a valid, recognised taxon and is a species as defined in the Act.
2. *Tandanus tandanus* is a member of the family Plotosidae, and is known by the common names eel tailed catfish and freshwater catfish.
3. The western population of *Tandanus tandanus* was originally widely distributed throughout the Murray-Darling River System in NSW, Queensland, Victoria and South Australia, with the exception of the cooler parts of the southern tributaries. It was relatively uncommon upstream of Wagga Wagga on the Murrumbidgee River and Lake Mulwala on the Murray River. There are potentially a number of eastern drainage populations and their taxonomic status is currently under investigation. There is also a current investigation of the eastern and western populations and their genetics, as a precursor to a proposed breeding and stocking program. It is found in freshwater areas, including tidal reaches of coastal rivers from the Shoalhaven River to the Tweed River in NSW. Native fish, including catfish have been translocated into coastal rivers from the Murray-Darling Basin and it is not know if the populations of *T. tandanus* in those catchments south of the Karuah River are endemic to the eastern river systems.
4. *Tandanus tandanus* is non migratory and lives in a wide range of habitats including rivers, creeks, lakes, billabongs and lagoons, and although it inhabits flowing streams, prefers sluggish or still waters. It can be found in clear to turbid waters, and over substrates ranging from mud to gravel and rock. It is rare in natural riverine habitats but can be found in farm dams through-out inland NSW and southern Queensland. Moderate remnant populations occur in the Macquarie catchment upstream of Warren, the Castlereagh catchment upstream of Mendooran, the Namoi catchment upstream of Wee Waa, the Gwydir catchment upstream of Moree and the Border Rivers catchment upstream of Goondiwindi.

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It is a large plotosid growing to 900 mm and 6.8 kg, but specimens over 2.0 kg are uncommon. It is a benthic species that lives, feeds and breeds near the bottom. It is a carnivore that feeds on crustaceans (mainly yabbies and shrimp), molluscs, aquatic insects and small fish.

5. *Tandanus tandanus* has the following conservation status:

    i. Victoria: Flora and Fauna Guarantee Act 1988: Vulnerable;
    ii. South Australia: Protected.
    iii. *Tandanus tandanus* occurs in the lower Murray, Darling and Lachlan River catchments, all of which are listed as Endangered Ecological Communities.

Criteria – reduction in abundance, geographic distribution or genetic diversity (Regulation clause 340F)

1. Records show that *Tandanus tandanus* was widespread in the western rivers in NSW and that it was one of the most abundant species in western waters, especially the lagoons and back-waters.
2. It remained an abundant species through the early and mid-1900's and catfish were regularly caught by inland anglers and formed part of the inland commercial fishery in NSW through the mid and late 1900's. However, there has been a significant and rapid decline in NSW waters, and the species was absent from the commercial catch in the late 1980's. Catfish are now rare or absent from all rivers and creeks in Victoria as well as many of the major tributaries in NSW including the Murray, Darling, Murrumbidgee and Lachlan rivers. No *T. tandanus* were recorded from the Murray Region and only 58 from the Darling in the NSW Rivers Survey. There has been a significant and rapid decline in the abundance of *Tandanus tandanus* in riverine habitats in the Murray/Darling Basin. The species is currently only regularly observed in the Macquarie catchment upstream of Warren, the Castlereagh catchment upstream of Mendooran, the Namoi catchment upstream of Wee Waa, the Gwydir catchment upstream of Moree and the Border Rivers catchment upstream of Goondiwindi. The species is also present in rivers in southern Queensland, and in some waters in Victoria, including Cardross Lakes and the Wimmera River where it has been translocated.
3. In light of the above, the Fisheries Scientific Committee has found that eel tailed catfish population in the Murray/Darling Basin has undergone a large reduction in abundance and a large reduction in geographic distribution within a time frame appropriate to the life cycle and habitat characteristics of the taxon; this meets the criteria of an Endangered Population.

Criteria – threatening processes (Regulation clause 340G)

1. The causes of the decline of *Tandanus tandanus* are uncertain, but probably include: historic commercial fishing; loss of habitat (lakes, billabongs, lagoons) through river regulation; interactions with introduced species, such as carp (*Cyprinus carpio*); loss of habitat and spawning sites through siltation; reduced success of spawning and recruitment, and loss of habitat due to alterations to flow patterns and flooding regimes; reduced habitat and loss of temperature spawning cues due to cold-water discharge from the base of large dams and high-level weirs; loss of aquatic plants; chemical pollution, including agricultural pesticides.
2. In light of the above, the Fisheries Scientific Committee has found that most of these threatening processes continue to operate throughout the geographic distribution of the

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species, and existing reserve systems or other forms of refuge do not protect the species.

Conclusion pursuant to section 220FA(1) of the Act

In the opinion of the Fisheries Scientific Committee:

a. *Tandanus tandanus* in the Murray/Darling Basin is facing a very high risk of extinction in New South Wales in the near future, as determined in accordance with the criteria prescribed by the Regulation as discussed above; and

b. The population in the Murray/Darling Basin is eligible to be listed as an ENDANGERED POPULATION. Excluded from this determination are the listed impoundments; Ben Chifley Dam, Burrendong Dam, Chaffey Dam, Copeton Dam, Keepit Dam, Pindari Dam, Split Rock Dam, Windamere Dam, Wyangala Dam.

Sources and Links

Clunie, P. and Koehn, J. (2001a). *Freshwater Catfish. Volume 1 A Recovery Plan*. Final Report for Natural Resource Management Strategy Project R7002 to the Murray Darling Basin Commission. Department of Natural Resources and Environment, Melbourne.

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Attachment E

Advice to Water Management Committees

NSW Government

No. 3 Floodplain Harvesting

What is floodplain harvesting?

Floodplain harvesting is the collection, extraction or impoundment of water flowing across floodplains. The floodplain flows can originate from local runoff that has not yet entered the main channel of a river, or from water that has overflowed from the main channel of a stream during a flood. For the purposes of this policy the floodplain is defined as extending to the 1 in 100 year flood line.

Harvesting can generally be put into one of three categories:

1. Diversion or capture of floodplain flows using purpose built structures or extraction works to divert water into storages, supply channels or fields or to retain flows.
2. Capture of floodplain flows originating from outside of irrigated areas using works built for purposes other than floodplain harvesting. Examples are:
   - levees and supply works such as off river storages constructed in billabongs or depressions that fill from floodplain flows
   - below ground level water channels from which the water is pumped into on farm storages.
3. Opportunistic diversions from floodplains, depressions or wetlands using temporary pumps or other means.

Capture of rainfall or runoff from farm irrigation fields, via tailwater systems or other means, is not floodplain harvesting.

What are the issues?

The harvesting of water from floodplains reduces the amount of water reaching or returning to rivers. This decreases the amount of water available to meet downstream river health, wetland and floodplain needs and the water supply entitlements of other users.

As well, floodplain harvesting can seriously affect the connectivity between the local floodplain, wetlands and the river, through the loss of flow volume and redirection of water flows.

The *Water Act 1912* provided powers to license floodplain harvesting. However this was never applied as there was generally no requirement to restrict total overall water extractions or off-allocation diversions. Harvested floodplain water has been treated as a freely available bonus to a farmer's licensed entitlement.

This situation has now changed. The Murray-Darling Basin cap applies to all water diverted from inland NSW catchments and rivers. Licensed and off-allocation access has been subject to increasing restrictions. Embargoes on water licences are also in place on many areas on the coast.

Floodplain harvesting works and water extractions also clearly fall into those activities that the *Water Management Act 2000* requires to be only undertaken by way of a licence. The Act also requires such licensing to consider the ecological functioning of floodplains.

Floodplain harvesting can no longer be left outside of the State's water management and compliance system or as a source of increase in further water diversions. Given this, it is the Government's intention that floodplain harvesting works and taking of water from floodplains be licensed and managed. It will take a number of years to complete the process. However, the water sharing plans must signal the basic principles that will govern the process.

Approach to floodplain harvesting

Floodplain harvesting will not be a component of individual water sharing plans being produced for the regulated and unregulated rivers. During flood times water originating in one river system may flow across floodplains and along "flood runners" into adjacent river systems. It is therefore often not possible to assign an area of floodplain to a particular river.

Instead, management of floodplain harvesting will occur on a state-wide basis, according to the six principles set out below.

There are many thousands of existing floodplain works which will require licensing and this will be done over the next couple of years. The licensing process will include proper environmental impact assessments.

A separate category of licence will be established.

Principle 1

All existing floodplain harvesting works and floodplain harvesting extractions will be licensed.

While all surface and groundwater licences now (or will shortly) specify volume entitlements or annual limits to water, it is not possible to do this for floodplain harvesting licences at this stage. This is because the pattern of use is highly episodic and site and infrastructure specific, and current data on structures and use is minimal.

The Department of Land and Water Conservation will licence existing structures and specify monitoring of use – including metering of pumps - as a licence condition where possible. This may not be possible initially in cases where a tailwater system is also picking up floodplain water as they are difficult to separate, or where overland flow is being captured by a billabong for which we do not have any information on its capacity. Options for application of volumetric conditions will be developed and implemented where appropriate within the first five years of the initial water sharing plans.

Principle 2

Licensing will focus initially on controlling the structures, but with movement towards specifying volume limits and flow related access conditions, including metering of pumps.

All new floodplain harvesting works are required by law to be licensed. However, as any new works would result in a growth in diversion, which would threaten river health and/or the water entitlements of others, such works would have to be offset by a reduction in other forms of water diversion.

Principle 3

No new works or expanded floodplain harvesting activities in the Murray-Darling Basin that will result in the diversion of additional water will be authorised.

Because cap is based on the use of water with development as it was in 1994, NSW considers that the water use that would result from use of the floodplain infrastructure in place in 1994, is part of the cap in each system. It is likely that there has been some growth in floodplain harvesting works and extractions since then.

However, it is expected that the licensing process will result in some modification of existing works. This may be adequate to offset any post 1994 development. If not, restrictions on the use of the licensed works will have to be applied to return diversions to cap levels. Such restrictions could include restrictions on pumping times or a requirement to modify the work to allow a proportion of flows to be bypassed.

By preventing the construction or enlargement of new works, the opportunity for any further growth in floodplain harvesting diversions will be minimised.

Principle 4

Floodplain diversions associated with works in place in the Murray-Darling Basin prior to the end of the 1994 irrigation season will be considered as within the NSW cap.

Principle 5

Once licensing is completed, an assessment of long-term use resulting from authorised structures against that from structures which existed in 1994 will be carried out and appropriate steps taken to keep harvesting to cap levels.

Trading of floodplain harvesting rights will not be permitted because the frequency and volume of use is site and infrastructure specific, and volume management will take some time to implement.

Principle 6

Floodplain harvesting rights will not be tradeable.

Plan Requirements

To provide a link between the water sharing plans and the floodplain harvesting policy, the following model provisions should be incorporated into regulated and unregulated river system water sharing plans.

1. *Harvesting of water from the floodplains of rivers which are included in this Plan's water sources is not subject to the provisions of this plan and has not been included in the diversion limit that applies to this plan.*

2. *This plan has, however, been developed on the understanding that the harvesting of water throughout the state will be managed on the basis of the principles set out in the policy advice. (The 6 principles should be listed).*

[i] https://finterest.com.au/aboriginal-management/
[ii] https://finterest.com.au/wp-content/uploads/2020/01/Chapter-24-Aboriginal_management.pdf
[iii] https://finterest.com.au/wp-content/uploads/2020/01/Chapter-24-Aboriginal_management.pdf