



Australian Government

Australian Bureau of Agricultural and  
Resource Economics – Bureau of Rural Sciences



# Management of Genetic Resources in the Murray-Darling Basin

**Andy moore**



[www.abare-brs.gov.au](http://www.abare-brs.gov.au)

# MDB

Large complex system

1,000,000<sup>2</sup> km

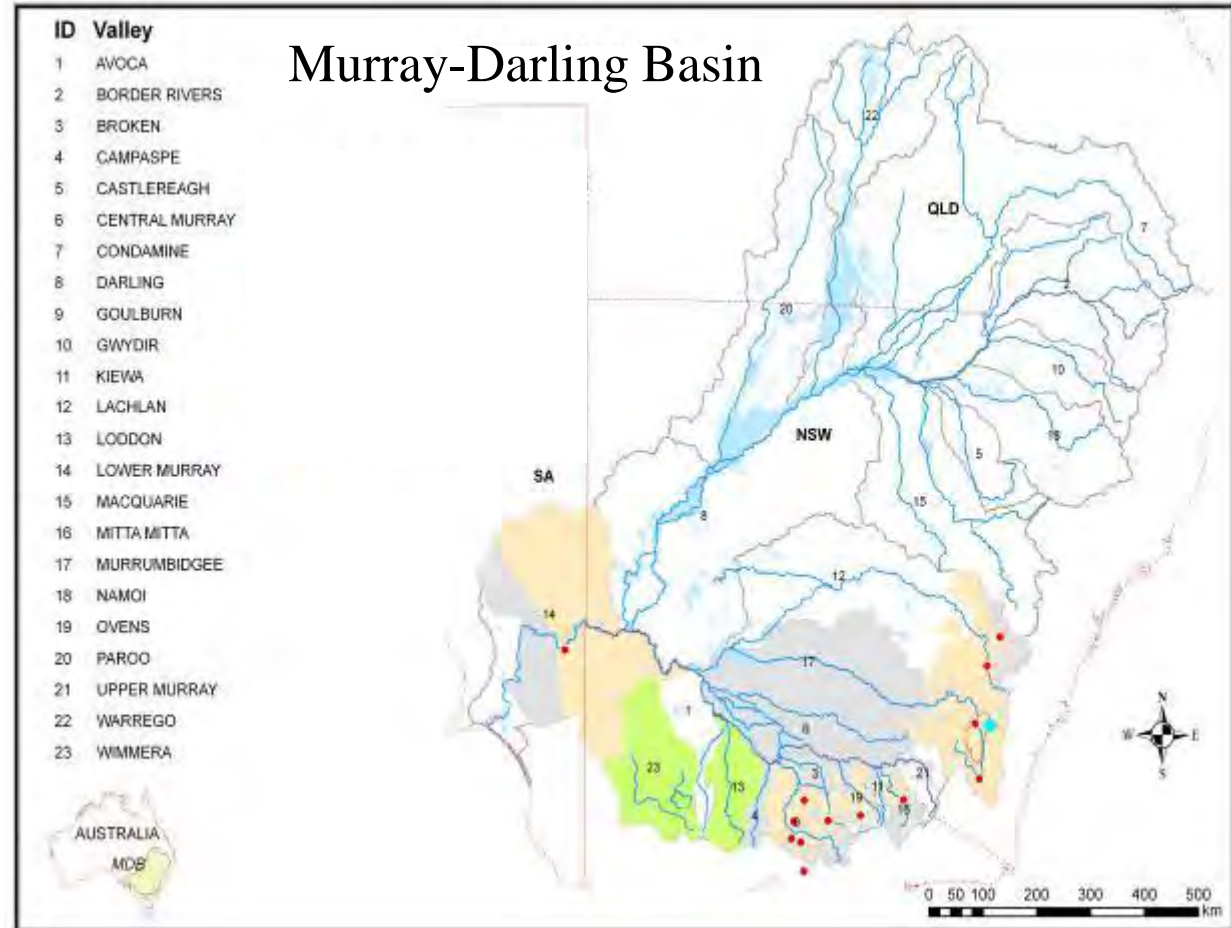
23 rivers

Murray (3530km)

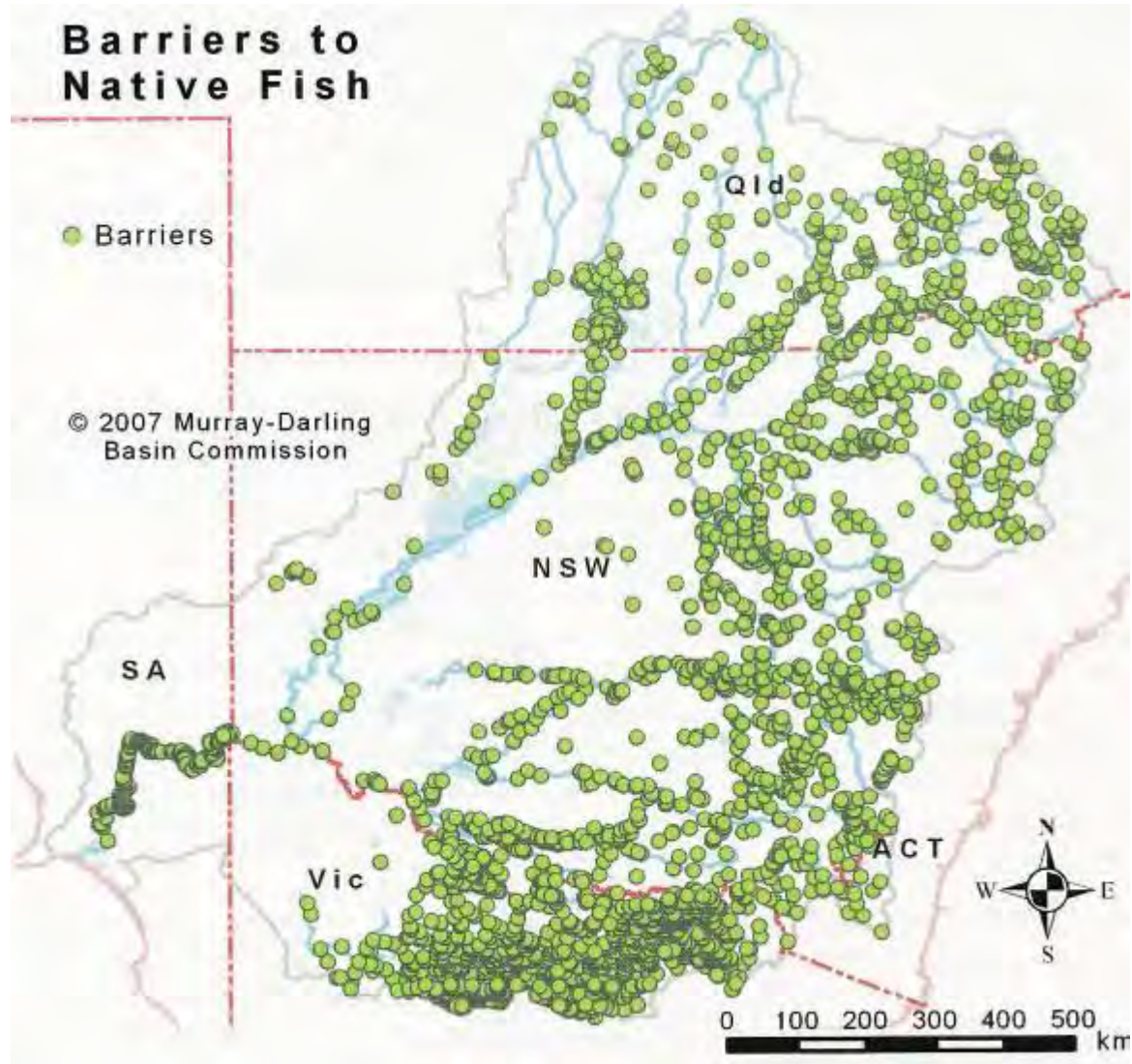
Darling (2740km)

Murrumbidgee

(1690km)



Fragmented systems



# Status of the MDB

- Two-thirds of flow diverted from rivers
- Median annual flow to the sea is now 27% of natural median flow
- Rivers currently in state of drought for more than 61 years in every 100 compared with 5 years per 100 under natural conditions
- Recent flows promising

# Status of fish in the MDB

- Native fish populations are only 10 percent of their pre-European settlement levels
- Primarily a result of human activities: widespread habitat and water quality degradation, reduced flow, overexploitation, barriers to movement and exotic species
- Recent prolonged drought is likely to have reduced populations even further
- MDB Native Fish Strategy aims to rebuild all fish stocks within the Basin to 60% of pre-European settlement levels within 50 years

# What role can genetic management play?



# Genetic threats

- Small or fragmented populations
- Genetic swamping
- Inbreeding & outbreeding
- Hybridisation & introgression
- Local extinctions
- Loss of genetic heritage



# What activities can be guided?

- Captive breeding
- Restocking
- Translocations
- Population rescue
- Genetic rescue
- Threatened species planning



Australian Society for Fish Biology  
 Workshop Proceedings  
**Enhancement of Marine and  
 Freshwater Fisheries**

7-12 August 2000

Albury, NSW

**Freshwater Fish Stocking in NSW**

**Environmental Impact Statement  
 Public Consultation Document**

Published in November 2003 by  
 NSW Fisheries  
 Coastal Fisheries Centre  
 PO Box 21 Cronulla NSW 2230



**10** Broodstock & population genetics



The 10th edition of the Australian Society for Fish Biology Workshop Proceedings, 'Enhancement of Marine and Freshwater Fisheries', was held in Albury, NSW, in August 2000. The workshop was the first to be held in a regional area and was a significant milestone in the history of the Society. The workshop was held in Albury, NSW, in August 2000. The workshop was the first to be held in a regional area and was a significant milestone in the history of the Society.

**101 - SUMMARY**

Broodstock and genetic management of fish hatcheries and significant environmental effects must be considered in hatchery and management. The quality and quantity of broodstock, broodstock production and systems of broodstock management as well as the availability of broodstock for commercial stocking, genetic stocking and environmental population...

...discuss within 5 years to improve and to monitor performance and production, and to further the maintenance of genetic diversity, broodstock should be equipped with secure facilities and data systems.

...the genetic broodstock can be broodstock of high quality, i.e. of high quality, and the genetic broodstock performance of these fish remains high, at least until 10 years of age. Unpublished...

NSW Department of Primary Industries, Environmental and Heritage Division

**Hatchery  
 Quality  
 Assurance  
 Program**

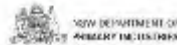
**Murray Cod**  
*Maccullochella peelii corassini*



**Golden Perch**  
*Maccullochella australis*



**Silver Perch**  
*Maccullochella australis*

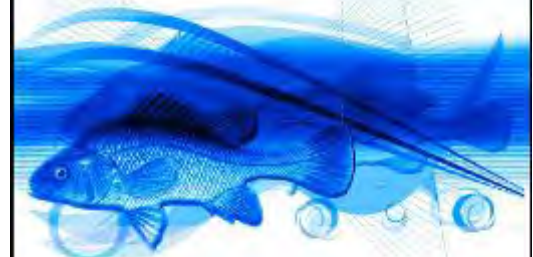


Steven J. Rowland & Patrick Tully



**Managing Fish Translocation &  
 Stocking in the Murray-Darling Basin**

Statement, recommendations and supporting papers



**THE NSW  
 FRESHWATER FISH STOCKING  
 FISHERY MANAGEMENT  
 STRATEGY**



NSW DEPARTMENT OF  
 PRIMARY INDUSTRIES

2005

CPRI/NSW/05/001

# How does this project advance things?

## Aim of the project

*The aim of the project was to provide a guide and resources for the management of genetic resources for fish and crustaceans in the Basin*

## Objectives

- Overview of genetic principles and current issues
- Review legislation and policies across jurisdictions
- **Review genetic data for fish and crustaceans in the Basin**
- **Conduct a workshop to determine the best approach to manage genetic resources within the Basin**
- **Provide guidelines and recommendations for genetic management within the Basin**
- Provide a template for stocking and hatchery genetic plans

# Genetic management units

- History of debate on defining genetic management units
  - Discrete populations
  - Evolutionarily Significant Units
  - Management units
- Has a consensus been reached?
- What is the best approach?
- What is the best approach for the Basin?

# Workshop on defining genetic management units (21-22 April 2009, Canberra)

## Key speakers

- Dick Frankham – Evolutionary and genetic distinctions in managing fish
- Fred Allendorf – Defining and conserving the processes and products of evolution
- Robin Waples – Defining conservation units and implementing science-based planning
- Jane Hughes – What drives evolutionary distinction in freshwater systems
- Michael Hammer – The race to define conservation units in Murray-Darling fishes
- Peter Jackson – The Murray-Darling Basin
- Andy Moore – Population distinction in the Murray-Darling Basin: What do we know?

# Key workshop recommendations

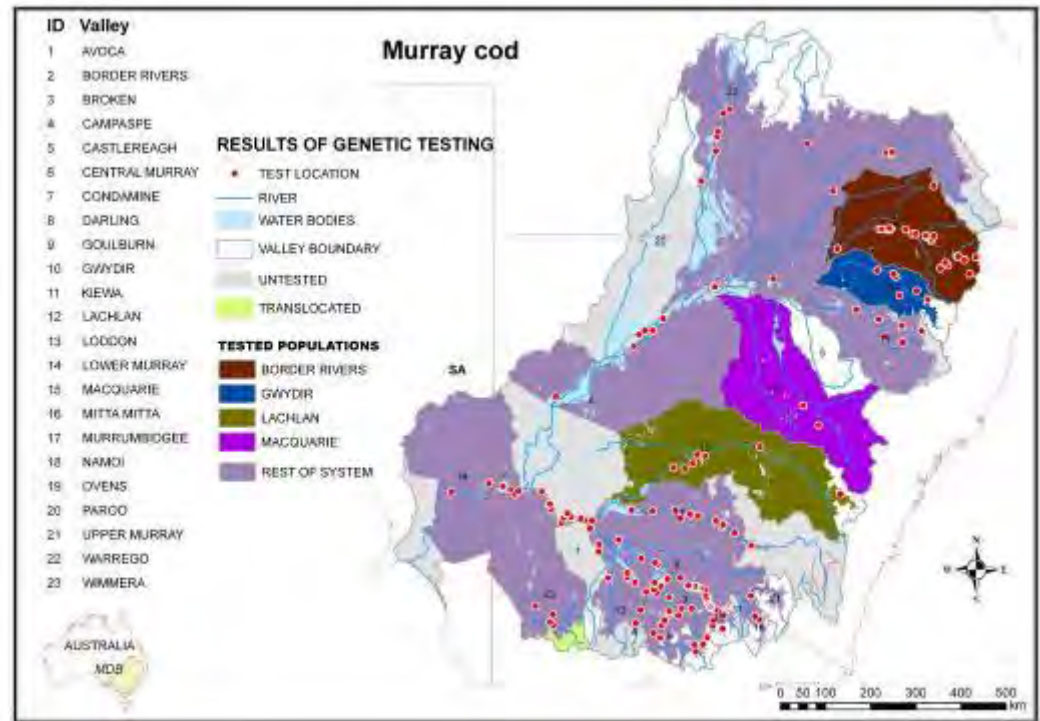
1. Form a genetic management committee
2. Hold a multi-jurisdictional workshop to foster a consistent approach
3. Adopt Waples 1991 ESU definition
4. Adopt Moritz 1994 MU concept
5. Define ESU's and MU's for Basin species
6. Fill major knowledge gaps (key and threatened species)
7. Research into habitat heterogeneity, natural connectivity and the effects of artificial barriers
8. Long-term monitoring to determine:
  - If stocking is swamping natural recruitment
  - If there is natural recruitment
  - If there is any evidence of stocked fish producing recruits

# Review of existing genetic data

65 species reviewed

Species profiles included

- Natural range
- Habitat/ biology
- Genetic sampling methods
- Genetic markers
- Evidence of structuring
- Genetic management
- Knowledge gaps
- Research priorities



# Species with genetic data

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## Native fish

Silver perch  
Murray cod  
Trout cod  
Golden perch  
Macquarie perch  
Freshwater catfish  
Hyrtl's tandan  
Two-spined blackfish

Northern blackfish  
Southern pygmy perch  
Bony herring  
Climbing galaxias  
Flat-headed gudgeon  
Dwarf flat-headed gudgeon  
Carp gudgeons  
Australian smelt

## Crustaceans

Yabby  
Murray crayfish  
Australian river prawn  
Glass shrimp  
McCulloch's shrimp complex

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# Species with little genetic data

## Native fish

Rendahl's tandan  
Olive perchlet  
Tamar goby  
Western blue-spot goby  
Lagoon goby  
Small-mouthed hardyhead  
Darling River hardyhead  
Murray hardyhead  
Un-specked hardyhead  
Barred galaxias  
Common galaxias  
Mountain galaxias  
Spotted galaxias  
Flat-headed galaxias  
Obscure galaxias  
Riffle galaxias

Spangled perch  
Desert rainbowfish  
Murray-Darling rainbowfish  
Congolli  
Estuary perch  
Short-finned eel  
Long-finned eel  
Short-headed lamprey  
Pouched lamprey

## Crustaceans

Lyell's crayfish  
Burrowing crayfish  
Burrowing crayfish  
Hanging Rock crayfish  
Lamington crayfish  
Dunns Swamp crayfish  
The Mistake Mountain crayfish  
Sutton's crayfish  
Clayton's crayfish Macca's crayfish  
Riek's crayfish  
Alpine crayfish  
Barmah Forest swamp yabby  
Rotund yabby  
Freshwater crab  
Freshwater spider-crab



# Some key recommendations

1. Populations that are defined as distinct genetic management units should be treated as unique populations with limited transfer of individuals between units – exception genetic rescue
2. A committee should be convened to oversee the ongoing development of a genetic management plan for the Basin and to assess individual species information – ongoing process
3. Encourage jurisdictions to use the information contained within this report to develop a unified approach to the management of genetic diversity within the Basin
4. Address knowledge gaps for species with insufficient genetic data (outlined in species profiles) to allow the identification of genetic management units for the Basin
5. Adequate stocking and hatchery genetic protocols should be adhered to for all breeding programs within the Basin

## Acknowledgements:

Jenny Ovenden, Jane Hughes, Peter Jackson, Fred Allendorf, Robin Waples, Dick Frankham, Michael Hammer, Stuart Rowland, Leanne Faulks, Meaghan Rourke, Heleena Bamford, Tim Page, Ben Cook, Gavin Hinten, Joel Huey and Nic Marton

## Conclusion and Thank you

*Science and economics for decision-makers*