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Sequential fishways reconnect a coastal river

Meaghan L. Duncan
NSW DPI Fisheries

Wayne Johnson
Charles Sturt University

Jonathon Doyle
NSW DPI Fisheries

Jason Thiem
NSW DPI Fisheries

Lee Baumgartner
Charles Sturt University

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Duncan, Meaghan L.; Johnson, Wayne; Doyle, Jonathon; Thiem, Jason; and Baumgartner, Lee, "Sequential fishways reconnect a coastal river" (2018). *International Conference on Engineering and Ecohydrology for Fish Passage*. 17.
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Department of
Primary Industries

Sequential fishways reconnect a coastal river



Meaghan Duncan, Jonathon Doyle, Wayne Robinson, Lee Baumgartner, Jason Thiem, Ivor Growns, Martin Mallen-Cooper and Tony Paull

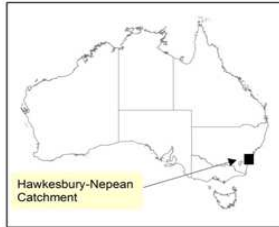


Fish passage challenges in coastal rivers

Migration between salt and freshwater (diadromy) is a key part of the lifecycle for many species

- Anadromous
- Catadromous
- Amphidromous
- Potamodromous





The Nepean River

- Highly regulated coastal river system
- 11 weirs between Penrith and Maldon and five large dams in the upper reaches
- Supplies 95% of Sydney's water
- Historically diverse fish community including many diadromous species well into the upper reaches.



Drown-out frequency

	Weir	Year of construction	Height of structure (m)	Drown-out frequency
downstream	Penrith Weir	1920	1.3	3.0-5.0
	Wallacia Weir	1908	5.6	1 in 100 years
	Theresa Park Weir	1975	3.7	0.8
	Brownlow Hill Weir	1908	1.8	0.5
Upstream	Mount Hunter Weir	1908	2.2	0.7
	Cobbitty Weir	1908	2	0.9
	Sharpes Weir	1907	3.6	1.0
	Camden Weir	1907	2.2	1.9
	Menangle Weir	1908	0.7-3.0	1.3
	Douglas Park Causeway	1960	0.8	0.8
	Maldon Weir	1968	16	1 in 100 years



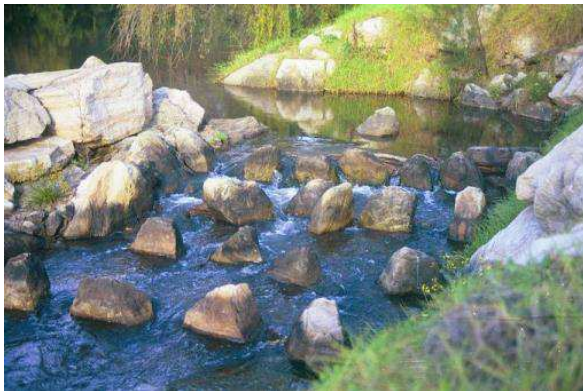
Existing fishways



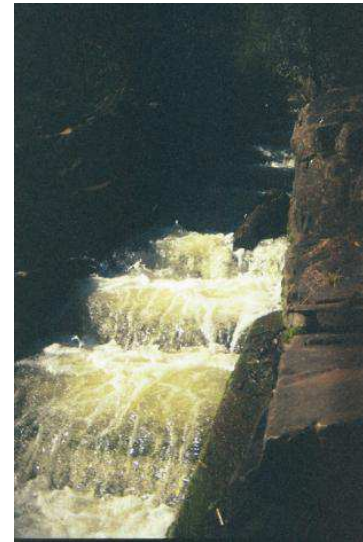
Theresa Park (rock ramp)



Cobbitty (vertical slot)



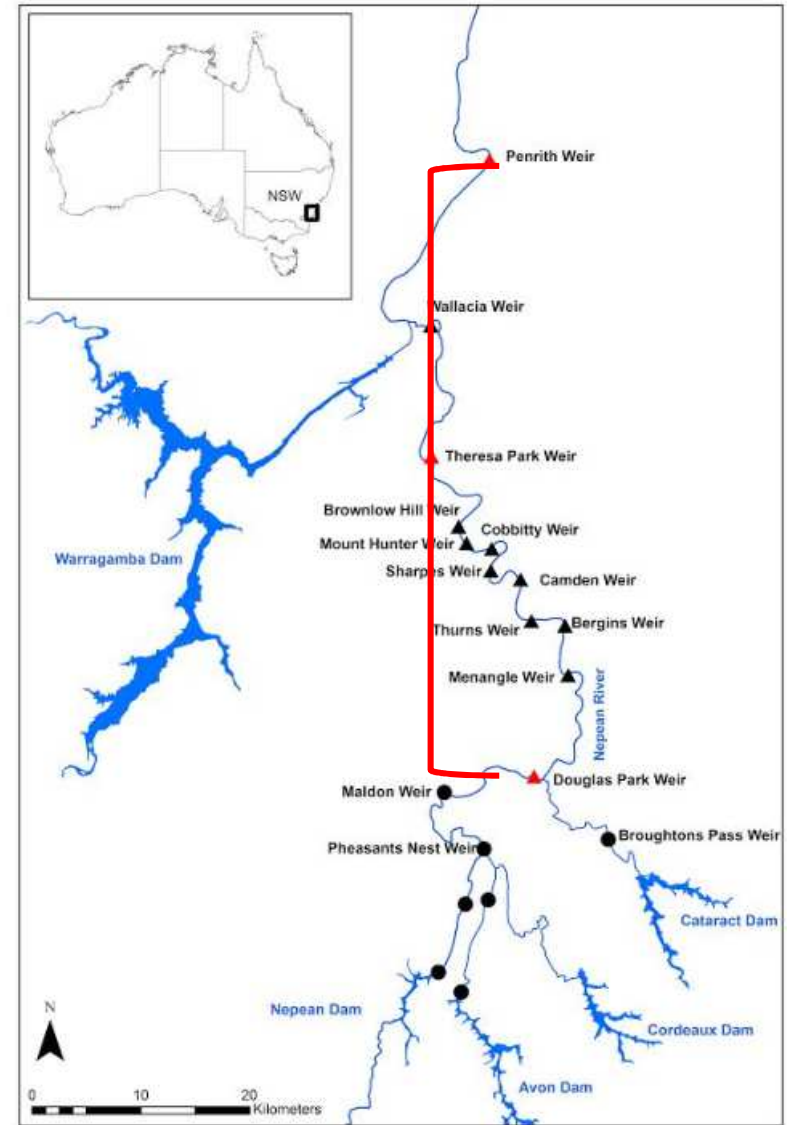
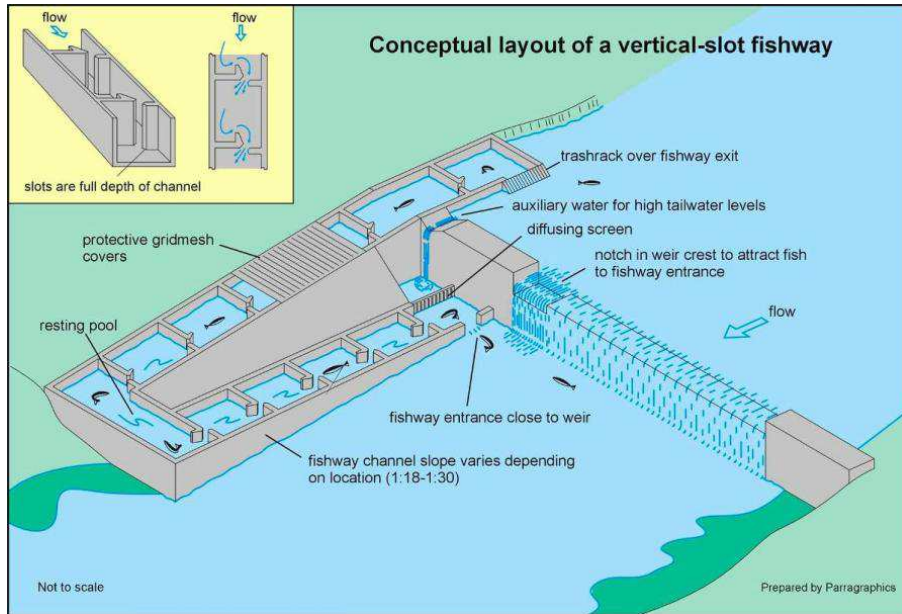
Mt Hunter (rock-ramp)



Wallacia (pool and weir)



Vertical slot fishway



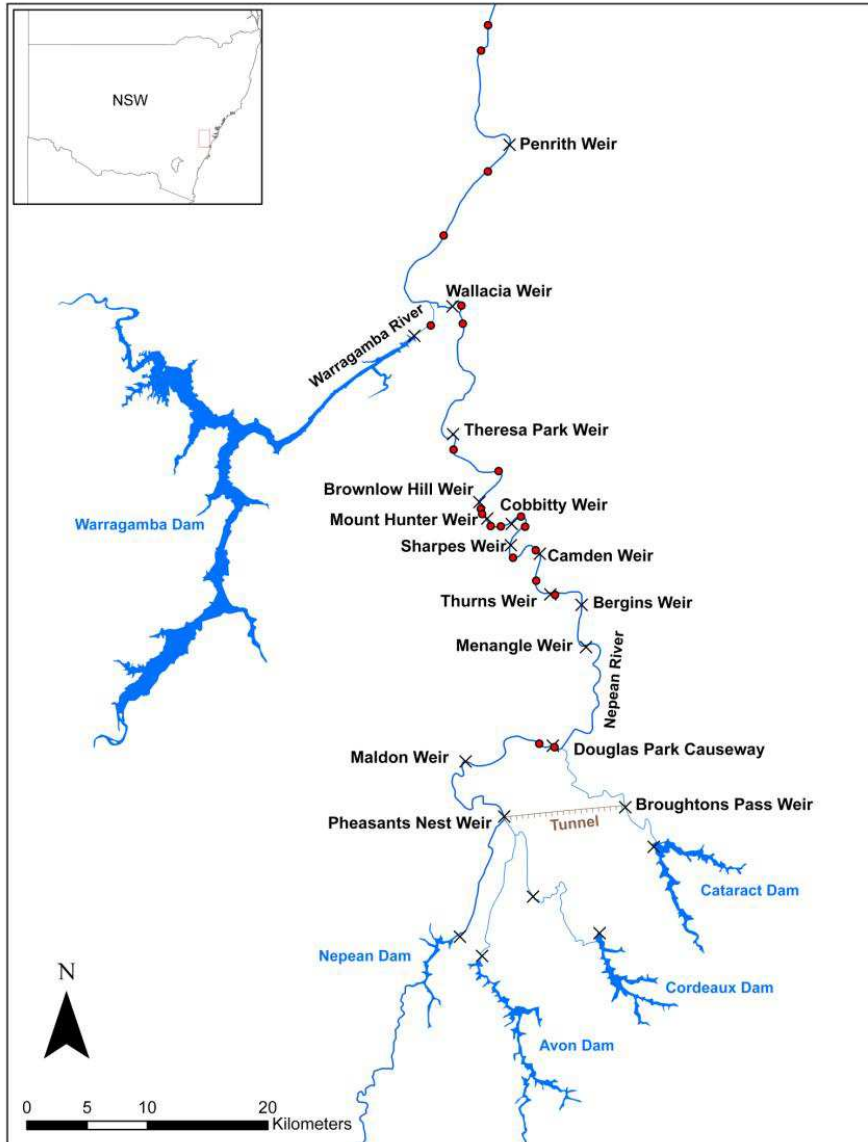
Evaluating improvements to fish passage

Research questions

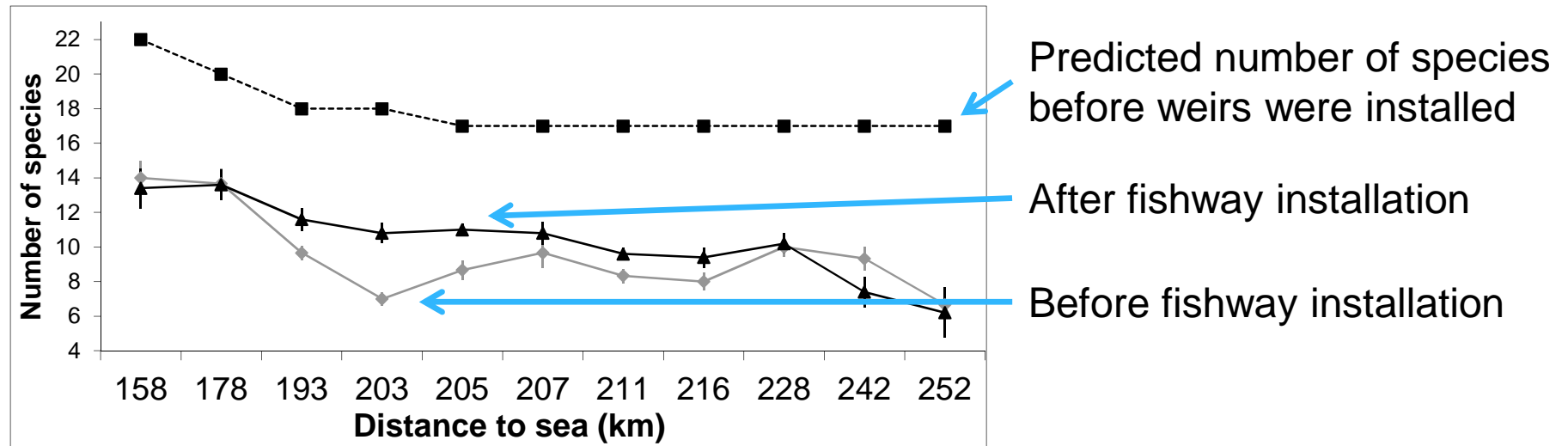
1. Does fish community structure improve upstream of the weirs post-fishway construction (electrofishing)?
2. Are the fishways passing fish from 35mm to 1m in length (trapping)?
3. Have the weirs caused population genetic fragmentation in Australian smelt, and is gene flow restored by the fishways (microsatellite analysis)?



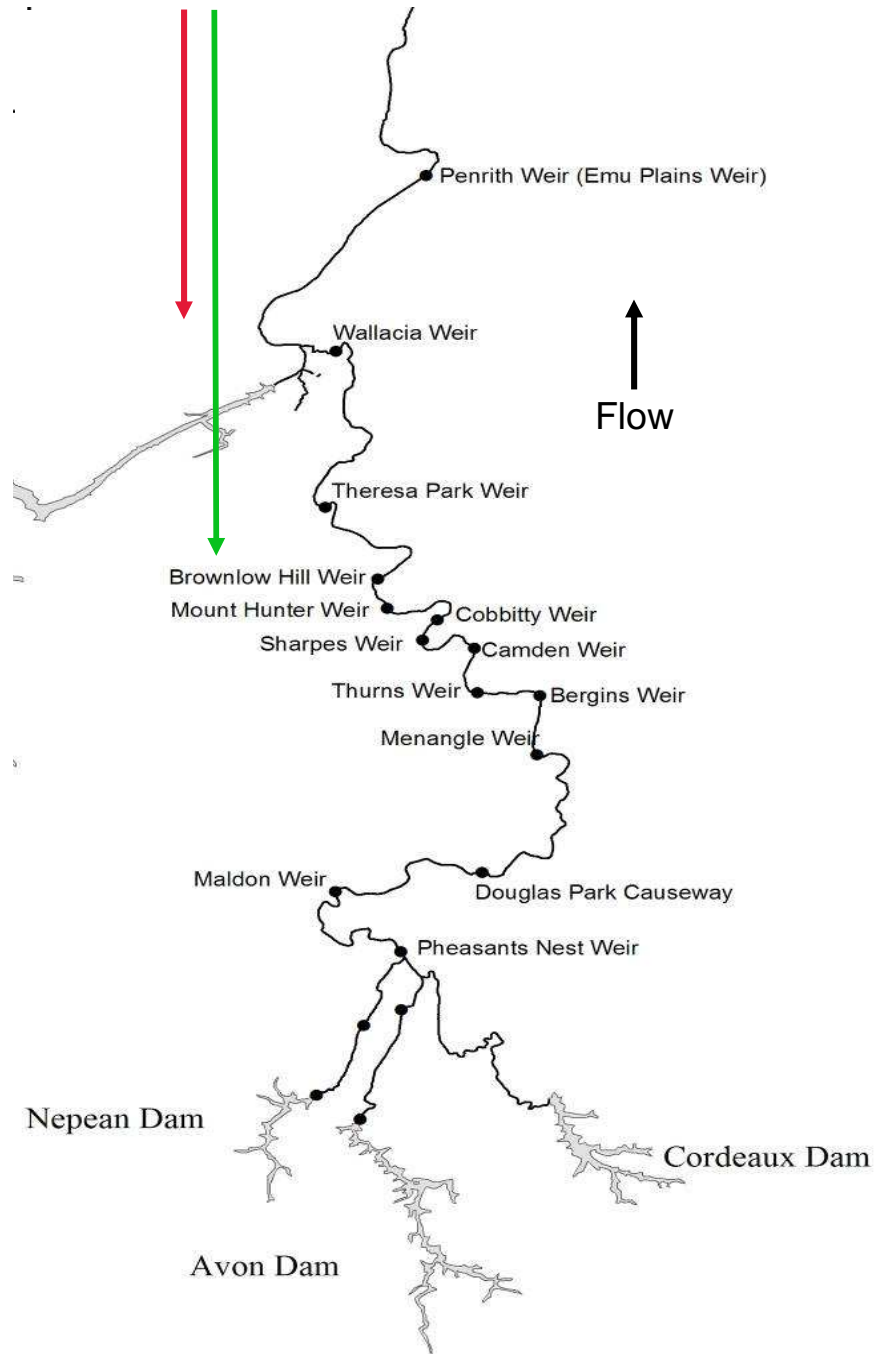
Electrofishing sites



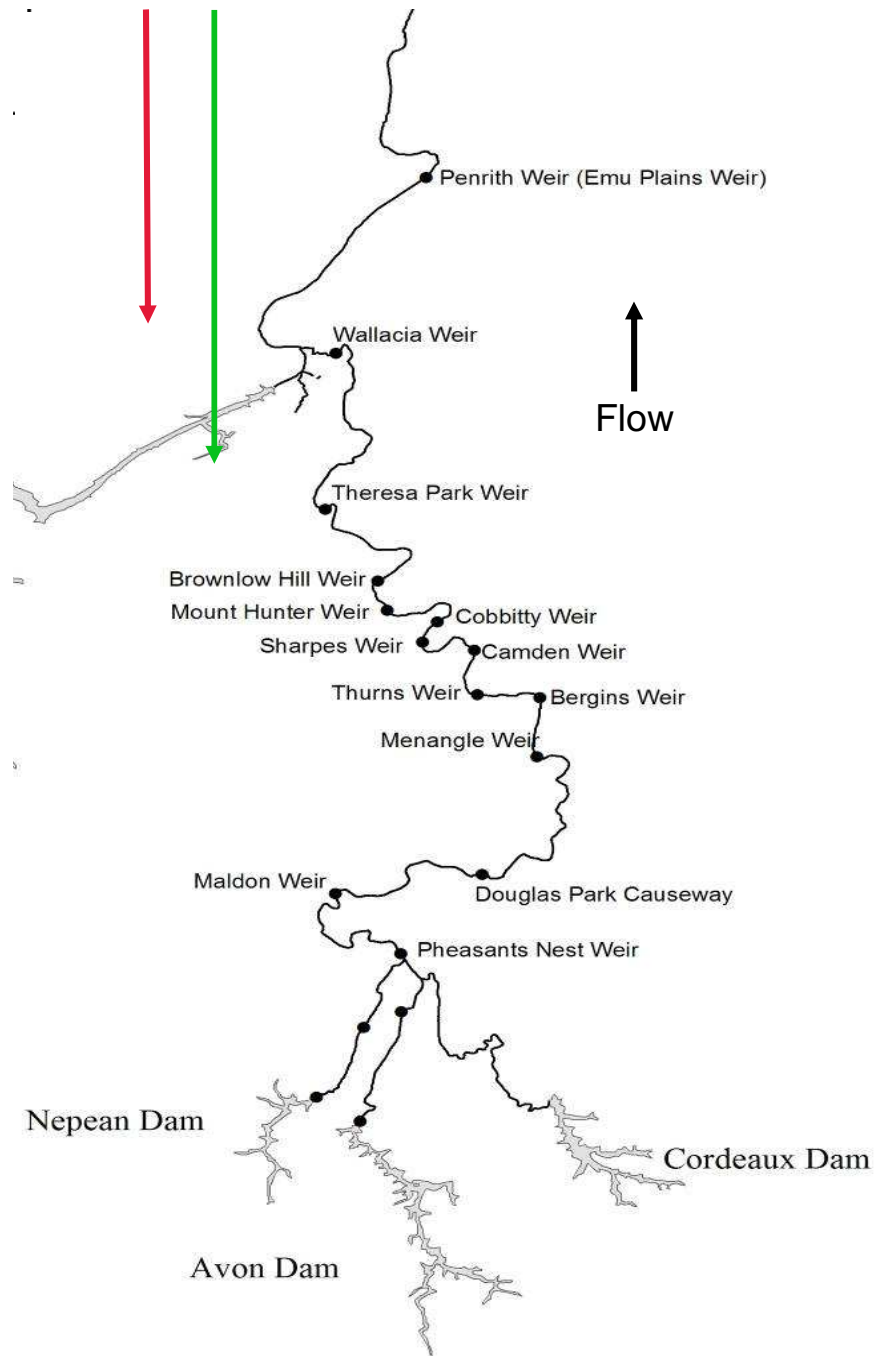
Number of species pre- and post-fishways



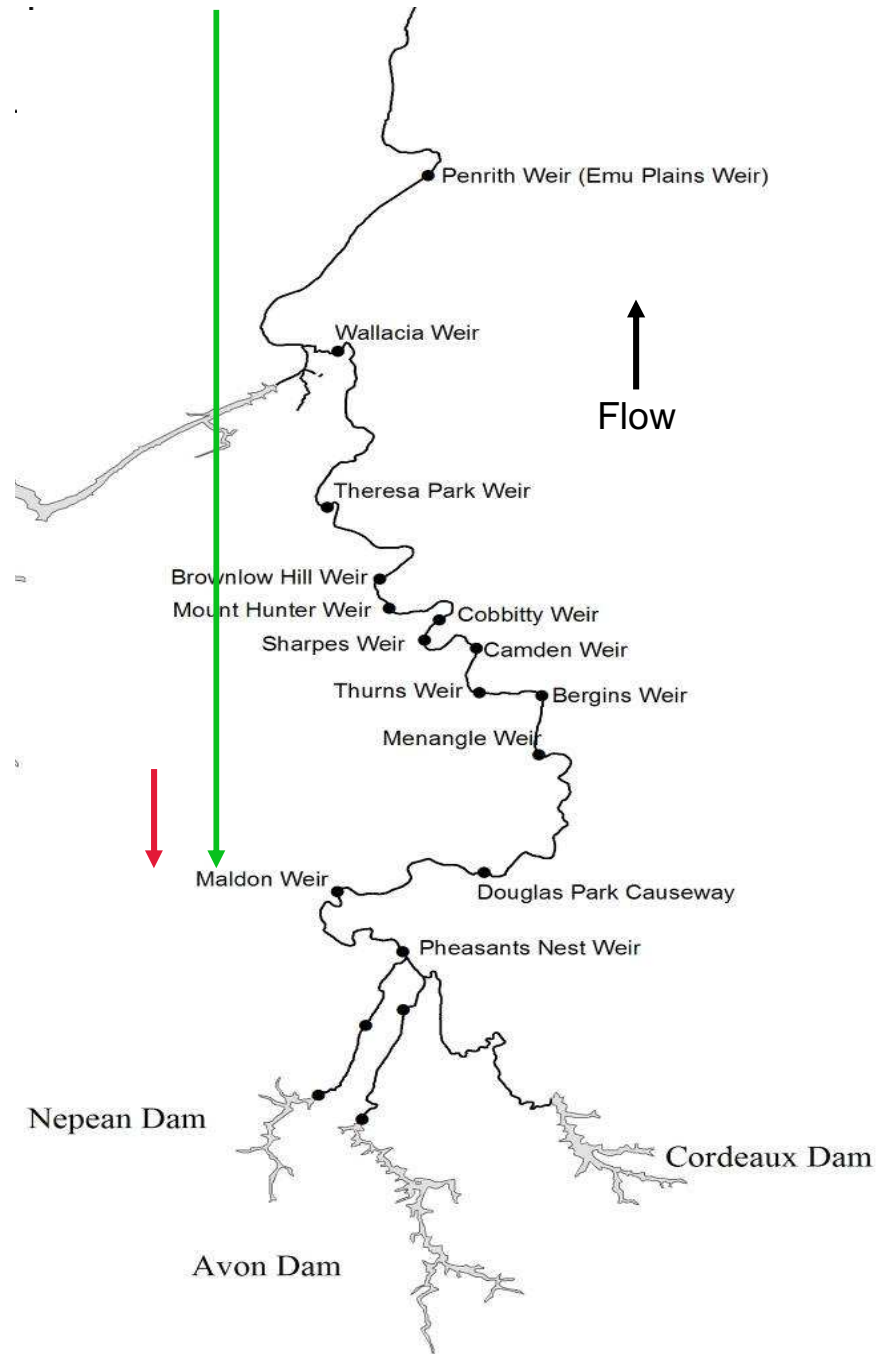
Striped gudgeon (amphidromous)



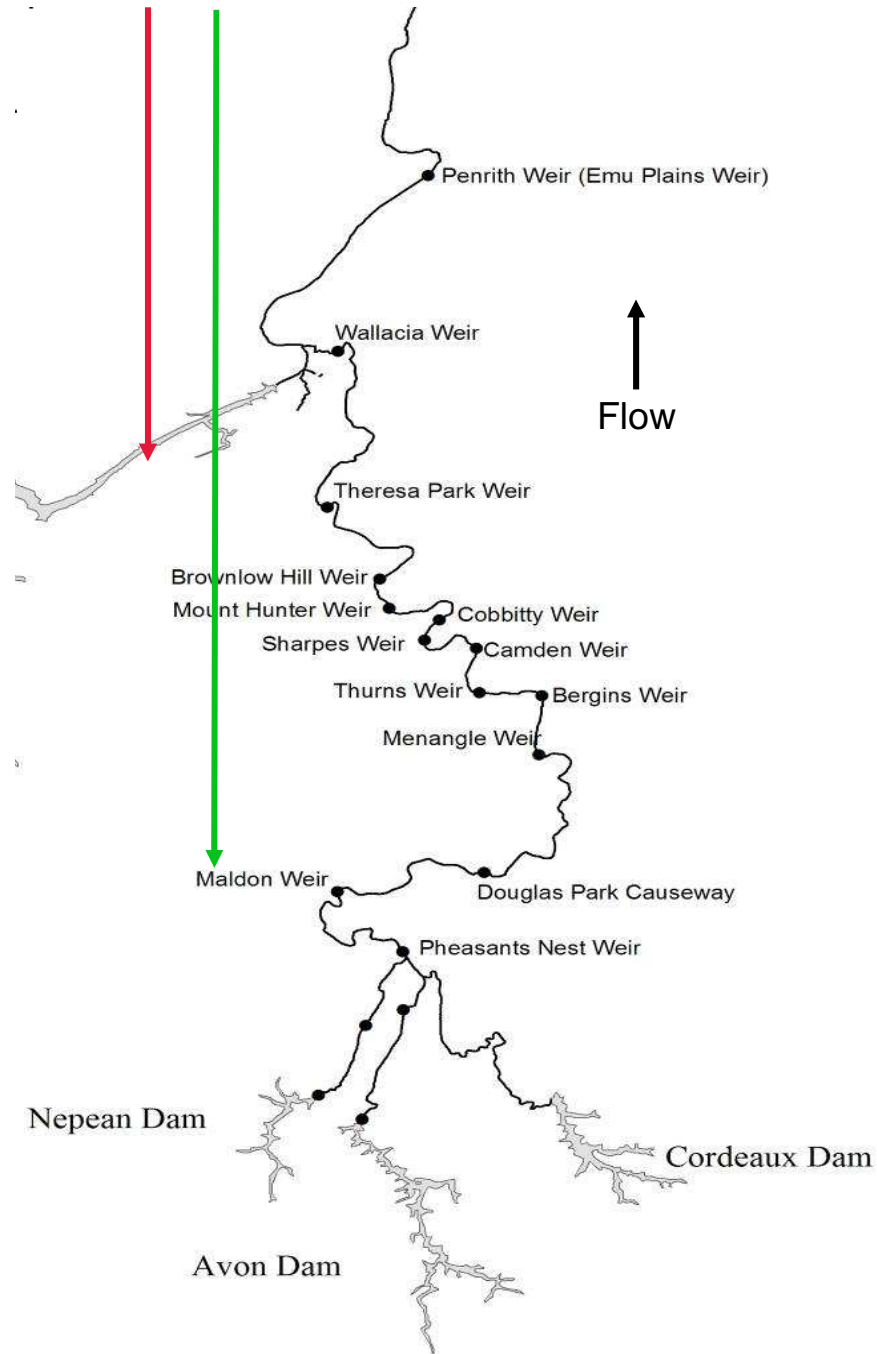
Empire gudgeon (amphidromous)



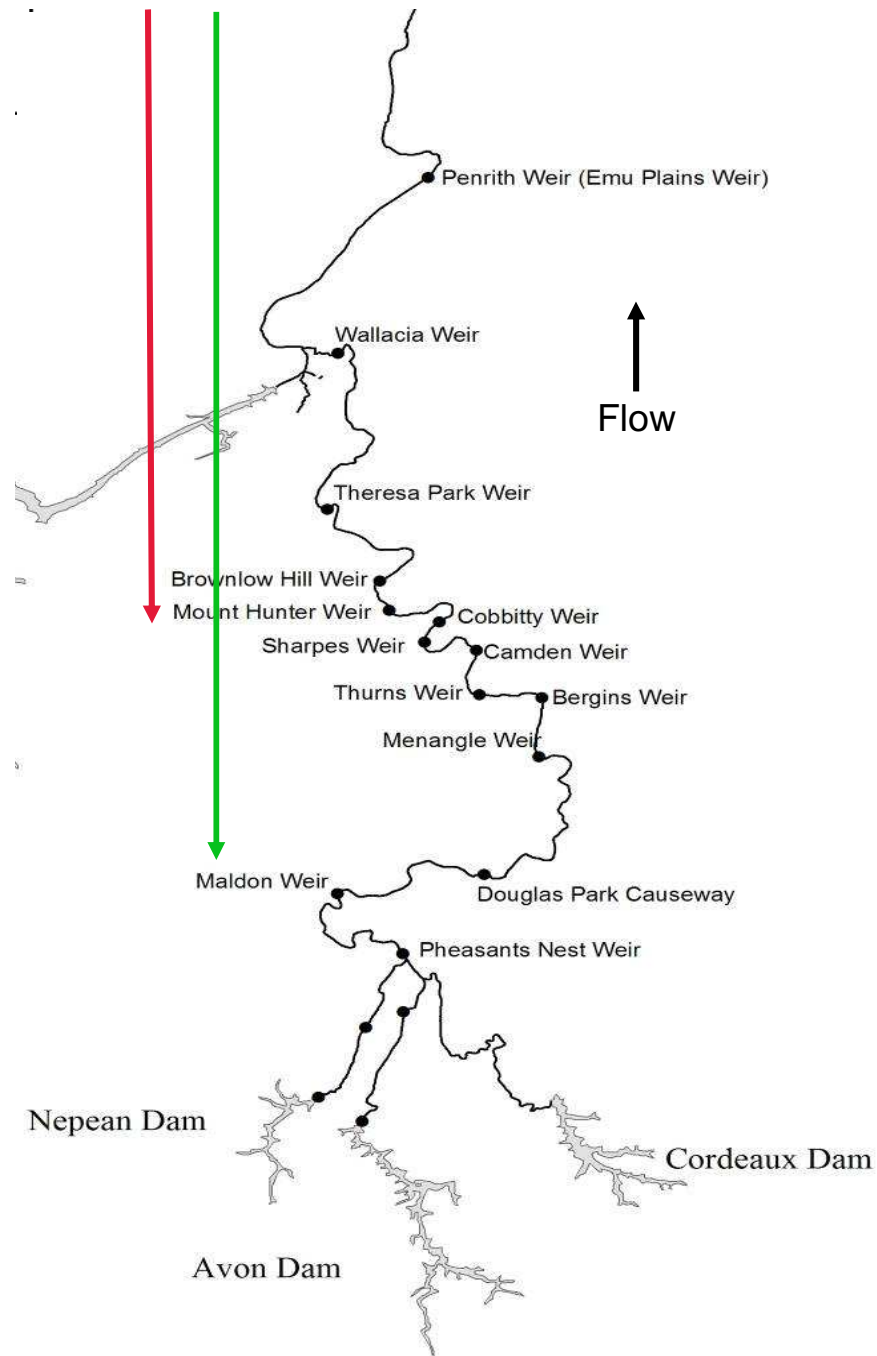
Cox's gudgeon (amphidromous)



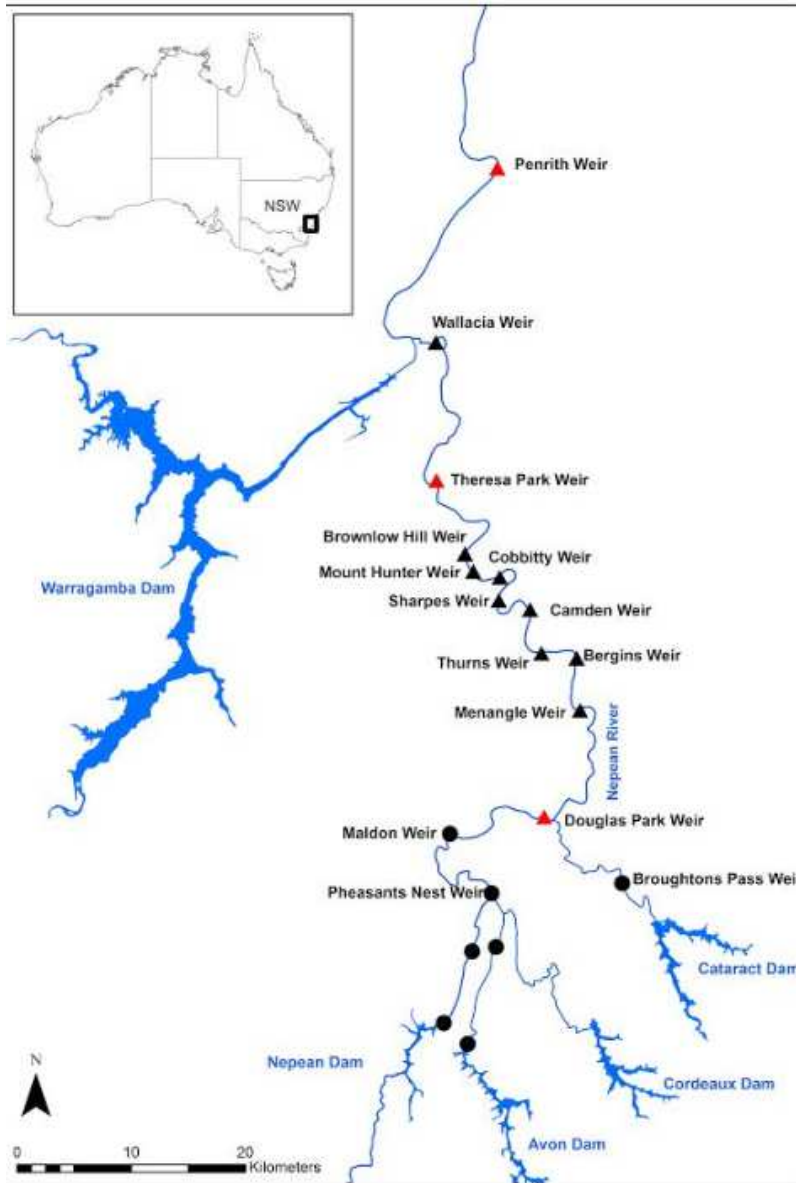
Freshwater mullet (catadromous)



Sea mullet (catadromous)



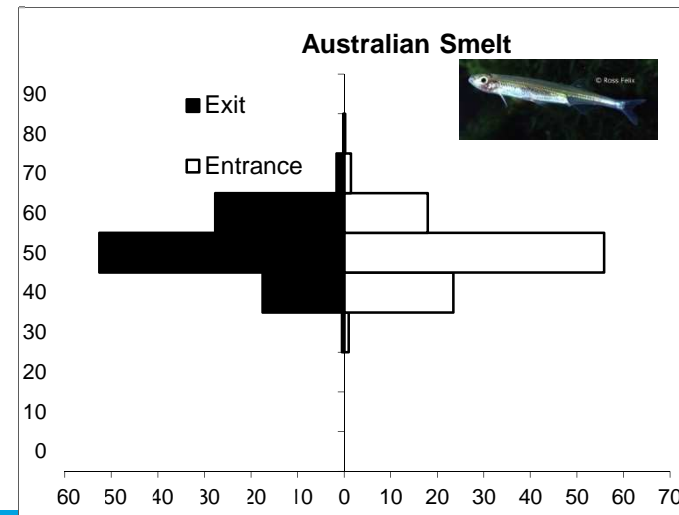
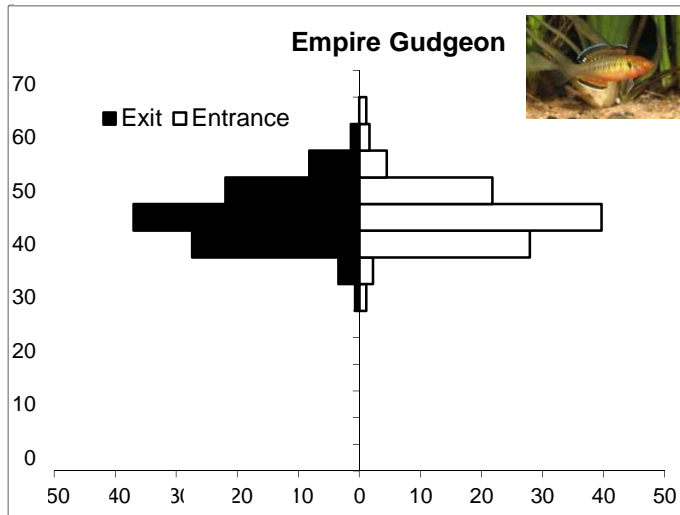
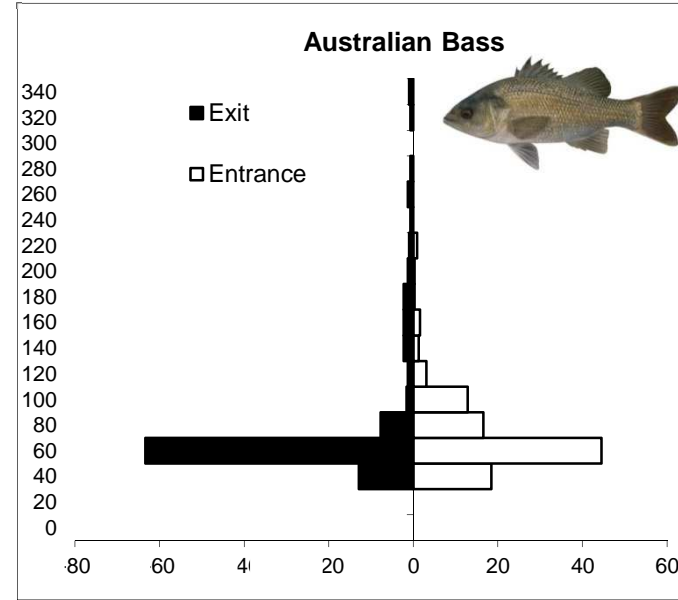
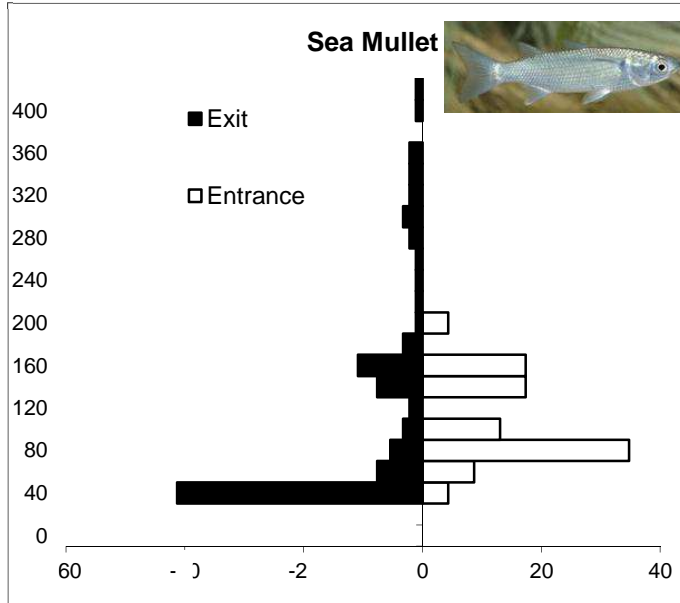
Fishway trapping



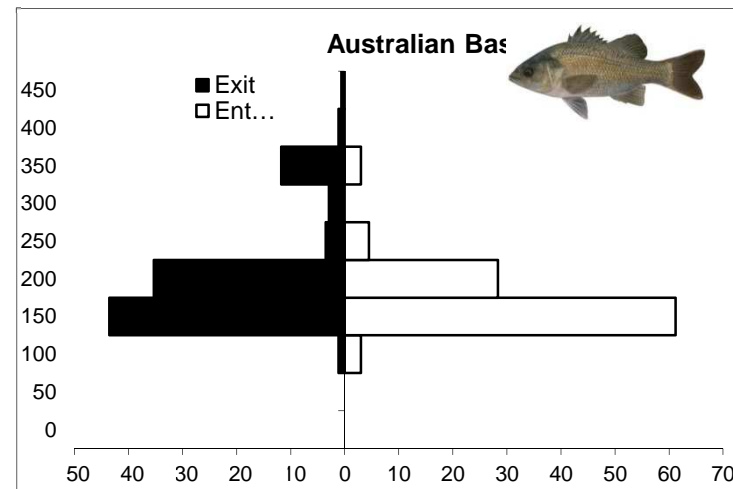
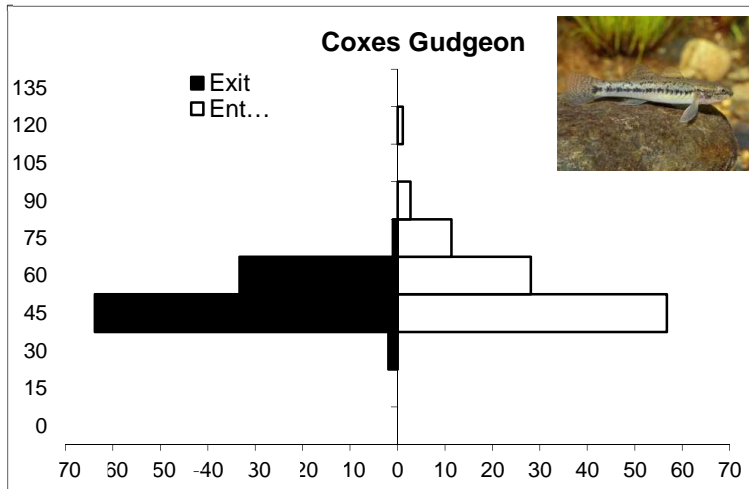
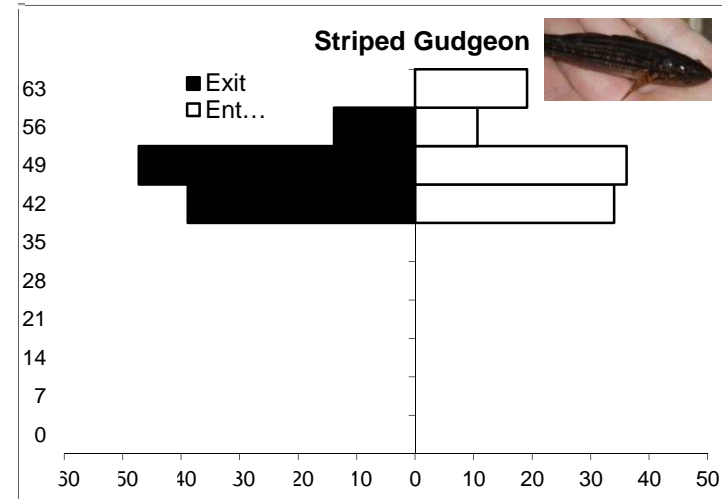
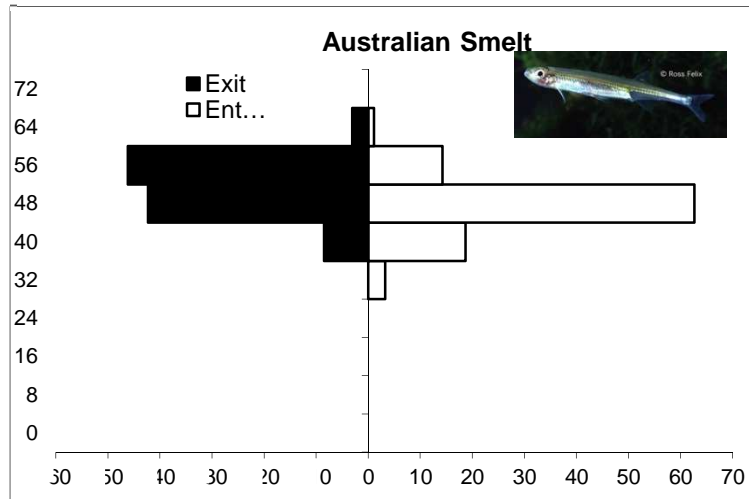
Number of paired samples	24-27
Number of species in entrance	19
Number of species in exit	17
Size range in exit	20-1200mm (better than design specifications)
Difference in size of fish between entrance and exit	Minor
Missing from exit (or low numbers)	Flat-headed gudgeon, and dwarf flat-headed gudgeon



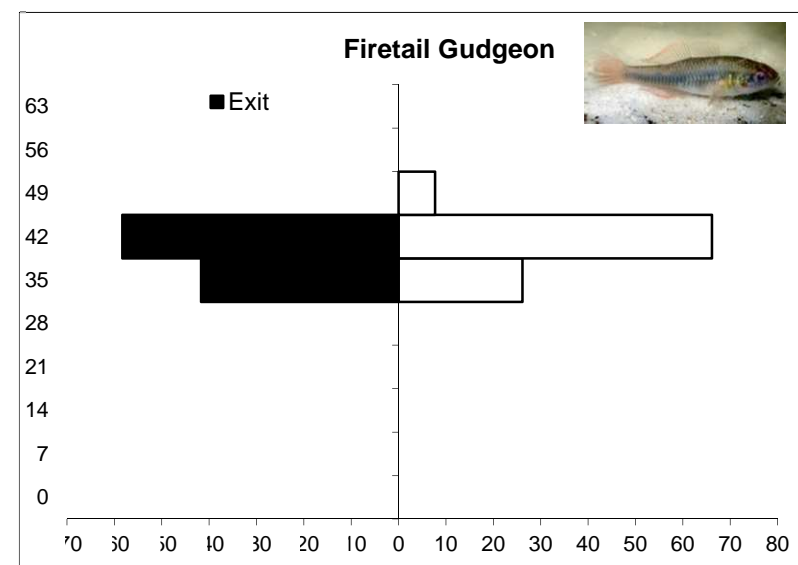
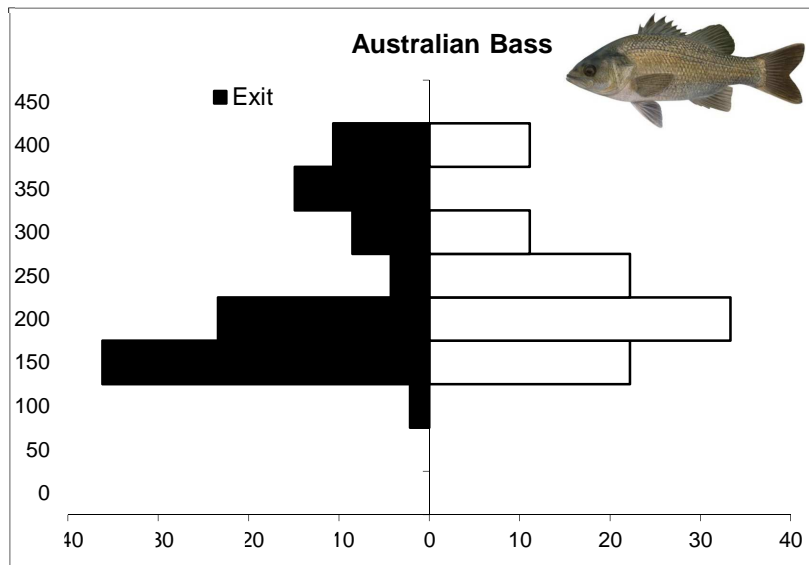
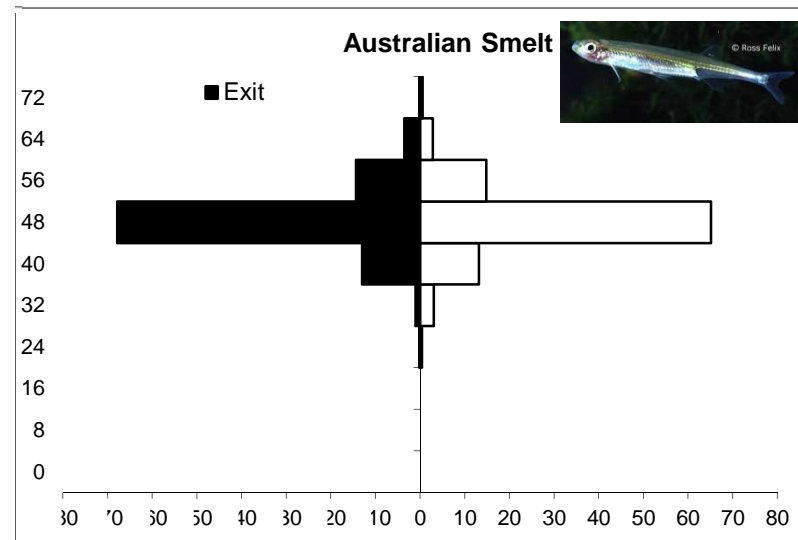
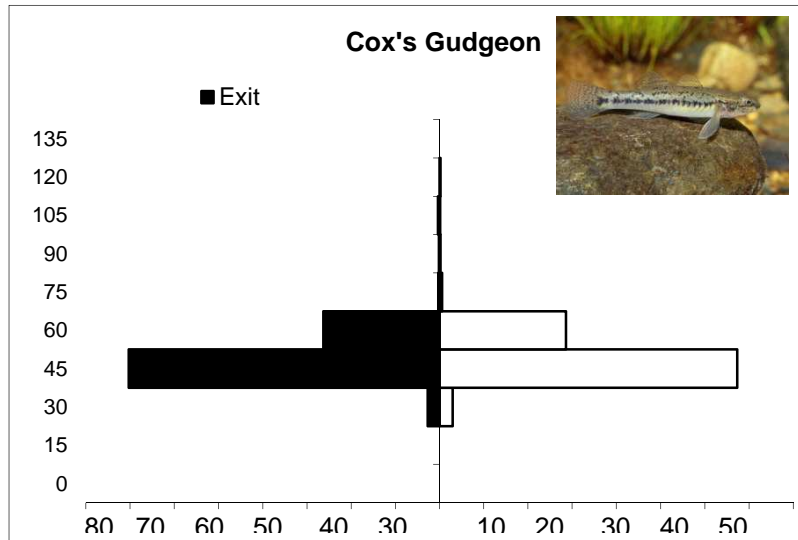
Penrith



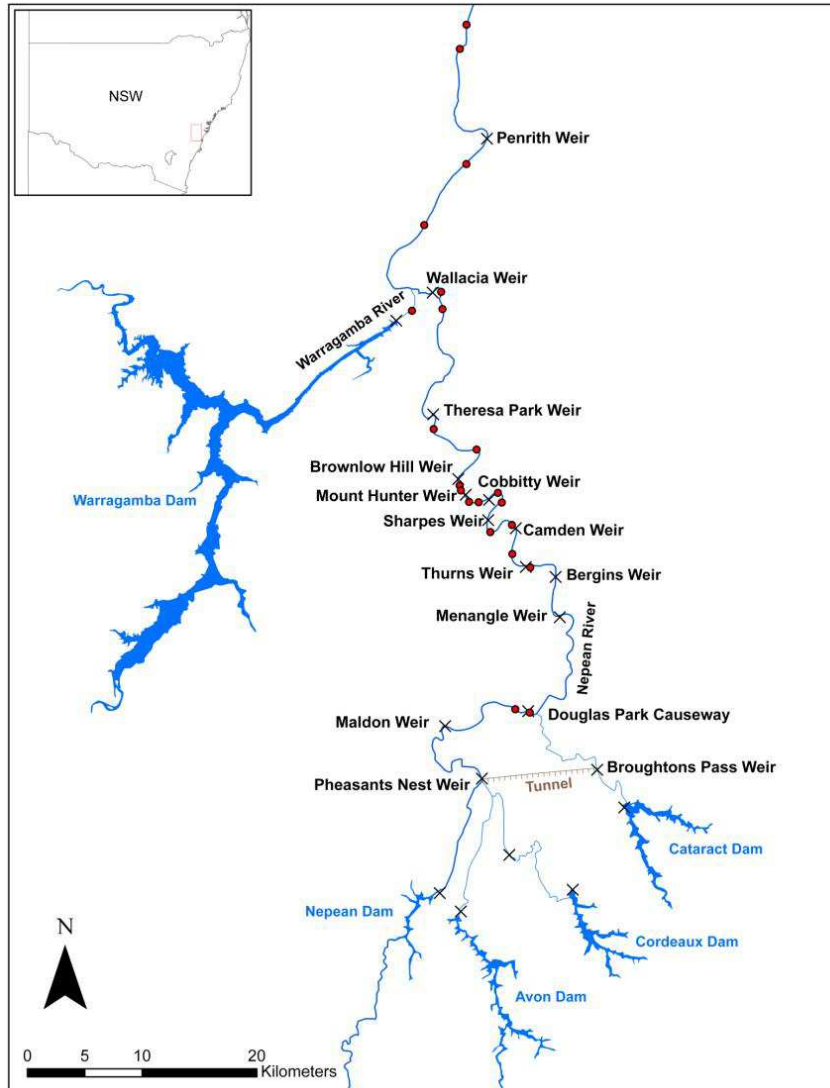
Theresa Park



Douglas Park



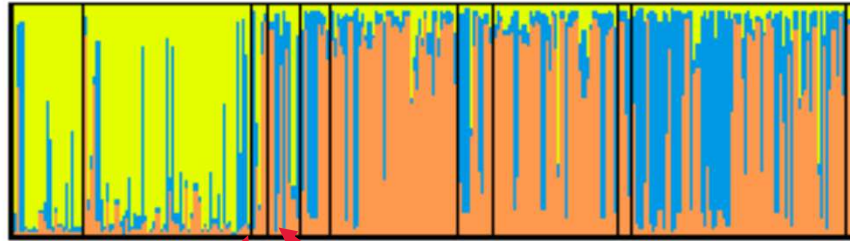
Genetic structure



- 8 microsatellite loci
- 266 samples pre-fishways
- 241 samples post-fishways

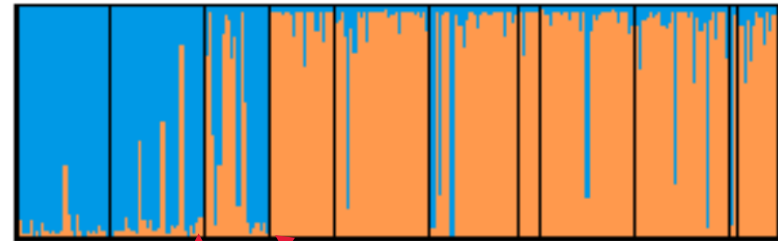
Results: Genetic structure

Pre-fishways, 3 genetic populations



Wallacia Weir T. Park Weir Menangle weir

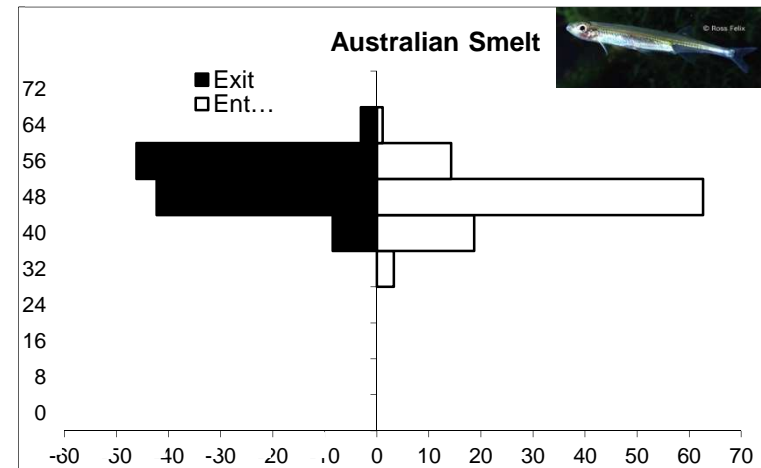
Post-fishways, 2 genetic populations



Wallacia Weir T. Park Weir



Bents Basin



Theresa Park Fishway

Conclusions

- Low-level barriers can be just as significant a problem to fish as large dams
- In just three years, post-fishways species diversity is increasing upstream
- Most species successfully use the fishways and all size ranges are well represented at the exit
- Upstream gene flow has improved, but Australian smelt may be genetically fragmented by natural barrier
- Fishways cannot overcome all problems associated with barriers, but can make substantial differences when operating efficiently



Acknowledgements

- **Funding: Sydney Catchment Authority (now Water NSW)**
- **Field work: Jamie Hutchison, John Stuart, Frances Corey, Martin Hill, Andrew Bruce, Dylan Galt, Jack Simpson, Michael Rodgers, Chris Smith, Duncan McLay, Tim McGarry, Jarrod McPherson and Rohan Rehwinkel**
- **Laboratories: Wagga Wagga Agricultural Institute and Yanco Agricultural Institute**

