STATE NRM CONFERENCE 2015

Finding the Balance:
Healthy Environment,
Productive Economy

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Western Australia

PROCEEDINGS

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Welcome

The theme: Finding the balance: healthy environment, productive economy was agreed early on by the hard working organising committee.

As our State undergoes a focus on development, it is important to pay equal attention to the natural assets: abundant and unique biodiversity, healthy soils, fresh water, coasts and importantly active and engaged community members.

Operating in a world with of changing environment, economy and society, you will hear of groups who have been successful in undertaking long term programs that improve land and water management, actively involve communities, and conserve natural capital.

In these endeavours we can all play a role, from personal commitment to care to participating and playing important roles in community groups, regional NRM organisations, in industry and government.

NRM WA and the State Natural Resource Management Office and invite you to fully participate in ‘Finding the Balance’.

We encourage you to listen, engage and question and most importantly enjoy the conference.

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Conserving South-western Australia’s Rarest and Most Threatened Freshwater Fishes

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Steve Beatty is currently a Senior Research Fellow at the Freshwater Fish Group, Centre for Fish and Fisheries Research (Murdoch University). He has conducted a broad range of research on the ecology and biology of fish and freshwater crayfish in Western Australia and has >140 publications in this field. His particular passion is increasing the understanding of threats facing south-western Australian species and ecosystems particularly climate change, water abstraction, salinisation, and introduced species.

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Introduction
- Rivers, streams and wetlands of southwestern Australia support populations of fish found nowhere else in the world. Many of these species are threatened and populations are declining in both abundance and distribution. In order to help understand the drivers of these declines and devise management actions to halt them, this collaborative project aimed to fill key knowledge gaps relating to the ecology of three of south-western Australia’s most threatened freshwater fishes, the Western Trout Minnow, Balston’s Pygmy Perch and the Little Pygmy Perch, one of Australia’s ‘newest’ fishes.
• The key tasks were to:
1. Determine the distribution, migration patterns, critical spawning habitats;
2. identify critical habitats that sustain populations over the summer period;
3. assess the risks to the ongoing sustainability of populations;
4. recommend management actions for the protection of populations and preservation of critical habitats; and
5. increase community awareness with regard to these threatened fishes.

Methodology
• This project represented the largest single project focussed on the ecology of southwestern Australia's endemic fishes and included three years of field-based research. Activities were undertaken throughout a large proportion of the known historical range of the target species, extending from catchments immediately south of Perth to Two Peoples Bay, just east of Albany.
• A particular focus of the project was to provide new ecological knowledge on each species which required multiple sampling events concentrated in specific catchments including the Kent, Goodga and Angove rivers for the Western Trout Minnow; Millyeannup Brook and the Blackwood River for Balston’s Pygmy Perch, and; the Mitchell, Hay and Denmark rivers for the Little Pygmy Perch.
• In excess of 150 sites were sampled across the region using a combination of GIS, aerial (helicopter) mapping, and on-ground fish sampling, which included; fyke netting, seine netting, and larval light trapping.
• Movement patterns, abundances (relative and actual), current distributions, and critical habitats of all species were determined across multiple catchments.
• The first remote passive integrated transponder (PIT tagging) telemetry study for a south-western Australian freshwater fish (Western Trout Minnow) was conducted to determine fine scale movements of the species (and the Common Jollytail) through the Goodga River Fishway and to determine the population size of the threatened species.
• The first Visible Internal Elastomer (VIE) tag of south-western Australian fishes in a river environment was conducted to determine the population sizes of four species in refuge pools in the Hay River.
• The information gathered is being used to assess the threats and risks to the species and to develop management approaches to enhance their conservation.

Key Project Outcomes

**Western Trout Minnow (Galaxias truttaceus)**
• Distributional range of Western Trout Minnow increased. Distribution in the Kent River confined to tributary and mainstem habitats in the lower catchment where permanent, low salinity habitats provide refuge over the summer period. Natural barriers probably restrict upstream distribution.
• The life-cycle involves utilisation of riverine and lake habitats at different life stages. Migratory patterns of Western Trout Minnow strongly linked to a hierarchy of river flows over daily to seasonal time scales.
• Passage through a vertical-slot fishway in the Goodga River during the autumn breeding season is correlated strongly with flow pulses. Also shown to be able to ‘climb’ over the weir (Close et al. 2014).
• Spawning of Western Trout Minnow occurs over a period of months after the onset of winter rains. Spawning occurs on flushes of elevated river flow during autumn and early winter. Extensive searches and sampling for eggs failed to identify critical spawning areas. Distribution of newly hatched larvae suggest that spawning occurs in riverine habitats in the lower reaches of catchments.
• Populations size (mature) of the species in the Goodga River is estimated to be ~13900. Slightly lower CPUE in the Angove River and very low abundance in the Kent River.

**Balston’s Pygmy Perch (Nannatherina balstoni)**
• 31% decline documented in the area of occupancy (Morgan et al. 2014). The species may have been lost from at least 5 catchments from which it was previously known to occur including the Moore River, Turner Brook, Dombakup Brook, Marbelup Brook, and the King River. Two previously undetected populations were discovered in the Meervis and Elsie.
• The species migrates into seasonally flowing tributaries in systems impacted by secondary salinisation. Examples include Millyeannup Brook in the Blackwood River and Mitchell River in the Hay system.
• A critical spawning and nursery habitat for the Blackwood/Millyeannup population was discovered for the first time.
during this study, comprising seasonally inundated wetlands in the headwaters of Milyeannup Brook. In the Hay/Mitchell system, the three sympatric pygmy perches displayed a seasonal partitioning of reproductive timing with *N. balstoni* spawning earliest in mid-winter, followed by *N. pygmaea* in late-winter/early spring and lastly *N. vittata* in mid/late-spring.

- Aerial and follow up on-ground surveys identified critical baseflow refuge habitats in a number of catchments that housed restricted and isolated populations of this threatened species. The most critical of these were located in the Hay River, Margaret River, Milyeannup Brook and Denmark River.
- The refuge habitats identified are threatened by various processes including inter alia, declining rainfall/flow due to climate change, alien fish species, and secondary salinisation.

**Little Pygmy Perch (Nannoperca pygmaea)**

- The Little Pygmy Perch was formally described during this study (Morgan *et al*. 2013). The known distribution prior to this study was a highly restricted section of the Hay River and adjoining Mitchell River (less than 2 stream kilometres), but new populations were discovered in the Denmark and Kent rivers and Lake Smith.
- Distribution includes middle-upper reaches of the Denmark River (~30 river km (rkms)) and middle-lower reaches of the Kent River (~50 rkm), as well as another population in Lake Smith located near the Donnelly River.
- The Hay River population was found to undertake a short breeding migration into the Mitchell River each winter when the tributary begins to flow before retreating back to permanent refuge pools in the Hay River mainstem when flows declines in the Mitchell River.
- The VIE mark-recapture program in key baseflow refuge pools in the Hay River revealed that the number of Little Pygmy Perch was ~90 fish in one pool compared with ~8117 Western Pygmy Perch and just ~26 Balston’s Pygmy Perch.
- Extensive monthly sampling over a two-year period in the Hay/Mitchell system revealed that the critical spawning habitat for this population is located in the lower section of the Mitchell River (within ~3 km of the Mitchell/Hay confluence). The exact habitat characteristics for spawning were not identified; however, it is likely that spawning occurs amongst flooded riparian vegetation in the Mitchell. Similarly, the critical breeding/nursery habitats for the Denmark River population, appears to be restricted to a solitary tributary in the upper catchment that features extensive areas of seasonally inundated sedgelands that may provide critical spawning/nursery habitat.
- The highly restricted extent of occurrence of this species renders it susceptible to catastrophic losses from possible future perturbations such as prolonged drought, drying of critical baseflow refuges, secondary salinisation, and existing (i.e. Eastern Gambusia) and future alien species introductions.
- From the aerial and ground surveys undertaken to map refuge habitats, two artificially created pools, built to provide a water source for fire-management activities, were shown to be utilised. In fact, these artificial refuges represented ~50% of the known refuge habitat in the key spawning tributary in the Denmark catchment.
- There is good potential to mitigate the threat of population declines or losses of this species by providing additional human-created refuge habitats, using those identified in this study as a model and this is one of the key recommendations to emerge from this project.

**Risk identification**

The findings are being used to identify and rank risks to the population to refine management actions designed to help prevent or halt their decline. Several additional knowledge gaps have also been identified.

While the impacts, likelihood and consequence of the various impacts vary between species, key threats, their impacts and mitigation strategies that were identified are summarised as follows:

- **Flow reductions:** Caused by rainfall reductions (climate change), water abstraction (e.g. irrigation, potable), land use changes. Impacts on migratory pathways, nursery habitat, and resource availability resulting in less recruitment (see Beatty *et al*. (2014)). Need to ensure sustainable water abstractions, landuse (impacting hydrology), and captive breeding or relocations as a back-up to mitigate extinction risk.
- **Refuge loss:** Caused by rainfall reductions (climate change), water abstraction (e.g fire water points). Species shown to be most vulnerable during baseflow when they become concentrated in pools or small sections of rivers. Creation of new strategic waterpoints is an option along with awareness and management of existing refuge pools, and captive breeding.
- **Water quality decline:** Salinisation trajectories for certain rivers remains an ongoing threat, also future temperature increases due to climate change (along with nutrient inputs, dissolved oxygen declines). Exceeding species tolerances possible with baseflow populations most affected (e.g. salinity in main channel of Kent and Hay rivers) could reduce
the range and threaten populations. Environmental tolerances of all species should be determined to model viabilities. Ongoing actions to address salinity important in key rivers (such as was achieved in the Denmark River).

- **Introduced species**: Known to be a major stressor on native fishes and a sharp decline in introductions has occurred over recent decades in this region (Beatty and Morgan 2013; Hourston *et al.* 2014). Result in competition, predation, aggression, introduction of disease. *Gambusia holbrooki* already in main channel of several rivers. Prevention of new introductions important (through education), and monitoring for new introductions to maximise chances of elimination prior to establishment (e.g. Goldfish eradication in the Darch Brook, Margaret River).

- **Instream barriers**: Some level of impact in certain rivers for these species. In general, instream barriers prevent migration (for spawning and dispersal) and can increase mortality and reduce recruitment to populations. Fishway prioritisation and barrier removal (where feasible) can mitigate these impacts (e.g. Beatty *et al.* 2013).

- **Riparian degradation**: Riparian vegetation is important for providing food, shelter, shade and bank stability (along with nutrient uptake) that benefits fish and aquatic ecosystems generally. While considerable amounts of the remaining distribution of the target species was shown to be in State Forest or National Park, protecting remnant vegetation on private land throughout catchments remains very important (such as fencing from stock, rehabilitation where required) such as in the Goodga River.

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**References**


