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# Resurvey of historical collection sites for Balston's Pygmy Perch in the South West Linkages Target Area

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Report to

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*"Protecting threatened fishes in the South West Linkages Target Area"*

## Introduction

Balston's Pygmy Perch (*Nannatherina balstoni*) is one of the rarest native freshwater fishes endemic to south-western Australia (Morgan *et al*. 2011, 2014). The species inhabits near-coastal lakes, wetlands and flowing streams, and was historically distributed between the Moore River (north of Perth) and the Angove River (east of Albany) (Morgan *et al*. 2011, 2014). Numerous anthropogenic stressors including habitat destruction, pollution, river regulation, and water abstraction have resulted in an approximate 31% decline in the distribution, with the species apparently having been extirpated from the Swan Coastal Plain and a number of other systems across its range (Morgan *et al*. 2014). The contemporary distribution extends from the upper reaches of the Margaret River to the Angove River near Two Peoples Bay (Morgan & Beatty 2003; FFGFHU unpubl. data) (see Figure 1). Remnant populations are highly fragmented within this range (Morgan *et al*. 2014).

In light of its typically low abundance and restricted distribution, *N. balstoni* has been formally recognised as *Vulnerable* to extinction under the Commonwealth Government's *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and is listed under Schedule 1 ("fauna that is rare or is likely to become extinct") of the Western Australian Government's *Wildlife Conservation Act 1950*. Accordingly, this fish is the flagship species of the current project entitled "*Protecting threatened fishes in the South West Linkages Target Area*".

A thorough review of the historical distribution of *N. balstoni* was conducted at the outset of this project and has now been published in the scientific literature (see Morgan *et al*. 2014). To complement this review, one of the project's primary aims was to resurvey a number of historical collection sites in order to ground-truth the current status of resident *N. balstoni* populations. The results of this survey should provide valuable data for authorities in developing management and recovery strategies for the conservation of this threatened south-western Australian endemic.

## Methods

### *Site selection*

Twenty historical site localities of *N. balstoni* occurrence were selected to resurvey in the course of the present study. This selection did not include all historic collection sites in the study area; rather, sites were chosen to provide a broad spatial coverage across the South West Linkages Target Area (Figure 1). An emphasis was placed on selecting sites from as many different catchments or sub-catchments as possible within the constraints of the allotted timeframe and budget. When *N. balstoni* was not captured at a historic site, effort was made to sample other sites within the same or nearby catchments in order to search for extant populations, with 10 such sites being sampled during the study. Additionally, five sites not historically known to house *N. balstoni* were also surveyed during the study in order to search for previously unknown populations.

### *Capture techniques*

Various nets and/or a backpack-mounted electrofisher (Smith Root LR20) were used during the survey with the specific gear used at each site dependent on site conditions (e.g. water depth, flow velocity, habitat complexity, etc.). Paired fyke nets were deployed facing upstream and downstream at riverine sites and along the margin of lacustrine sites. These nets were constructed from 2 mm woven mesh and consisted of two 5 m wings, a 1.2 x 0.8 m opening, and a 5 m long pocket with two non-return funnels. At sites where free standing water was limited (e.g. narrow creeks, shallow pools) and in pool/water point habitats, a 2.5 or 5 m long seine net was used, both constructed from 1 mm woven mesh and fishing to a depth of 1.8 m. A 26 m seine net constructed of 3 mm woven mesh (with 9 mm wings) and fishing to a depth of 1.8 m was used at the Lake Smith site, a large (*ca*

300 x 100 m) open water body with firm shallow banks. Some sites that were visited (e.g. Lake Samuel) were unable to be sampled using available gear types due to dense emergent sedge growth along the banks and deep, soft sediments underfoot. The electrofisher was used at sites with abundant snags and large woody debris to momentarily stun fish allowing them to be captured at the surface with a scoop net.

At all sites, presence or absence of *N. balstoni* was recorded along with the numbers of all fish species captured. All animals were released alive at the site of capture.

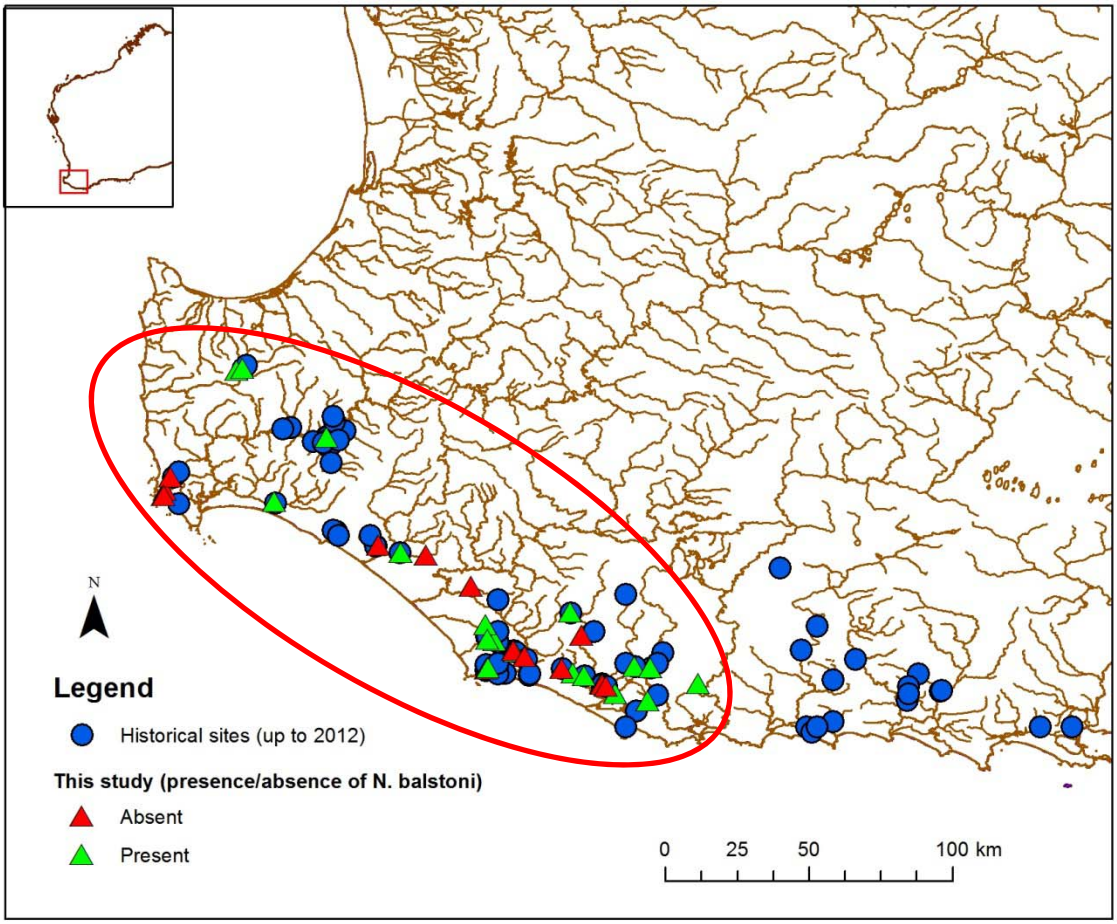


**Figure 1**. Historical collection sites (blue circles) and the 35 sites surveyed during the current study showing presence (green triangles) and absence (red triangles) of Balston's Pygmy Perch (*Nannatherina balstoni*). N.B. No sites east of the Frankland River were surveyed as part of current study as they are located outside of the South West Linkages Target Area (outlined in red).

**Results and discussion**

Of the 35 sites sampled during this study, 30 were either exact locations from which *N. balstoni* had been previously collected or were situated within the same catchments as these sites. Balston's Pygmy Perch was found at 50% of these sites and often in very low abundance relative to sympatric species (Table 1). At first glance, this result would appear to indicate a dramatic range decline for the species; however, this interpretation is not entirely accurate. A closer look at the data indicates that in many cases where *N. balstoni* was not captured, the species was found at a nearby site within the

same catchment (Figure 1, Table 1). It is possible that the species evaded detection at many of the historical survey sites purely as a result of the low abudance that is typical of this species. For example, the authors recently conducted a mark-recapture study to determine abundances of percichthyids in refuge pools in the Hay River and estimated that *N. balstoni* was outnumbered by Western Pygmy Perch (*N. vittata*) by over 300 to 1 (FFGFHU unpubl. data). Moreover, conditions at some sites (e.g. Lake Smith) were unfavourable for effective sampling due to high water levels which may have led to a "false negative" result. At such sites, and in catchments like the Dombakup Brook (part of the Warren River catchment) where the species was not captured, we intend to undertake further sampling prior to the completion of this project in order to search for extant populations of *N. balstoni*.

An accurate evaluation of the viability of *N. balstoni* populations sampled during the study was hindered by a lack of available quantitative historical data which mostly consisted of basic presence/absence information. However, a de facto metric for assessing population viability is relative abundance, i.e. the numbers of of *N. balstoni* caught relative to the total fish catch at each site (Table 1). Balston's Pygmy Perch was often caught in low relative abundance, comprising <5% of the total catch at 40% of sites where it was captured (Table 1). On the other hand, it was among the most abundant species at some sites including Milyeannup Brook and Elsie Brook, comprising 45.6% and 38.2% of the catch, respectively (Table 1). It comprised 5–30% of the total catch at the remaining sites (Table 1), all of which were characterised by relatively pristine habitat condition and most of which were located within gazetted conservation estate (i.e. nature reserves or national parks).

The International Union for the Conservation of Nature (IUCN) protocol was used to calcuate the area of occupancy (AO) for *N. balstoni*. Firstly, a 2 x 2 km grid was overlayed on the distribution map and the number of 4 $km^2$ (400 ha) grid squares containing sample points gathered during the current survey was summed to give an estimate of AO for Balston's Pygmy Perch of 72 $km^2$ (7,200 ha) in the South West Linkages Target Area. As noted above, however, the species was likely to have evaded capture at many 'absence' sites and this, coupled with the limited spatial extent of the survey effort relative to the total length of inhabitable river reaches, suggests that this AO calculation is likely to be underestimated.

The results of our survey efforts suggest that the decline in the distributional range of *N. balstoni* within the target area has probably been minimal. However, perhaps the most concerning finding of this study was the absence of the species from Turner Brook, a small drainage system near Cape Leeuwin which was sampled intensively at four separate sites during the study. Two species closely related to *N. balstoni* that are typically common in south-western Australian rivers and which had been recorded previously in Turner Brook (i.e. Nightfish and Western Pygmy Perch) were also not captured in this system. The disappearance of these species is likely attributable to the numerous anthropogenic impacts present in the Turner Brook catchment including the proliferation of instream barriers (e.g. dams), extensive land clearing for pasture and livestock grazing, the presence of feral fishes (Eastern Gambusia), and widespread riparian habitat degradation and stream homogenisation. Most other catchments sampled during this study were not impacted as heavily as Turner Brook and remained in relatively pristine condition with the exception of Fly Brook (Donnelly River catchment), Scott River (Blackwood River catchment), and Dombakup Brook (Warren River catchment) which were all partially cleared for farming. Balston's Pygmy Perch was either recorded in extremely low abundance (Scott River, Fly Brook) or not at all (Dombakup Brook) in these catchments (Table 1), therefore our data suggest that land clearing for agriculture is likely to be contributing to declines in abundance for this species. A similar trend has also been documented outside the South West Linkages Target Area where *N. balstoni* has apparently been extirpated from the heavily cleared King River catchment near Albany as well as the Moore River north of Perth and possibly other rivers and wetlands of the Swan Coastal Plain, although historical records are lacking from the latter region (Morgan *et al*. 2014).

One surprising finding of this study was the co-occurrence of Balston's Pygmy Perch (albeit a single individual) with feral Rainbow Trout (*Oncorhynchus mykiss*) in Fly Brook. Very few records exist of *N. balstoni* occurring in sympatry with feral fish species, and none with predatory species such as trout. Fly Brook is annually stocked with trout by the Department of Fisheries, Government of Western Australia, but a review of this practice seems warranted given that trout compete with and predate upon on native teleosts (Jenkins 1952; Pusey & Morrison 1989; Morgan *et al*. 2004), and that *N. balstoni* is listed as vulnerable under the Commonwealth's EPBC Act 1999.

Balston's Pygmy Perch was captured at five additional non-historical sites sampled during the present study. Three of these additional sites were located within close proximity of historical sites; however, the remaining two were notable in that they represented significant range extensions for the species. In excess of 20 specimens were captured from Elsie Brook, a tributary of the middle reaches of the Frankland River, with the only previous record of the species from the Frankland catchment coming from a collection made by Christensen (1982) in the extreme upper reaches of the catchment near the township of Rocky Gully. The other significant range extension was the collection of a solitary specimen from an artificial water point in the upper Meerup River near Northcliffe. To our knowledge, this river system had not been previously surveyed for freshwater fishes. Further survey effort in the Meerup River would be prudent given that the system houses Balston's Pygmy Perch.

**Figure 2**. Surveying historical collection sites to assess the current status of populations of Balston's Pygmy Perch (*Nannatherina balstoni*) in the South West Linkages Target Area, 2014. Clockwise from top left: seine netting in Doggerup Creek; Lake Smith, one of the historical sites where *N. balstoni* was not captured during the study, probably due to high water levels; shallow pools inhabited by *N. balstoni* in the upper Shannon River catchment, and; a solitary *N. balstoni* specimen captured in Fly Brook (Donnelly River catchment), a feral rainbow trout was captured in the same net (photos by M. Allen).

**Table 1**. Sites location information, showing the number of Balston's Pygmy Perch (#BPP), the total number of individual fishes of all species (#FISH) and the relative abundance (%) of *Nannatherina balstoni* at all sites sampled during the present study. Asterisks (*) indicate a site was located close to a historical BPP site.

| Catchment | Site | Latitude | Longitude | Historical site | BPP present | #BPP | #FISH | Relative abundance |
|---|---|---|---|---|---|---|---|---|
| Blackwood | Milyeannup Bk - Brockman Hwy (old bridge site) | -34.09268 | 115.565209 | YES | YES | 114 | 250 | 45.6% |
| Blackwood | Scott R - Bridge on Milyeannup Rd | -34.29273 | 115.40035 | YES | YES | 1 | 1367 | 0.1% |
| Deep | Jn Beardmore & South West Hwy | -34.811 | 116.53033 | YES | YES | 4 | 16 | 25.0% |
| Deep | Weld River - Beardmore Rd | -34.814833 | 116.57917 | YES | YES | 7 | 31 | 22.6% |
| Donnelly | Fly Bk - Charley Rd | -34.45235 | 115.7962 | YES | YES | 1 | 78 | 1.3% |
| Forth | Forth River - Chesapeake Rd | -34.8635666 | 116.42585 | YES | YES | 4 | 42 | 9.5% |
| Forth | Forth River | -34.864167 | 116.42583 | YES | YES | 2 | 84 | 2.4% |
| Gardner | Large pool on Chesapeake Rd | -34.765333 | 116.156 | YES | YES | 2 | 120 | 1.7% |
| Margaret | Canebrake Pool | -33.88144000 | 115.28224000 | YES | YES | 1 | 10 | 10.0% |
| Margaret | Margaret River-Great North Rd (Rapids Pool) | -33.876667 | 115.30017 | YES | YES | 2 | 278 | 0.7% |
| Shannon | Shannon River-Bridge on Chesapeake Rd | -34.839333 | 116.37117 | YES | YES | 4 | 17 | 23.5% |
| Shannon | Pools at Jn of Deeside Coast & Preston Rds | -34.64086 | 116.3285 | YES | YES | 4 | 60 | 6.7% |
| Forth | Kingsman Bk - Chesapeake Rd | -34.865667 | 116.42867 | YES | NO | 0 | 1 | 0.0% |
| Forth | Pool/small stream 5.2km west of Broke Inlet Rd | -34.873333 | 116.4395 | YES | NO | 0 | 3 | 0.0% |
| Gardner | Narrow stream on Windy Harbour Rd | -34.814667 | 116.06867 | YES | NO | 0 | 8 | 0.0% |
| Gardner | Pool 450m south of L14 | -34.8195 | 116.06367 | YES | NO | 0 | 1 | 0.0% |
| Gardner | 1st pool on Lower Gardner River Rd | -34.760667 | 116.1505 | YES | NO | 0 | 0 | -- |
| Lake Smith | Lake Smith | -34.42993 | 115.726408 | YES | NO | 0 | 154 | 0.0% |
| Shannon | Chesapeake Brook - 20.05 km W Broke Inlet Rd | -34.816 | 116.30133 | YES | NO | 0 | 5 | 0.0% |
| Shannon | Nelson Rd bridge | -34.71329 | 116.36251 | YES | NO | 0 | 54 | 0.0% |
| Doggerup Ck | Summertime Track xing -between L. Samuel & Doggerup | -34.72406 | 116.06954 | YES* | YES | 3 | 67 | 4.5% |
| Gardner | Culvert on Windy Harbour Rd d/s of Meandering Stream | -34.81362 | 116.06985 | YES* | YES | 1 | 30 | 3.3% |
| Inlet | Inlet R - SW hwy | -34.918483 | 116.569883 | YES* | YES | 3 | 13 | 23.1% |
| Gardner | Chesapeake Rd ford | -34.779912 | 116.184615 | YES* | NO | 0 | 28 | 0.0% |
| Turner | Caves Rd xing | -34.25903 | 115.05848 | YES* | NO | 0 | 935 | 0.0% |
| Turner | "Old Karridale" wetland/dam | -34.21675 | 115.07553 | YES* | NO | 0 | 0 | -- |
| Turner | Near mouth of Turner Brook | -34.274675 | 115.05209 | YES* | NO | 0 | 30 | 0.0% |
| Turner | Lower Turner Brook | -34.27389 | 115.05357 | YES* | NO | 0 | 429 | 0.0% |
| Warren | Dombakup Bk - Marri Rd | -34.55833 | 116.017733 | YES* | NO | 0 | 71 | 0.0% |
| Donnelly | Fly Bk - Fly Brook Rd | -34.4611 | 115.87659 | YES* | NO | 0 | 17 | 0.0% |
| Big Ck | Big Ck - Chesapeake Rd | -34.89456666 | 116.4690833 | NO | YES | 3 | 11 | 27.3% |
| Doggerup Ck | Windy Harbour Rd pools near Lake Florence | -34.72995000 | 116.09073300 | NO | YES | 2 | 26 | 7.7% |
| Frankland | Elsie Bk - Copeland Rd | -34.864333 | 116.7292 | NO | YES | 21 | 55 | 38.2% |
| Meerup | Water Point - Guernsey Gully Rd | -34.68001 | 116.06147 | NO | YES | 1 | 114 | 0.9% |
| Shannon | Chesapeake Bk - Chesapeake Rd | -34.830466 | 116.3361833 | NO | YES | 30 | 150 | 20.0% |

**Key findings and recommendations**

- Populations of *N. balstoni* persist in all but one catchment from which the species was previously known in the South West Linkages Target Area. This area comprises the "epicentre" of the remnant distribution of *N. balstoni* and is characterised by vast areas of relatively pristine habitat that are actively managed for conservation purposes.

- The proportion of historical sites where *N. balstoni* was captured (50%) was lower than anticipated which was likely due to false negative results stemming from its typically low relative abundance, particularly in catchments affected by farming and other anthropogenic disturbances.

- The abundance of *N. balstoni* relative to sympatric species ranged between 0.1% and 45.6% of the total fish catch at sites where it occurred. The highest abundances were recorded at Milyeannup Brook in the Blackwood River catchment (a renowned hotspot for *N. balstoni*).

- Two significant range extensions were documented within the study area in Elsie Brook (Frankland River) and the upper reaches of the Meerup River.

- The species appears to have been lost from Turner Brook which was impacted by numerous anthropogenic stressors (e.g. dams, feral fishes, land clearing and degradation of riparian zones). We also suspect that it has been lost from Dombakup Brook (Warren River catchment), despite only a single site being sampled during this study. Dombakup Brook has been impacted by farming in the upper reaches and logging elsewhere, and is part of the Warren River which is annually stocked with Rainbow Trout and houses self sustaining populations of three other feral fish species. Outside this area, at least two *N. balstoni* populations have been lost including those in the Moore River north of Perth and the King River near Albany, and we fear that populations in the Kordabup River and Marbelup Brook on the south coast may have also been lost.

Recommendations stemming from this component of the study include:

1. Resampling in Dombakup Brook and Lake Smith as well as other historical sites that were unable to be sampled during the present study due to restricted access (e.g. Lake Maringup, Lake Quitjup, Lake Florence, etc.) should be undertaken. Historical sites located outside the South West Linkages Target Area should also be surveyed, thus allowing a comprehensive assessment of the status of *N. balstoni* to be completed across its entire distributional range.

2. Balston's Pygmy Perch appears highly susceptible to the presence of invasive aquatic species, only rarely being captured at sites that house such species. The capture of a solitary *N. balstoni* specimen in Fly Brook with a juvenile Rainbow Trout was unexpected and is the first incidence, to our knowledge, of the species being captured together with an introduced salmonid. The Department of Fisheries, Government of Western Australia, stocks Rainbow Trout each year into Fly Brook but we strongly recommend that such practice be reviewed in light of the "re-discovery" of Balston's Pygmy Perch in this system. The stocking of introduced predatory species in a catchment that houses a species listed as vulnerable to extinction is at odds with the Department's charter for conserving the State's native aquatic biodiversity.

**Acknowledgements**

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