



FISHES of SAHUL



VOLUME SIXTEEN
NUMBER THREE

OCTOBER-NOVEMBER 2002

JOURNAL OF THE AUSTRALIA NEW GUINEA FISHES ASSOCIATION
Incorporated Registration No. ACO27788J



The Western Rainbowfish *Melanotaenia australis*(?**) Annie Creek., NT.

M.H.



- DARWIN RAINBOWS – Peter Unmack**
- SARATOGA – Bruce Sambell**
- THE MARSHWORTS – Nick Romanowski**
- FRESHWATER CRAB – Neville Coleman**

Rainbowfish populations with unusual colour varieties within the range of *Melanotaenia australis*, with miscellaneous observations on other fishes in the Darwin area.

The Darwin area has always been of great interest to me due to the fact that this is where the ranges of *Melanotaenia splendida inornata* and *M. australis*** abut. The areas where two species (or subspecies) come together are of considerable interest to biogeographers as they allow investigations into exactly where the boundary exists between species (if it is indeed exact), what factors may be responsible for the boundary, and whether other unrelated species show the same patterns over the same geographic area. My first visit to Darwin was in 1997 during which I collected a handful of rainbowfish samples from each major drainage and some smaller ones. Analysis of some of these samples showed Blackmore and Charlotte River *M. australis*(?) populations have *M. nigrans* mtDNA*** (see Fishes of Sahul Vol. 11, no. 1, p. 500), while *M. exquisita* from the upper Mary River had *M. s. inornata* mtDNA, as did samples of *M. exquisita* collected by Bruce Hansen from Bindoola Creek in Western Australia (see Fishes of Sahul Vol. 13 no. 1, p. 602). Earlier analyses by Danqing Zhu at the University of Queensland showed the same for *M. australis*(?) from Blackmore River and that the fish from the upper South Alligator River had *M. exquisita* mtDNA. More recently I have found that *M. exquisita* from Waterfall Creek have *M. nigrans* mtDNA. It is interesting to note that all the fishes from the Darwin area identified as being unusual by Gunther Schmida (see Fishes of Sahul Vol. 11, no. 1) are all presently thought to be old hybrids (more on hybridisation later).



Going north can be rough.

M.H.

Over July and August of 2001, we (Peter Unmack, Rachael Remington, Michael Hammer and my father Stanley Unmack) were fortunate to have the privilege of staying at the Wilson household just south of Darwin. Dave Wilson is a top fellow and an expert on many aspects of the Territory, especially when it comes to what creek has which fish. We ended up spending a couple of weeks sampling around Darwin as part of a broader trip collecting fishes for my genetic studies into the biogeographical relationships of Australian fishes. The specific purpose of the Darwin sampling was to allow further investigation into hybridisation involving *Melanotaenia splendida inornata* and *M. australis* with both *M. nigrans* and *M. exquisita*. Our primary goal was to collect as many separate drainages as possible for all three species so that geographic variation, biogeographic patterns, and hybridisation patterns could be determined. A further advantage was to see the wild colouration of ...



Umbrawarra Gorge (background), home for *Melanotaenia exquisita* (left) and *M. australis* (right). M.H.

... Darwin Rainbows

these species which is important in rainbowfish identification. The following is a brief account of our findings.

Prior to the trip we basically knew that all *splendida*-type rainbows from the Daly River west are considered *Melanotaenia australis*, and all those from the Adelaide River east are *M. splendida inornata* based upon historical taxonomic work, observations of colour patterns, and some genetic work. The big question though was who occurs where in-between these two drainages? This area only contains two larger rivers, the Finnis and Reynolds, although these are tiny relative to the Daly and Adelaide rivers. There are also around 8 to 10 smaller drainages west of the Adelaide River. One further problem confounding the issue is what defines *M. australis* versus *M. s. inornata*? Typically, in this region, people have often considered *M. australis* to have red fins, while *M. s. inornata* has yellow ones. Morphologically or meristically there is little that tells them apart, the biggest difference is that *M. s. inornata* tends to be deeper bodied and seems to grow a little larger.

The following is a summary of our findings from east to west. Rainbowfish collected from 13 sites in the Wildman, Mary, and Adelaide rivers all seemed to fit the typical form of *Melanotaenia splendida inornata*. They all had yellow fins with no obvious major colour pattern differences. Fishes from the next few drainages were ambiguous as to their identification. The drainage immediately west of the Adelaide River is the Howard River. It usually contains only red finned rainbows, however Dave Wilson reported seeing yellow finned rainbows at a couple locations during two wet seasons. However, all we could find during 1997 and this trip was the red finned form. Perhaps the yellow fish swam over from the Adelaide River during the wet season, but didn't persist? Perhaps they represent a genetic change in colouration that didn't persist? Unless more yellow fish turn up, this puzzle as to their identity will remain

unsolved. The same looking red rainbowfish in the Howard occurred in all tributaries to Port Darwin (Elizabeth, Berry, Darwin, and Blackmore). To me, these populations look basically like typical *M. australis* found in the Daly system. Dave also tells me he saw yellow finned fish in Berry Creek on one occasion. The next series of rivers (Charlotte, Annie, Leviathan) all drain into Bynoe Harbour. These all had a yellow finned form, although a few fish collected within the Annie River had some red on their fins as well as yellow. No *M. australis* were found in Leviathan Creek. The fish from the upper Charlotte River were observed in both 1997 and this trip, both times large shoals of big rainbows could be observed, although they were very difficult to catch. Luckily, on the first trip, Dave demonstrated his cast netting skills to secure a few specimens. These are some of the largest wild specimens I ...



Annie Ck, red-form of *Melanotaenia australis*(?) M.H.



Annie Ck, yellow-form of *Melanotaenia australis*(?) M.H.

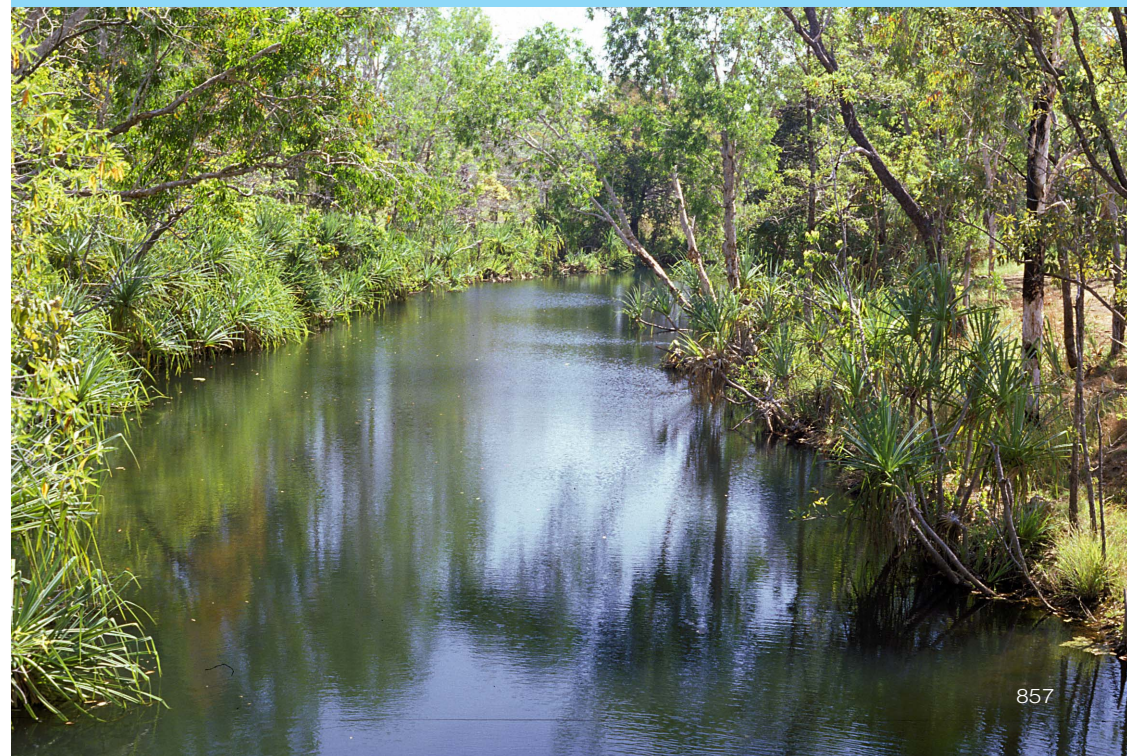


The scenic Red Lily lagoon, before crossing the Daly River.

M.H.

Wildman River, west branch on Arnhem Highway.

M.H.





Tributary to Fish Billabong, Daly River.

M.H.

have ever seen, some had to be in excess of 15 cm! Physically, they by and large appear to be *M. s. inornata*. We tried to get into Corrawara Creek which lies somewhat in-between Port Darwin and Bynoe Harbour, but could not find any access to it. It will likely have the yellow form, but it would be interesting to know for sure. We only collected one site on each of the Finnis and Reynolds rivers. Both had the typical red finned form that appears very similar to those in the Daly drainage. Dave had mentioned that within the Daly drainage, all the rainbows were red, except the Fergusson River which had yellow ones. True to Dave's form, that was exactly what we found after sampling 12 sites this trip, and two on the previous one in 1997. The only exception to this was in Umbrawarra Gorge. Here, virtually the entire population was red, but there were a very small number of fish in one interconnected pool that also had some yellow mixed in with red in their fins. We sampled a couple of tributaries to the Fergusson River, Pine and Copperfield creeks and both were pure yellow. Interestingly, the Edith River, which flows into the lower Fergusson River has red fish. It would be most interesting to determine where the colours change from yellow to red in the Fergusson River. The yellow and red fish appear basically identical in form and colour pattern, except their fin colouration is different (although I'm sure well trained eyes such as Gunther Schmida's might find other differences).

Aside from the populations we visited, there are other unusual "*inornata*" populations in the Northern Territory that are worthy of discussion. These include fish sometimes referred to as *Melanotaenia australis* (see Fishes of Sahul Vol. 7, no. 4) and/or *M. solata* (which is presently synonymised under *M. splendida inornata*). This was described from specimens collected in 1948 from Groote Eylandt, Bickerton Island (next to Groote), and a creek near Yirrkala. It is difficult to ascertain much from the original description except these populations had red fins which is atypical for *M. s. inornata* in that region. There was a more recent collection from Yirrkala of a red finned fish that appeared more like *M. s. splendida* than *M. s. inornata* according to Neil Armstrong. Whether this is the same fish as *M. solata* is unclear. Another form, sometimes referred to as *M. australis* or *M. solata* is the red finned fish from the ...



Mary River Billabong.

M.H.

Fishes in the Mary River Billabong: *Ambassis agrammus*, *Mogurnda mogurnda*, *Ophisternon gutturale*, *Scleropages jardinii* and two colourforms of *Porochilus rendahli*

M.H.







Mogurnda mogurnda from the Wildman River, West Branch.

M.H.

upper South Alligator River (see *Fishes of Sahul* Vol. 7, no. 4). As mentioned previously, this form appears to be a hybrid with *M. exquisita* which may partially explain their odd appearance. The ultimate identity of *M. solata* populations remains a mystery, and will likely continue to given the difficulty of collecting additional samples.

The one recurring pattern with these odd populations is hybridisation. So what exactly do I mean by this? We've always been told rainbowfishes don't hybridise in the wild. And there is lots of evidence to support this. Occasional F1 hybrids are known to occur, but these are very rare and isolated. This type of hybridisation (F1's) between related fishes is not uncommon and probably doesn't have any significance in the bigger picture. There has never been any evidence for a mass hybrid swarm (F1's and parental backcrosses), or any suggestion that backcrossing occurs. It is assumed these hybrid specimens are either infertile (which could be easily tested in aquaria by performing crosses and back crosses) and/or their parental species won't spawn with them as they recognise them as not being of one of their own.

The type of hybridisation I am talking about is not the same as above, although it may have originated via those means. We have found some rainbowfish populations that contain the "wrong" mitochondrial genome. Within any given animal cell there are several separate independent genomes. The primary one is the nuclear genome which contains the cells' DNA (several million to billion DNA bases). It is double stranded and undergoes recombination (exchange of DNA between the strands) at various times. Several minor genomes also exist, one is the mitochondrial genome (mtDNA, mitochondria are where most of the energy production in cells occurs) which contains around 16,000 DNA bases. This genome is single stranded, does not undergo recombination, and is usually maternally inherited (only the females' copy is passed on to offspring). We have identified these rainbowfish populations as being hybrids because they have a different species' mtDNA. However, they appear to have their own species' nuclear DNA. This demonstrates hybridisation has occurred, but through various evolutionary forces (e.g., selection) only the mtDNA has been retained. This is a relatively rare situation in fishes, although it is being more frequently reported as more species are examined. The result is, these hybrid populations are essentially pure and identical to conspecifics except for their mtDNA. However, there is one piece of evidence that some nuclear DNA has been incorporated from the other species. The *Melanotaenia splendida* ...

... Darwin Rainbows



Glossamia aprion. Wildman River, West Branch.

M.H.

populations involved often look a little different relative to conspecific populations (as per Gunther Schmida's careful observations, see *Fishes of Sahul* Vol. 11, no. 1, p. 500). I should stress, these observations are very preliminary and a little speculative. Considerable work remains to be undertaken and it will take several years of research to unravel their complex hybridisation histories which probably go back several thousand years or more.



Hephaestus fuliginosus. Edith River, West Branch.

M.H.

As well as rainbows, many other species were also collected including several new records and observations. I had been keen to sample billabongs in the lower Daly River which seemed largely unexplored. Several species appear to have their southern limit in this area around Reynolds River. This river is immediately north of the Daly River and it seemed strange to me

that some of these species would not also occur in the Daly River, especially since two of them also occurred south of the Daly in the Moyle drainage (*Melanotaenia nigrans* and *Pseudomugil gertrudae*, see *Fishes of Sahul* Vol. 10, no. 2). We did not find either of those two, but did find *Denariusa bandata* for the first time in the Daly drainage and an undetermined *Pseudomugil****. The previous western limit of *D. bandata* was the Finnis River. The lower Daly River is fairly dry and lacks the smaller more permanent streams *M. nigrans* and *P. gertrudae* inhabit. Maybe further sampling in other tributaries will turn them up.

The observations on the lower Daly River led me to another idea. It has often been said that *Melanotaenia exquisita* is an escarpment/upland species and *M. nigrans* is a lowland coastal one. This situation appears artificial based on collection bias. An interesting fact revealed itself to me when I returned from the trip. Except for one area, *M. nigrans*, *M. exquisita*, and *M. gracilis* never occur together in the same drainage. The exception to this rule is the South Alligator River where both *M. nigrans* and *M. exquisita* occur (I'm not sure if they can be collected from the same localities, but both definitely occur in this drainage). *M. exquisita* is certainly not very common in lowland environments, but can be found in local patches. We managed to extend its downstream range in the Mary River by about 50 km when we found it in a tiny unnamed tributary to the Mary River 2 km west of the main river crossing on the Arnhem Highway at an elevation less than 50 m. I have no doubt they will be found in other tributaries in this virtually unsurveyed area. I also would expect other populations to be found in the lower tributaries of the Daly River too. At the moment the lowermost population is in Umbrawarra Gorge which is at an elevation less than 150 m and meets the Daly River about 35 km downstream from the junction of the Fergusson River. In rivers where *M. exquisita* is absent it is replaced by *M. nigrans*. The latter species occurs above most of the waterfalls in Litchfield National Park (Finnis and Reynolds rivers) and occurs in the very upper-

most reaches of the Mann River on the escarpment adjacent to rivers containing *M. exquisita* (based on collections by Helen Larson). These are the exact same habitats that are supposed to be the exclusive domain of *M. exquisita*. As for why this pattern exists, I have no idea. Perhaps they have quite different habitat preferences and the habitats suitable for both species are not present within the same drainages? Or perhaps they have very similar habitat preferences such that they do not coexist, except under rare circumstances?

Clearly the Darwin area holds further surprises as new places are explored and older places revisited utilising techniques for studying rainbowfishes such as genetics and behaviour. Excellent opportunities exist for studying the evolution of colour patterns in rainbowfishes. Why are some populations red, while others are yellow? How many genes are involved in determining colour? What colour preferences do rainbowfishes have when mating? Do these preferences differ between populations? Many as yet unsampled creeks exist in the Darwin area, no doubt they will eventually reveal additional secrets to those who seek them.



Melanotaenia s. inornata. Wildman River, West Branch. M.H.



Pseudomugil sp*** from the Daly River Billabong. M.H.



Melanotaenia nigrans. Darwin Area. M.H.

*Peter Unmack. Biology Department, Arizona State University, Tempe AZ 85287-1501, USA. <peter.unmack@asu.edu>

***Melanotaenia splendida australis* was recently elevated to full species by Dr. Gerald Allen based on genetic work.

***Editors note. Presented for this article as ‘tentatively identified as *signifer* (based on meristics and genetics)’. Dave Wilson has informed us that specimens collected by Charles Niaoutou, Alicia Hogan & Duncan Buckle from the same location, as directed by Peter Unmack, in August, 2002, were deposited in the NT Museum and identified as the Delicate Blue-eye *Pseudomugil tennelles*. In addition the question of what scientific name applies to the darwin rainbows remains unclear, but seem to favour *Melanotaenia splendida inornata*.

