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The Tarkine Bioblitz 2015.
A trip to one of Tasmania's last wildernesses.

Arthur River in the Tarkine wilderness, North West Tasmania. *Photo: Greg Martin*

Our October guest speaker is Greg Martin who, together with Phil Littlejohn, volunteered to partake in the 2015 Bob Brown Tarkine Bioblitz representing ANGFA Victoria. This event was held over a 72 hour period in late November last year and was attended by about a hundred scientists, naturalists, and like-minded volunteers from all over Australia.

The aim of the Bioblitz was to find and document as many of the animal and plant species present in an area known as the Tarkine wilderness in the far north west of Tasmania. The following taxa were included in the sampling: birds, mammals, fishes and macroinvertebrates, reptiles and amphibians, terrestrial plants, orchids, briophytes, algae, mosses and lichens.

Sampling excursions out into the field were run throughout the four day weekend, some starting before sunrise and the last ones finishing well into the night. It was a constant flurry of activity as many of the team

Julius River, a small tributary of the Arthur River, is home to the giant freshwater crayfish *Astacopsis gouldi.* This pristine river has the perfect conditions for giant freshwater crayfish to live: clean unpolluted and cool water and lots of in-stream decaying wood and fallen leaves which they feed on. *Photo: Greg Martin*

leaders gave presentations in the evening to showcase what they had found during the day.

Greg will show us photographs taken during that weekend which illustrate the truly unique qualities of the Tarkine – an area that is so worthy of our enjoyment, understanding and ultimately, our protection.

Left top: *Galaxias truttaceus* from the Arthur River.
Left: A juvenile *Astacopsis gouldii* from the Julius River.
Above: *Galaxias brevipinnis* from the upper Nelson Bay River. These fish was so stunningly coloured that we dubbed them "Tarkine Tigers".

Big Eel Creek, south of Temma on the wild west coast of Tasmania. *Photo: Greg Martin*

Breeding Blue-eyes.
Tips from John Cousins, John Coates and Ross Weber

Spotted Blue-eye *Pseudomugil gertrudae* from Bathurst Island, NT. *Photo: Gunther Schmida*

Our mini presentation this October is from three seasoned fish breeders; John Cousins, John Coates and Ross Weber. They will be drawing on many (!!) years of experience to guide us through the ins and outs of successfully breeding Blue-eyes.

Topics covered on the night will be conditioning fish for breeding, appropriate foods, setting up your breeding tank, water parameters and rearing the fry.

Pacific Blue-eye *Pseudomugil signifer. Photo: Gunther Schmida*

Some nice Blue-eyes will be available on the night so come along, learn something you might not have known and take home a breeding trio of something beautiful.

Pacific Blue-eye *Pseudomugil* cf. *signifer. Photo: Gunther Schmida*

Contents

Editor's Note

Wow! It feels like only a couple of months since our first VICNews of the year in February!

As usual we have tried to include a bit of variety beginning with an article about a recent evening field trip to western Victoria in search of Fairy and Shield Shrimp.

Next, there is an article arguing the case *against* introducing the deadly carp virus into our river systems, from the perspective of Koi enthusiasts.

Then, a detailed article from Katherine Cheshire and Anthony Townsend exploring the relationship between river flow rates and the actual flow rates that various fish species require.

Following that is an update from the Australian Society for Fish Biology blog site.

Lastly, an article looking at that controversial issue – the constant release of trout into our waterways.

President's Report October 2016

Welcome everyone to our October 2016 VICNews, number 122!

Our August meeting was a cracker with a characteristically quick and efficient AGM followed by an adrenaline-soaked auction. It was great to see lots of new faces at the meeting and it was wonderful to see some exciting prices achieved on the night. The highlight being Tom's purchase of Blue-eyes that achieved $150 for the bag of four!

A big thank you to all the people that donated or supplied fish for our auction including Bruce Hanson, Dave Wilson, Aquarium Industries, John Cousins, Ross Weber, Phil Littlejohn, Tony Fowler and anyone else I may have missed.

Lastly, thank you for everyone on the committee for putting their hands up for another year – we obviously make a great team! There were a couple of people that nominated themselves to join the committee as helpers, namely John Dekavalas and Steve Summers, and I would like to extend them a warm welcome to our committee.

See you at the October meeting!

Left: The crowd of bidders at our August meeting's mega auction.
Above: Tom with his prized bag of Blue-eyes!

Field Trip Files: Tiverton, western Victoria. Evening of 1st September 2016

Tiverton at sunset. This working sheep station is located on the volcanic plains of western Victoria. *Photo: Greg Martin*

On the afternoon of 1st September 2016, John Lenagan, Kwai Changkum and I visited Tiverton (formally known as Tiverton Station), a sheep property of about 2,300 acres two hours' drive west of the Geelong bypass on the road to Hamilton. Kwai had visited this property a week earlier and had found Fairy Shrimp, Shield Shrimp and perfect conditions for the mass breeding of frogs as there had been good rain and the low-lying areas were well flooded. Tiverton is a working sheep station and is special for a number of reasons: it is set aside as an area directly involved in the conservation of the Eastern Barred Bandicoot in conjunction with Mount Rothwell, Brolgas have been returning each year to breed there for a number of years now and, whilst there are no fish found on the property, there have been at least six species of frogs recorded. It was in part this last point that drew us to Tiverton (specifically there is a natural green morph of *Litoria ewingii* found here) but the chance to catch and photograph Fairy Shrimp and Shield Shrimp also was too exciting an opportunity for me to let pass.

We arrived as the sun was beginning to set, all three of us fixatedly scanning for Brolgas in the dimming light. Every half buried rock and distant sheep looks like a Brolga at dusk… that is until you look again and realise that… nope, it's just a rock...!

When we reached the homestead, John wandered off to photograph birds before it got too dark whilst Kwai and I spoke to Tim the station manager, explaining why we were there and what we hoped to find. That done, Kwai and I then donned waders and went down to 'check out' the old Tiverton cricket pitch which was now flooded. In the now very dim light, we found lots and lots of Fairy and Shield Shrimp right there amongst the flooded grass in no more than 100mm of water. I have seen Fairy Shrimp before but these specimens were huge at 25 – 35mm in length and had blue tips to the tail. The Shield Shrimp we found were also very large and so incredibly prehistoric looking! After collecting enough shrimp to get good photographs, we walked back up to the house to document what we had found and to wait for night to fall and the frog chorus to ramp up!

Shield Shrimp (Notostracans) or Tadpole Shrimp as they are often known, are from the (single) family Triopsidae (order Notostraca), of which there are two genera – *Triops* and *Lepidurus*. An extraordinarily pre-

Caught behind! Kwai dipnetting on the flooded old Tiverton cricket pitch. *Photo: Greg Martin.*

historic looking animal, Notostracans are living fossils having remained almost unchanged outwardly since the Triassic Period 199 million to 251 million years ago. They have a broad, flat carapace which conceals the head and bears a single a pair of compound eyes. The abdomen is long, appears to be segmented and bears numerous pairs of flattened legs. The telson is flanked by a pair of long, thin caudal rami. Phenotypic plasticity within taxa makes species-level identification difficult, and is further compounded by variation in the mode of reproduction. Within the Notostraca, and even within species, there is variation in the mode of reproduction, with some populations reproducing sexually, some showing self-fertilisation of females, and some showing a mix of the two. The frequency of males in populations is therefore highly variable. In sexual populations, the sperm leave the male's body through simple pores, there being no penis. The eggs are released by the female and then held in the cup-like brood pouch. The eggs are retained by the female only for a short time before being laid, and the larvae develop directly, without passing through a metamorphosis. Notostracans are omnivores living on the bottom of temporary pools and shallow lakes.*

Fairy Shrimp, order Anostraca, class Branchiopoda inhabit inland waters ranging from hypersaline lakes to lakes that are almost devoid of dissolved substances; they are "the most archetypal crustaceans" in ephemeral waters. The relatively large size of fairy shrimp, together with their slow means of locomotion, makes them an easy target for predatory fish and waterfowl. This has led to their distribution being restricted to environments with fewer predators, such as vernal pools, salt lakes and lakes at high altitudes or latitudes. The whole animal is typically 6–25 millimetres long and they swim "upside-down" and feed by filtering organic particles from the water or by scraping algae from surfaces. There are 300 species spread across 8 families worldwide.*

After setting up the field tank and placing our catch in it, I left John taking the pictures. Whilst Kwai caught up with Tim, I wandered off to the swamp with my digital sound recorder in anticipation of the evening frog chorus. On this occasion there was not a breath of wind and the sky was clear – perfect conditions to get a splendid recording. Later, when I retrieved the machine I noted that it had recorded 2 hours and 9 minutes (2 Gigabytes) of the most amazing frog chorus I have heard.

Field tank photographs completed, we put on our head torches (Kwai had forgotten his!), and then wandered off into the (very) dark night in search of frogs to photograph. As we had arrived in time to see the basic layout of the property whilst there was *some* daylight,

A different kind of catch on the cricket pitch! John and Kwai inspect their catch of Fairy and Shield Shrimp – it was amazing just how much life this shallow water supported. *Photo: Greg Martin*

Kwai dip nets for Fairy Shrimp. *Photo: Greg Martin*

we had an idea of the route we would follow as we sampled for frogs. Having said that, it was still very disorientating being in such darkness, only seeing what our head torches light up, nonetheless we walked off in our small group in the direction of the first of the flooded swamps ringing with frog calls.

As we passed the equipment shed, Kwai spotted eye shine (from some distance I might add), and it belonged to a Common Spadefoot Toad *Neobactrachus sudelli*.

Tadpoles, Shield Shrimp, Fairy Shrimp and Clam Shrimp (Conchostrachans) as well as Daphnia. One drag of the net caught all this. *Photo: Greg Martin*

Kwai chats with Tim, the station manager, whilst John takes pictures of the fast moving shrimp. *Photo: Greg Martin*

We photographed this big female and then continued on. The ground, although sodden from the recent rain, was quite rough underfoot with sheep hoof holes and half-buried granite exfoliations and before long we were wading through ankle deep water as well. We split up and proceeded. As I carefully scanned the water for the distended throat sacks of calling male frogs or the flash of green of a local Brown Tree Frog, it

Fairy Shrimp photographed in the field tank. *Photo: John Lenagan*

Shield Shrimp *Triops australiensis. Photo: John Lenagan*

Shield Shrimp eating a Fairy Shrimp in the field tank. *Photo: John Lenagan*

was more often than not that the "plop" of the frog's speedy retreat back into the water was the first sign that one was close by. I refined my frog catching technique by watching closely where the frogs retreated to – feeling around in the water until I felt squishy frog – and had many near misses, but eventually I got the hang of it and before long I had a good number of frogs

The underside of the Shield Shrimp *Triops australiensis* showing the many pairs of phyllopodous legs.* *Photo: John Lenagan*

to photograph – Spotted Marsh Frogs only at this stage and one Common Froglet.

As time went on I occasionally looked up from my little focused circle of illuminated water and could see Kwai off in the distance in one direction and John in another. Each of us was in a world of our own. We reconvened after some time and Kwai had some green phase male Brown Tree Frogs that he had somehow managed to catch – his secret technique, "look for them in the thistles". I took this advice onboard and scanned every thistle but to no good, there were no male Brown Tree Frogs that I could see.

When I told Kwai of my frustration with looking for them in the thistles he (almost immediately) pointed

Shield Shrimp *Triops australiensis.* Details of the anatomy from right to left: carapace with compound eyes clearly visible. The first eleven body rings, which comprise the thorax (hidden from view by the shield), bear one pair of legs each with the last one bearing the genital opening; in the female it is modified to form a broud pouch. The remaining segments form the abdomen, which end in a Telson and a pair of long, thin, multi-articulate caudal rami.* *Photo: John Lenagan*

Kwai still dip netting as dusk sets in. The swamp came alive as soon as the sun set with a cacophany of frog calls erupting all around us. *Photo: Greg Martin*

out a calling male Brown Tree Frog some distance off, floating on the surface of the water, but highlighted by his head torch and very visible. I had totally misjudged how far away they were when they were calling and

A frothy egg mass amongst the grass of the flooded paddock, most likely belonging to a Spotted Marsh Frog. *Photo: Greg Martin*

Common Spadefoot Toad *Neobatrachus sudelli. Photo: John Lenagan*

Common Froglet *Crinia signifera. Photo: John Lenagan*

Eastern Banjo Frog *Lymnodynastes dumerili.*
Photo: John Lenagan

just how effortlessly the sound was carrying that long distance in the still night air. Armed with this new information I was able to locate lots of them now; that being said, they were still difficult to actually bag! Despite my lack of luck bagging these beautiful animals, John was able to get some superb "in situ" photos of male *Litoria ewingii* floating on the surface. They were easy to approach, but when one tried to grab them they disappeared underwater very quickly. I tried waiting for them to re-emerge for air, which they did after about 5 minutes, but I still failed to actually catch one.

Eventually I decided to desist with my mission to catch one so I switched off my head torch to conserve the battery. When my eyes adjusted I found myself alone in the middle of the swamp but surrounded by light; there was no moon and the full pallet of the star-studded sky was stretched out above me and reflected in the water around me. As the frog calls throbbed in my ears I just stood there drinking in every detail, I didn't want to create any movement that would refract the water and disturb the perfect reflection of this extraordinary sky. This was a magical moment – a brief glimpse of being totally present.

Too soon I heard voices close by and I was snapped back to the swamp I was standing in at Tiverton, looking for frogs with Kwai, John and Tim. We traced our steps back towards the equipment shed heading now to the eastern side of the property to examine a larger swamp for any species not yet found in our nocturnal searching.

This second habitat was different from the first swamp; deeper and more established. The water had been here longer and the frog species present were different as well. In the first swamp we found Brown Tree

Eastern Banjo Frogs in amplexis under their frothy nest. The male can just be seen behind the female. *Photo: John Lenagan*

Frogs *Litoria ewingii*, Spotted Marsh Frogs *Limnodynastes tasmaniensis* and Common Froglets *Crinia signifera*. In the second location we could hear Eastern Banjo Frogs *Limnodynastes dumerili* and Striped Marsh Frogs *Limnodynastes peroni* as well as the first three species. Making progress through this water was a difficult job as the ground underneath was very soft and threatened to swallow you up quietly or at least slow you down to a standstill. Along the edge of the water Banjo Frogs were calling very loudly and quite quickly we were able to locate their frothy nests of eggs – some with the owners present and still in amplexis. Again, John was able to get some great "in situ" shots.

Although their call was clearly heard and we made many attempts to locate them, the Striped Marsh Frogs remained elusive on this night. The sixth species of frog known to occur on this property is the Growling Grass Frog *Litoria raniformis*, but they call in the summer time and we weren't expecting to find them on this field trip.

By now it was after 10pm so we decided to wrap it up and head back to our vehicle as we had a long drive home – for me it was 2 hours and 45 minutes – and we were feeling exhausted, although exhilarated, after nearly 4 hours in the swamps. As we drove we talked about Tiverton. This is a very special place, and although we hadn't seen any Brolga, we had experienced Tiverton at a most magical time – night time with no wind and almost no moon.

Male Brown Tree Frog *Litoria ewingii* (green phase). *Photo: John Lenagan*

Text by Greg Martin

*Additional information from Wikipedia.

Male Brown Tree Frog *Litoria ewingii* (green phase). Some individuals had more green than others. *Photo: John Lenagan*

Should we release the deadly carp virus into our rivers and water supplies? Professor Simon Chapman

On April Fools' Day, I tweeted "Breaking: deadly carp herpes virus to be trial-released in Lake Burley Griffin. #StinkingFish" and added a photo of masses of dead floating carp and this link to the CSIRO, discussing the plans for national release of the cyprinid herpesvirus-3 virus (CyHV-3) into Australia's inland rivers and lakes.

I later pinged the tweet to several national news outlets. None ran it as a one of the traditional mock news stories we often see on April Fools' Day. My attempt to seed the story would have instantly failed the instinctive credibility test that all good news editors have honed over the years.

Canberra's Lake Burley Griffin, like many of our waterways, is infested with plague proportions of "water rabbits": the reviled European carp.

The idea that a herpes virus which would rapidly see perhaps tens of thousands of bloated dead carp floating and putrefying in the national capital's iconic lake after the trial release of the virus was obviously beyond preposterous. It was too unbelievable to rate even as a good April Fool's joke.

And this of course is exactly why I published the tweet. The planned release is no joke. The CSIRO has been engaged in prolonged research to test the efficacy of CyHV-3 in killing carp and whether it poses any threat to native fish.

But Canberra's civic authorities would be the very last to put their hands up to volunteer for a trial. There would be several compelling reasons for their reluctance.

First, amazingly, there are no indications yet that carefully evaluated field trials are even being planned. Open, statewide release of the virus is apparently very much on the table as an option. The thinking appears to be that it could just be released wherever carp are infesting our waterways. And that's a lot of rivers and lakes.

Second, no nation or state anywhere in the world has ever purposefully released CyHV-3 into its waterways. If Australia goes ahead as planned, it will be the first nation to do so. Might not others have held off for good reason?

Just asking …

Third, serious questions arise about how the virus came into the picture. The virus "appeared" in Israel in 1998 and has since spread to 33 known nations via the global commercial trade in ornamental carp (koi). Most of these outbreaks have been confined to koi keepers' ponds where 70-80% of fish have rapidly died. In Japan though, the virus has been found in more than 90 rivers.

Outbreaks have also been reported without any known carrier. Here, suspicion arises that water birds may be able to spread the virus.

With no known history of outbreaks before it appeared in Israel, there is concern that an earlier non-fatal strain of the virus may have mutated. In discussion I had with a NSW scientist working closely on this issue, this possibility was downplayed. Herpes viruses are generally considered to be species-specific, with each animal species having its own herpes viruses. Species-specific viruses occasionally jump into new hosts, but these jumps seem to be determined by two factors.

1.Virus jumps really only occur between closely related host species (such as HIV/AIDS virus and Ebola virus jumping from non-human primates into humans).

2.Viruses are broadly classified as RNA or DNA viruses. DNA viruses (such as CyHV-3) are relatively stable, whereas RNA viruses (such as AIDS, Ebola and influenza viruses) are much more likely to undergo mutations that potentially allow them to jump hosts into a closely related species. Some small and very simple DNA viruses may jump species, but by contrast, CyHV-3 is a very large and complex DNA virus, and these are rarely associated with jumps.

Here, note the qualified language that always must occur in science: "generally considered", "relatively stable", "may", and "rarely associated".

Two viruses released in Australia to control rabbits, the Calicivirus (an RNA virus) and the virus causing Myxomatosis (a complex DNA virus) have respectively been present in Australia for some 20 and 60 years with no evidence of either jumping into another host during all that time.

The question nonetheless remains as to why CyHV-3 "appeared" only relatively recently and whether related strains might later "appear" in fish other than carp.

Fourth, we come to the problem of humongous quantities of dead, rotting carp stinking like the gates of hell and degrading our rivers. No one knows with any accuracy how many carp now infest Australia's waterways since their introduction in the late nineteenth century and the explosion in their numbers that followed flooding in the 1970s. One recent claim put it as "millions, if not billions".

The same report stated 140,000 tonnes of carp had been caught one year at just one lock on the Murray and processed into fertiliser. That would mean 384 tonnes each day: 16 tonnes every hour needing a 16-tonne truck delivering them to the Deniliquin carp fertiliser factory every hour.

But even rampant hyperbole like that fails to diminish the massive problem of feral carp in our rivers. Up to 90% of fish in the Murray-Darling Basin are carp. The voracious, toothless fish ravages river banks looking for worms and insects, causing rivers to choke brown with mud, and greatly degrading the habitat of native species, driving their numbers down. Carp also eat native fish eggs, invertebrates and tadpoles.

When carp die, they often sink and begin to rot before rising to the surface as they putrefy. I visited a friend's koi pond recently and found a well-dead large koi rotting on the surface. I could smell the single fish 30 metres away on a windless day. If the virus is released en masse, thousands upon thousands of carp – many weighing 5kg or more – will die quickly up and downstream from each release point.

When organic matter deluges waterways, the oxygen-carrying capacity of the water can be dramatically reduced, causing mass native fish deaths, as has occurred in recent years in the Hunter and Richmond rivers. Heavy rains flush this away, but in low rain and drought periods, the problem can be catastrophic.

Currently there are serious algal blooms in the Murray being caused by high nutrient loads (fertiliser run-off, human and livestock waste). CSIRO experiments with the virus show that if released when the water temperature is warm, the virus will kill up to 95 percent of individuals within 24 hours of symptoms appearing. The virus is most effective in juvenile carp, and is transferred between fish through the water, living without a host for up to four days.

Rotting biomass on this scale is almost certain to cause major problems for both clean-up, and the death of native fish stock, not directly from the virus, but indirectly because of degraded water quality.

The ingenious government plan to clean up this unprecedented mess is to have local community groups do it. Some A$30 million is being talked about to support this. A current NSW Natural Resources Commission draft discussion document talks of "building community capacity to participate in carp clean-up issues".

In well-populated centres near large towns, that may be sometimes realistic. But there's the small prob-

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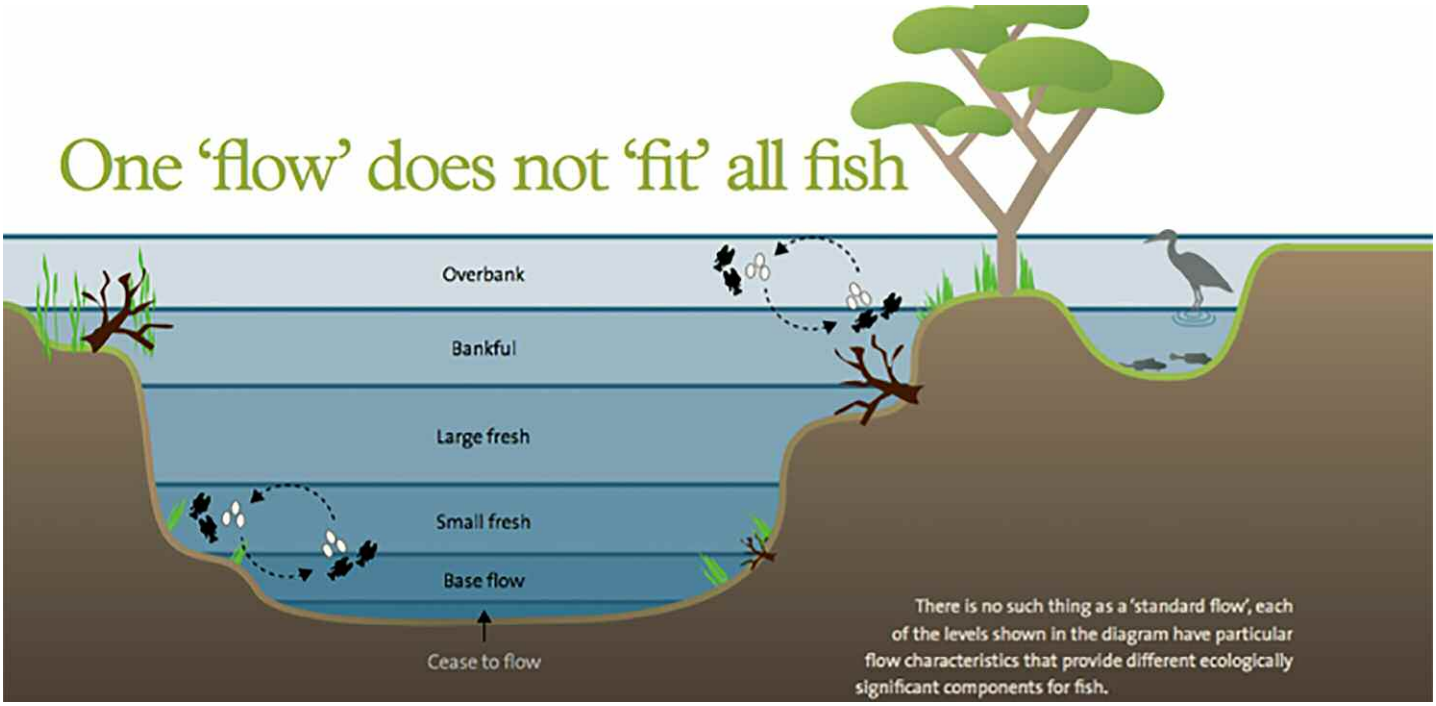
One ‘flow’ does not ‘fit’ all fish.
Katherine Cheshire and Anthony Townsend



It is sometimes assumed that providing flows of any magnitude, velocity, rate and frequency will benefit fish, however, as Kat Cheshire and Anthony Townsend explain, we need to provide a range of flows to meet different fish needs.

There are 46 native fish species in the Murray-Darling Basin (MDB). Each of these species has evolved differently, over millennia to the boom and bust nature of the Australian riverine landscape. Water and fish go together, and different fish have adapted diverse life cycles in response to the varying flow conditions (i.e. floods and droughts) of the Basin. When we look at the fish species in the MDB there are some basic differences in life cycle strategies:

-some are dependent on intermittent high flow pulses to spawn,

-others require fast flowing riverine habitats to live in,

-some require the inundated wetlands on our floodplains, and

-others can complete their life cycle in almost any conditions, including low flows.

Due to their dependence on different flows, our native fish populations are suffering from changes in the system. These changes occurred over just a handful of decades as a result of water extraction and river regulation. Fish play a critical role in the whole river system by cycling nutrients, providing food for other parts of the food web like waterbirds, and sustaining a billion dollar a year recreational fishing industry. Looking after fish, therefore, provides a range of environmental, social and economic benefits.

We know that restoring fish populations through smarter water delivery and protection of natural flows can be an effective way to manage river health in many ways:

-Improves completion of native fish cycles, which have adapted to the natural boom and bust of the MDB System, including providing cues for some fish to spawn (eg. Golden perch)

-Maintains water quality for fish health, including levels of dissolved oxygen, salinity and temperature.

-Ensures access to a diversity of habitats (wetlands, flowing water, river channels, drought refuges) during dry times, and nesting sites (woody debris, aquatic vegetation, gravel or cobbles).

-Water that inundates river benches and floodplains provides food for adult and baby fish, helping maintain their condition. Healthy fish are more likely to spawn, move and respond to difference cues, increasing their survival potential.

-Supports lateral and longitudinal movement of fish throughout the MDB (e.g. Murray cod and Silver perch have been recorded moving hundreds to thousands of kilometres), ensuring genetic diversity of fish and allowing dispersal to different locations.

1. Overbank flows

inundate floodplain and off-channel habitats. Provide lateral connectivity, large-scale nutrient and sediment cycling and increase productivity.

2. Bankfull flows

are the flow rate at which overbank flows begin, they are characterised by the inundation of low-lying ephemeral wetlands and floodplains.

3. Large in-channel pulses (freshes)

Substantial increases in flow that provide inundation of in-channel features such as benches and longitudinal connectivity. May connect floodplain wetlands and anabranches with low commence to flow thresholds.

4. Small in-channel pulses (freshes)

small increases in flow that provides longitudinal connectivity, and may provide productivity benefits.

5. Base flows

Generally confined to deeper parts of the river channel, and provide connectivity between pools and riffles, preventing cease to flow events.

6. Cease to flows

No-flow periods occur when flows decrease so much that a series of disconnected pools results (i.e. no-flow periods).

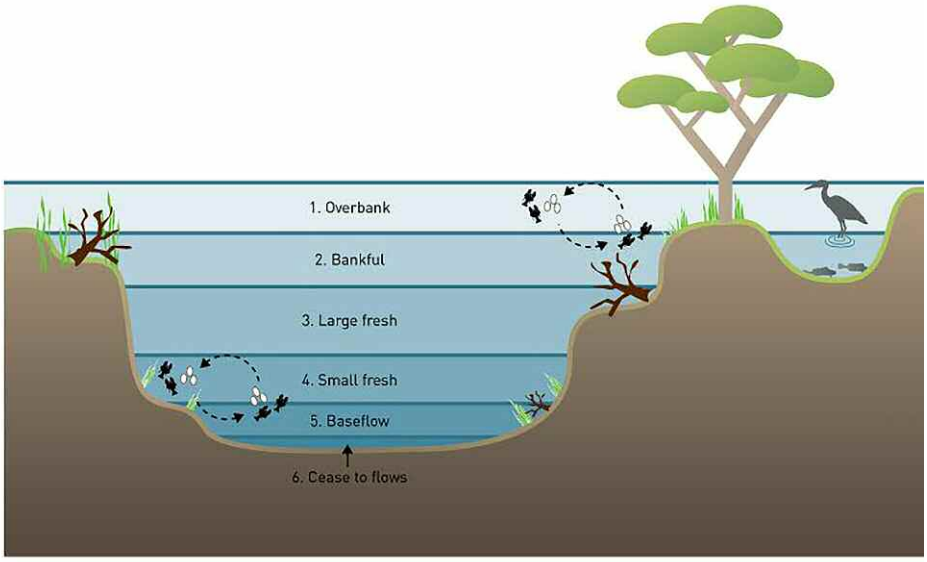


Figure 1: River and wetland/floodplain flow descriptions – different fish need different flows. Figure NSW DPI Fisheries, for better quality image download the pdf of this article – the link is at the end of the article.

Figure 1 shows the range of different flows our rivers and connected wetland floodplains experience. Fish respond differently to different flows, and this means that assuming any water will have positive outcomes for all fish is too simplistic.

It is not feasible to manage water delivery specifically for each of the 46 different fish species in the MDB, but our team did want to manage water more effectively so that we optimised outcomes for fish. Our response to this problem was to develop an approach using 'functional groups', where we sorted the fish into groups

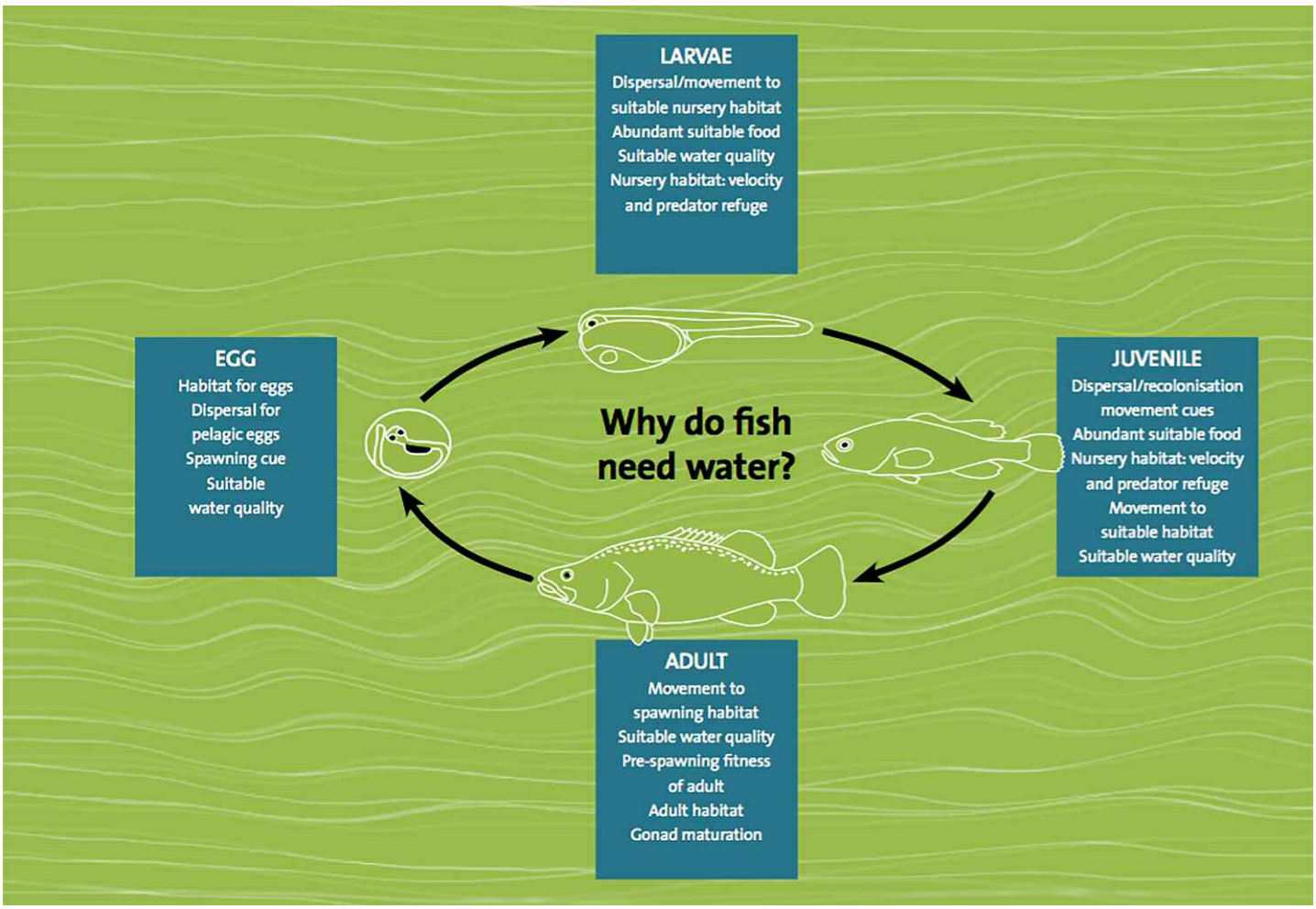


Figure 2. The influence of flows on the different stages within the life cycle of fish.

based on shared life history and characteristics and responses to flow.

NSW DPI Fisheries, in collaboration with fish scientists and managers from across the Basin, used these functional groups to develop a simplified management framework for fish and water management called the 'Fish and Flows' projects. We built on previous functional group approaches for fish and integrated the latest science and knowledge about flow related responses and life history requirements of fish. This enabled us to develop different functional groups of species for the southern and northern Basin.

These projects focused on how water and flow influence key characteristics of fish life cycles (see Figure 2), with key stages being:

-egg, larval and habitat preferences,

-distances of juvenile and adult movements,

-if cues are required to initiate spawning,

-how and where they spawn (e.g. nesting or not),

-how many eggs they produce,

-how frequently they need to spawn to maintain populations,

-life span, and

-survival and maintenance of populations (dependent on food availability and water quality requirements).

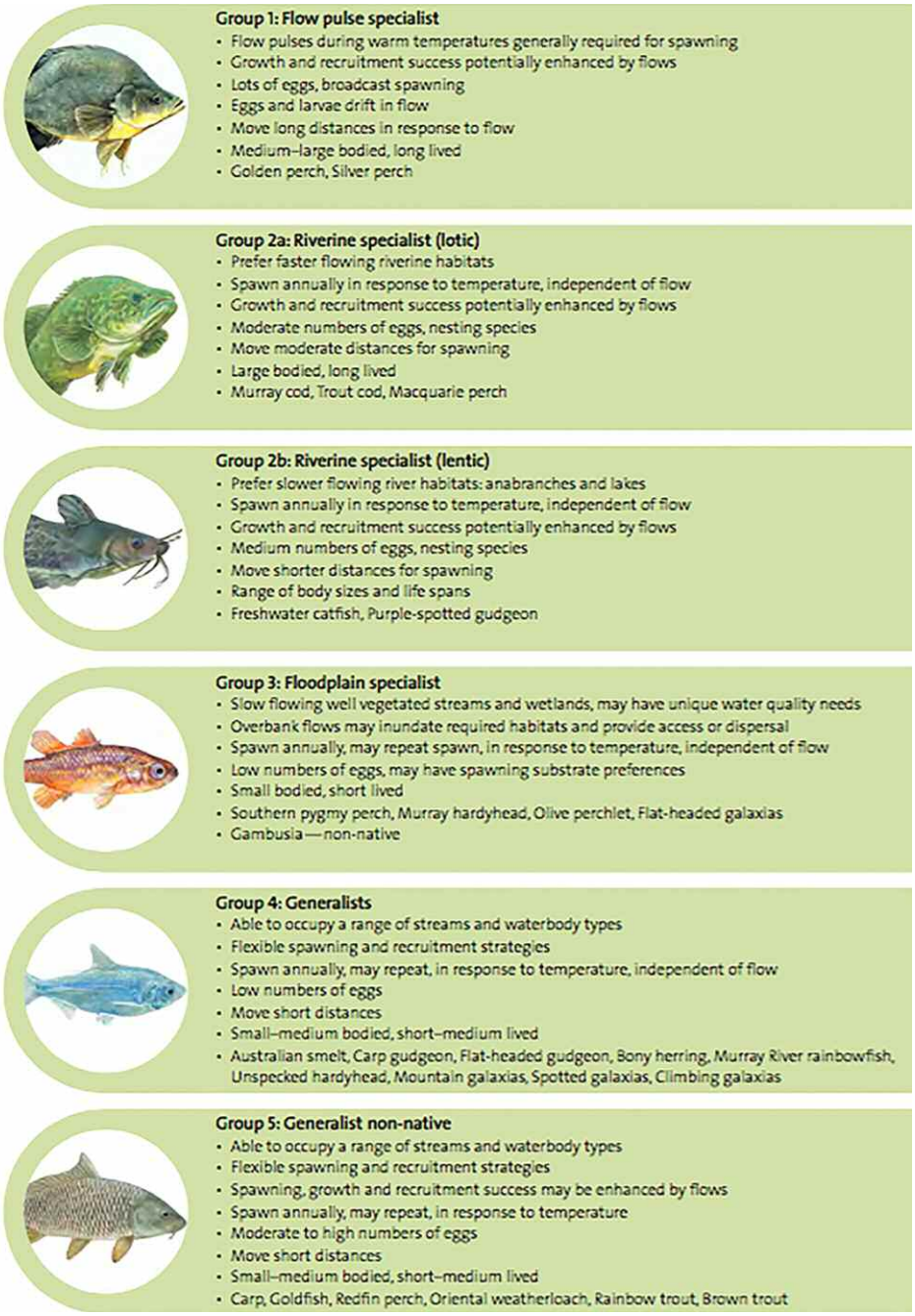


Figure 3. Functional groups of fish developed during the Fish and Flows projects, highlighting their flow-related attributes and example species. A better quality version of Figure 3 can be seen in the downloadable pdf of this article at the link below:
http://www.finterest.com.au/wp-content/uploads/2016/08/Article-3_One-Flow-Does-Not-Fit-All-Fish.pdf

Using these characteristics, we identified five different functional fish groups that are now being used to simplify water management targets for fish (Figure 3).

These groups of fish all rely on water and flows, but respond differently to various parts of the flow regime (see figure 4). We want to improve our understanding of how the magnitude (both volume and height), frequency and duration of different flow events influence each group. This will allow water management strategies to be fine-tuned over time to achieve outcomes for specific functional groups.

In addition, we want to discover the thresholds required to maintain populations during drier times. We hope this understanding will enable us to improve their condition during wetter periods and refine our capacity to achieve outcomes under various water management scenarios.

As part of the 'Fish and Flows' projects, conceptual hydrographs were developed. These describe specific elements of flows needed to support the spawning, recruitment, maintenance and condition needs of each of the fish functional groups (Figure 4). Fish have adapted to historical flow patterns, so the hydrographs consider the natural variation in flow magnitude, seasonal timing, and duration for a system. It is expected that these generic hydrographs will be adjusted by water managers to suit different locations across the Basin in the design and prioritisation of watering actions.

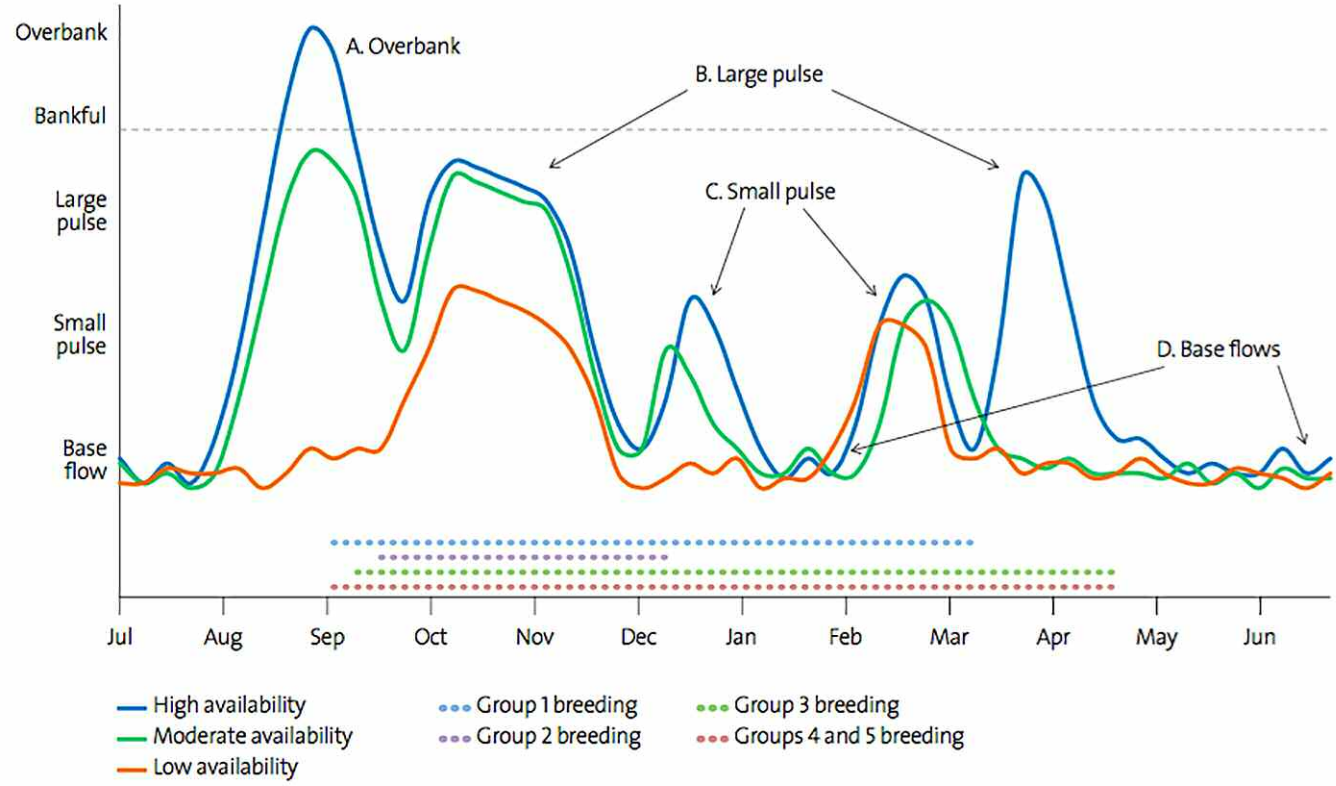


Figure 4. Conceptual flow hydrography for three water availability scenarios (high, moderate and low) and breeding season windows for each functional group of southern MDB fishes (dotted lines) that are shown in Figure 3.

While water is the most important element to keep fish alive, fish cannot live on flows alone. We can achieve greater outcomes from environmental water by undertaking parallel complementary actions including: improving fish habitat through re-snagging, restoring in stream and riverbank revegetation, fixing fish passage, screening pumps and diversions, and controlling invasive species. Flow management and complementary actions working in parallel will support bringing native fish back into a healthy working Basin, and will increase the potential to achieve long-term social and environmental outcomes through water management.

Kat Cheshire and Tony Townsend are team members at NSW DPI Fisheries. They are well known in the 'fishy' world for being great communicators and knowledgeable about fish in the MDB. You can contact them by email if you want to know more about this work.

This article was first published on the Finterest website and is reproduced above. To view the original article go to the link below: http://www.finterest.com.au/fish-movement-and-migration/one-flow-does-not-fit-all-fish/

For further information

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anthony.townsend@dpi.nsw.gov.au.

Left: Anthony Townsend
Below: Katherine Cheshire

Australian Government

MURRAY–DARLING BASIN AUTHORITY

Extinction looms for four Australian freshwater fish. From the Australian Society for Fish Biology

The Running River rainbowfish is now considered Critically Endangered by the ASFB Threatened Species Committee, but has no official protection. *Photo: Michael Hammer*

The Australian Society for Fish Biology warns that several native fish species face extinction without immediate conservation action. At the society's annual conference, held September 4 – 7 in Hobart, Tasmania, members of the ASFB Threatened Species Committee upgraded their conservation listings for four freshwater species.

The four new species at risk are the Running River rainbowfish (*Melanotaenia* sp.), Malanda rainbowfish (*Melanotaenia* sp.), Utchee rainbowfish (*M. utcheensis*), and Swan galaxias (*Galaxias fontanus*). Three of these species are now listed by the society as Critically Endangered, the final stage before extinction.

The Threatened Species Committee is a group of independent fish experts, who since 1985 have maintained a list of Australia's most threatened fish. They convene annually to update their list and review new nominations. Based on the available evidence, the committee decided on Sunday to update the conservation listings for these four species.

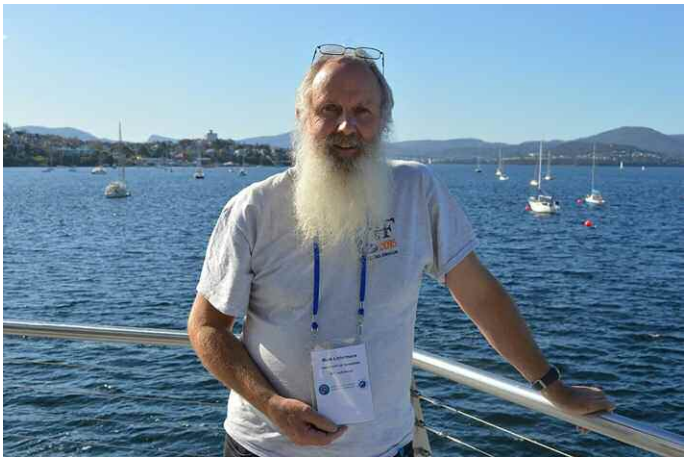
Mark Lintermans, a freshwater ecologist at the University of Canberra and convener of the committee, has been working recently to save one of these species, the Running River rainbowfish. Although neither it nor the Malanda rainbowfish have been formally described, both face rapid extinction due to hybridisation or competition with another rainbowfish that has been introduced into their environment.

In the case of the Running River rainbowfish, the introduced rainbowfish is hybridising the native species out of existence, and this is happening very rapidly. "The Running River rainbowfish could go extinct within the next 2–3 years, it's that quick," says Lintermans. "So it's important for us to list them now, even before they have their formal names, to try and raise awareness about their conservation plight."

Rainbowfish, he says, are the often-overlooked jewels in our freshwater ecosystems. "They're certainly our most colourful, and one of our most diverse fish families. And they're only small: they might only be 50 – 80mm long, but literally they're called rainbowfish because they have the colours of the rainbow. They're an incredibly attractive species.

"If you don't go out and fish for them with a rod and line, people tend to ignore the smaller fishes in our environment, and, in fact, they probably make up the greatest part of our fish diversity."

Urgent action is needed to protect these species – both to eliminate the threats to their survival, and to establish insurance populations through translocation. "I'm currently involved in a project with the Running



Freshwater ecologist Mark Lintermans warns that more must be done to protect these four freshwater fish species.
Photo: Andrew Katsis

River rainbowfish," says Lintermans, "trying to find some creeks where we can potentially translocate animals to try and give us a bit of breathing room, so they don't get hybridised out of existence."

Unfortunately, conservation funding is limited, and the official processes in place to support endangered species are slow, particularly when a species is formally undescribed. "We're starting to do some work on one of them – the Running River rainbowfish – but we currently do this based on crowdfunding and what money we can scrape together. Because they're not nationally listed under the EPBC Act, it's very hard to get funding for this sort of work.

"It highlights a bit of a gap between some of our national threatened species approaches, because until you have a formal listing under the EPBC Act, then generally it can't get a priority for action. But it will take quite possibly a year to get listed under that Act, and the fish may be gone before then.

"We can't just afford to let species go extinct because of these threats. For instance, there's a number of rainbowfish that are threatened by the same process, so we need to start addressing this process of moving fish around, because it's a real threat. Really, I think they have their intrinsic value, and what right do we have to condemn them to extinction?"

To help support conservation research on the Running River rainbowfish, visit: https://www.canberra.edu.au/about-uc/uc-foundation/what-can-i-support/tabs/research/running-river-rainbow-fish-fund

Andrew Katsis is Communications Manager for the Australian Society for Fish Biology.

The four threatened species:

Running River rainbowfish (*Melanotaenia* sp.): A single population, restricted to 13 km of river between two gorges. Rapidly hybridising with another rainbowfish, *M. splendida*. Listed as Critically Endangered.

Malanda rainbowfish (*Melanotaenia* sp.): Only three populations remain, and two are likely to disappear soon due to competition with an introduced rainbowfish, the eastern rainbowfish. Listed as Critically Endangered.

Utchee rainbowfish (*M. utcheensis*): Restricted to six populations in a small number of tributaries of Johnstone River. Listed as Vulnerable.

Swan galaxias (*Galaxias fontanus*): Currently listed as Endangered under the EPBC Act. Has lost four populations since last review in 2002, due to drought and introduced trout. Now listed by the ASFB as Critically Endangered.

This article was first published on the Australian Society for Fish Biology blog. The original article can be viewed here: https://www.facebook.com/notes/australian-society-for-fish-biology/extinction-looms-for-four-australian-freshwater-fish/945120975596675

The Malanda rainbowfish (right) with the introduced species that is threatening its survival, the eastern rainbowfish (left).
Photo: Michael Hammer

Rabbits of the river: trout are not native to Australia. By Susan Lawler.

The World's Largest Trout in Adaminaby pays homage to an introduced pest that harms native fish. *Photo: Halans/flickr*

Yesterday's announcement of the removal of trout from a small creek in the Alpine National Park to protect a critically endangered native fish highlights the problem that is trout.

Trout have been so successfully and so pervasively introduced into Australian freshwater systems that most people now think that they are native. The truth is that trout have caused the extinction or demise of many freshwater fish and invertebrate species, including some excellent angling fish such as the Murray cod, Macquarie perch and trout cod.

The introduction of trout to Australia was supported by Acclimatisation Societies which supervised the hatching and release of introduced trout without any consideration of its impact on native fauna.

This does not surprise us because we know that these organisations deliberately introduced thistles, sparrows and rabbits, all of which are well known pests in an Australian context.

The surprising thing is that trout have evaded the pest label, and despite abundant evidence that they are causing the extinction of native fauna, their continued existence in Australian rivers is supported by government agencies that release millions of trout fry every year.

These same agencies are responsible for protecting the native species impacted by trout, and ironically breed and release trout's victims at the same time. In 2012, Victorian Fisheries hatched and released Murray cod, golden perch, trout cod, silver perch, Australian bass and Macquarie perch, all of which are native fish struggling to compete with trout. At the same time, they released brown trout and rainbow trout despite the fact that many trout populations are known to be self-sustaining (in other words, not at risk of extinction). To be fair, Victorian Fisheries now only releases trout into lakes or impoundments, but the movement of these populations into nearby rivers is virtually guaranteed.

Trout have been removed from other small rivers and creeks in the past to protect the barred galaxias and the spotted tree frog. The responsible agencies are aware that trout are a serious threatening process, and yet they are unlikely to ever remove trout from a large river. This is because recreational fishers have come to believe that trout fishing is something which every Australian has a right to. Worse, many fishers think this is because trout are a natural part of the Australian environment and therefore deserving of our protection.

Obviously, trout fishing is an important part of the tourism industry and many rivers are so well stocked with trout that there is no point in trying to remove them. On the other hand, few Australians realise that we enjoy trout fishing at the cost of excellent native angling experiences.

Barred Galaxias *Galaxias fuscus*, one of the many small native fish at risk of extinction from trout predation. *Photo: Tarmo Raadik*

Macquarie perch and trout cod (formerly known as blue-nose cod in Victoria) were excellent angling species before they became endangered. Murray cod are still highly prized where populations are not too vulnerable to be fished, but they no longer grow to the great sizes of the past.

People who fished the Murray River used to be called "whalers" because they came back with monster fish as large as themselves. Current regulations require anglers to throw fish back if they are above a certain size, so the thrill of fishing for something that could be larger than yourself is no longer available.

This is not due to trout alone, of course. River regulation, pollution and habitat alteration all play a role in declines of our native fish. But the reverence with which trout are held among fishers obviously plays a role.

The construction of a barrier to prevent trout from moving into a small stream and the removal of 700 trout by electro-fishing is an important and laudable step towards the protection of one species of upland native Australian fish. The Shaw galaxias is a critically endangered species that would not have survived without this intervention.

But let it also remind us that trout are threatening native fish in rivers, impoundments and lakes, and too few people are concerned because they think that trout belong here.

Unfortunately, trout are actually worse than rabbits, because they are both carnivorous and voracious. As a fisher said in 1905 in the Sydney Morning Herald: "Trout will eat anything but the log fences hereabout. They have cleared out the bream, the cod and the carp, but we will not mind that if they stay themselves."

Some of us do mind.

Author – Susan Lawler

Head of department of Environmental management and Ecology, La Trobe University

10th May 2013

Should we release the deadly carp virus into our rivers and water supplies?

...Continued from page 15

and into side channels, creeks, and billabongs.

It would appear likely that volunteer recording of carp sightings is well advanced on the east coast, but less documented in the vast, remote west of the state, almost certainly because of fewer citizens being engaged in reporting, not because of less carp.

Hundreds if not many thousands of tonnes of fish will die rapidly and rot in poorly inaccessible parts of our rivers. Folksy ideas about local volunteer crews cleaning all this up in a kind of aquatic "clean up Australia" movement sound seriously naïve.

Fifth, while feral carp are rightly vilified as pests, they have been in our rivers for many decades. Other species have adapted to them with carp fry and young fish eaten by native fish and birds. Adult carp spawn around 300,000 eggs, although a huge number of these perish or are eaten before and after fertilisation.

No modelling has been released on the impact on these native species if up to 90% of a major source of food suddenly dies. Should we be planning a program to reintroduce native species, or do we just sit back and see what happens? Are we potentially leaving an ecosystem gap for some other problem to fill?

Finally, the virus will of course also get in water catchments supplying towns and cities. The CSIRO has so far been unable to guarantee that virus will be denatured by the levels of chlorination used in town water entering pipes. Warragamba and southern dams have carp and supply water to Sydney's Prospect water treatment plant, and so we would expect direct release of the virus into these supplies.

It needs to be underlined that the risk to humans is infinitesimally small, arguably non-existent. But the communication challenges of convincing the public of this will make the problems of promoting the beneficial health measures such as water fluoridation and folate fortification of flour look like a Sunday school picnic. Imagine this: "Let us release a herpes virus into the water supply. It won't harm anyone. We promise."

Insiders are expecting Commonwealth approval for the release in 2018, with implementation shortly afterwards. Submissions are now being invited to a NSW enquiry into feral animal control, including carp.

Professor Simon Chapman is a professor of Health at the University of Sydney. ***He has kept ornamental koi for nearly 20 years and is patron of the Australian Koi Association.*** *Chapman is a regular writer on public health matters in leading Australian newspapers.*

This article was first published on "the conversation'"website and is reproduced above. The original article can be viewed at https://www.google.es/search?q="simon+chapman"+carp+virus+rivers+and+water+supplies&ie=utf-8&oe=utf-8&client=firefox-b&gfe_rd=cr&ei=_L_iV6-mEuvv8AeH1oiwBQ

Club Meeting Details

General Meetings:
ANGFA Victoria's meeting are held on the first Friday of every second month starting the year in Feb, at The Field Naturalists Club of Victoria which is situated at 1 Gardenia Street Blackburn. (Melways map 47 K11). Doors open at 7:30pm. Meetings start at 8.15pm sharp and aim to be finished by 10pm, followed by supper.

Next Meeting Date: Friday 7th October 2016

ANGFA Vic Committee Meetings:
Venues: to be announced. Contact Kwai Chang Kum if you would like to be further involved (0430 434 488).

Trading Table
Any financial ANGFA member who has fish, plants or live food that they would like to sell is invited to bring their goods to the trade table. All items being presented for sale must be clearly marked: fish showing species name and location if applicable and plants identified by species. Goods will be accepted prior to 7.45pm and the Trading Table will operate between 7.45 and 8.15pm.

Other Fish Groups in VIC

EDAS
Meets last Friday of the month starting Jan.
Contact: Daryl Maddock (03) 9874 1850

EDAS Plant Study Group
Meets Second Friday of the month (at various members' homes).
Contact: Eddie Tootell (03) 9337 6435 (a.h.)

Aquarium Society of Victoria (AS of V)
Meets last Friday of the month, alternating with EDAS.
Contact: Daryl Maddock (03) 9874 1850

Marine Aquarium Society of Victoria
Contact: MASOV (03) 9830 6073.

Victorian Cichlid Society
Meets first Wednesday of the month.
Contact: Graham Rowe (03) 9560 7472.

ANGFA Vic key contacts

President: Kwai Chang Kum
Phone: 0430 434 488

Treasurer: John Lenagan
Phone: 0413 730 414

Secretary: Glenn Briggs
Phone: 0408 771 544

Vice President and Membership Officer: Gary Moores
email: kathmoores@yahoo.com.au

VICNews: Greg Martin
Phone: 0407 094 313
email: greg@aquariumsbydesign.com.au

ANGFA Vic Website: Lyndon Giles
email: webmaster@angfavic.org

Contribute to ANGFA Vic on Facebook

ANGFA Vic Website: www.angfavic.org
ANGFA National Website: www.angfa.org.au
Postal mail: ANGFA Victoria
P.O. Box 298 Chirnside Park, Victoria. 3116.

Join ANGFA now!!! New expanded membership package now applies

To join ANGFA or to renew your membership online, follow these 4 easy steps:

1. Go to www.angfavic.org
2. Click on membership
3. Select membership renewal tab for ANGFA then ...
4. Click the Paypal icon to pay with Paypal.

To pay with your Debit Card or your Credit Card talk to the Treasurer John Lenagan at a meeting.

If you want to use snail mail and pay by cheque, print out the form below, fill out your details and send it to: ANGFA Victoria, P.O.Box 298, Chirnside Park. Vic. 3116

Join ANGFA now and enjoy benefits including regular meetings, digital versions of two regional club magazines and buyer discounts.

To the Treasurer, ANGFA Victoria, Please accept my application for membership to ANGFA.

(Please print)

NAME.....

.....

ADDRESS .....

.....

.....

Postcode.....

Phone Bus .....

A/H:.....

1. I enclose $45 for my ANGFA Membership which includes digital copies of Fishes of Sahul (FOS), VICNews and the ANGFA NSW magazine.
2. I enclose $65 (in total) to get a printed copy (at the end of the year) of the four editions of FOS for this subscription year, as well as the above items.

Forward application and cheque to: ANGFA Victoria, P.O.Box 298, Chirnside Park. Vic. 3116.

Businesses who support ANGFA Victoria

The businesses listed below actively promote Australian Native Fishes by making native fishes available in the aquarium trade.
ANGFA suggests that members show their appreciation by supporting these businesses.

Amazing Amazon
Paul and Ben
365 Springvale Road, Glen Waverley
Phone: (03) 9545 0000
www.amazingamazon.com.au

Aquagreen
Dave Wilson
Phone: (08) 8983 1483
aqua.green@bigpond.com

Aquariums By Design
Greg Martin
Phone: 0407 094 313
greg@aquariumsbydesign.com.au

Coburg Aquarium
Greg Kirby
Phone: (03) 9354 5843
232-236 Bell Street, Coburg
www.coburgaquarium.com.au

Paky Pets
Keith
Phone: (03) 5940 1091
Shop 2/114 Princes Highway, Packenham

Subscape Aquarium
Justin and Kim
Phone: (03) 9427 0050
310/312 Victoria Street, Richmond

Upmarket Aquarium
Greg Kirby
Phone: (03) 9600 9051
442 Queen Street, Melbourne

Victorian Reptile Supplies
Adam
Phone: (03) 8742 1283
6/75-85 Elm Park Drive, Hoppers Crossing