WHAT SNAG IS THAT?

I WAS STANDING AROUND A BARBEQUE WITH SOME FISH BIOLOGISTS WHEN ONE OF THEM REMARKED, "VIC, WE'VE BEEN ELECTROFISHING THIS STRETCH OF THE MURRAY FOR A FEW YEARS NOW, AND WE ALWAYS CATCH THE SAME SPECIES AT THE SAME SNAGS. WHY WOULD THAT BE?" THUS BEGAN VIC HUGHES' PhD JOURNEY.

Now, life for a river fish is just one long upstream swim. Which is at least one reason why snags [instream woody habitat] are so important to native fish in the River Murray. Fish are almost always found at snags which they use as shelter from the constant flow of the river [hydraulic refuge]. My thinking was that different snags might provide different hydraulic conditions, and that might be why different fish favoured particular snags.

With this as my hypothesis, I set out to study hydraulic conditions around snags, particularly how they change between snags of different physical character, and river discharges. My study was in the Yarrawonga to Tocumwal reach of the River Murray, one of the few which has largely undisturbed natural snags. I looked at 90 snags of differing physical complexity, at five different river discharges. There are three components of instream flows:

1. flow direction,
2. horizontal velocity component (i.e. the speed at which the water is flowing in that direction,
3. a vertical velocity component (the speed at which the water is flowing up or down relative to the horizontal).

I measured these three hydraulic conditions with an acoustic doppler profiler (ADP). The ADP provided measurements in 25 centimetre depth cells through the water column to produce a velocity profile—a three-dimensional 'picture' of flow through the water column. I recorded about 50 profiles at each snag (and at each discharge) and summarised the data. This gave a 'snag scale' picture of hydraulic habitat.

So, what did I find? At very low river discharge (base flow of 2000 megalitres per day), there were no significant differences in hydraulic conditions between simple and complex snags. As discharge increased, however, the differences became apparent. They were maximised at the highest discharge measured (15,000 megalitres per day), where 11 out of 19 hydraulic variables showed differences.

These variables provide some insight into the different hydraulic complexity of snags, for example, while the mean horizontal velocity was higher at very simple snags (single logs parallel to the flow), it did not show a lot of difference between other, more complex snags. Variability of velocity did, however, increase with snag complexity, meaning complex snags had more areas of low velocity than simple snags. This is shown in their more positively skewed distribution of velocities (Figure 1).

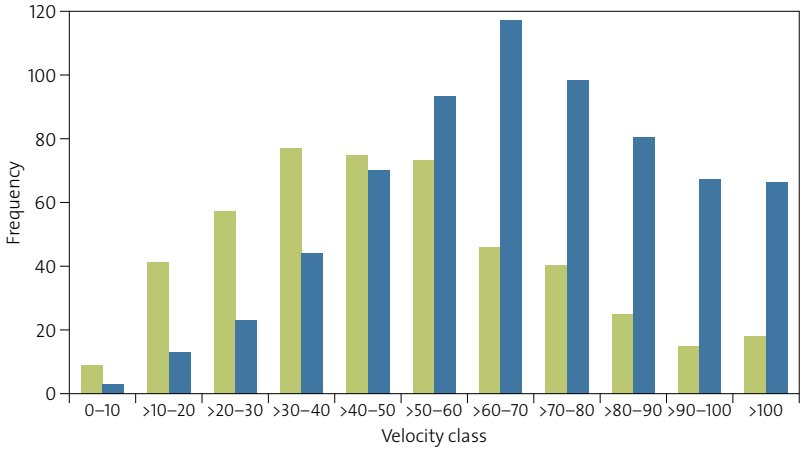

Figure 1 shows the distribution of velocities at a complex and a simple snag. The complex snag (green) has a positively-skewed distribution and more areas with lower velocities than the simple snag (blue). In so doing, it provides more hydraulic refuge for fish.

FOR FURTHER INFORMATION

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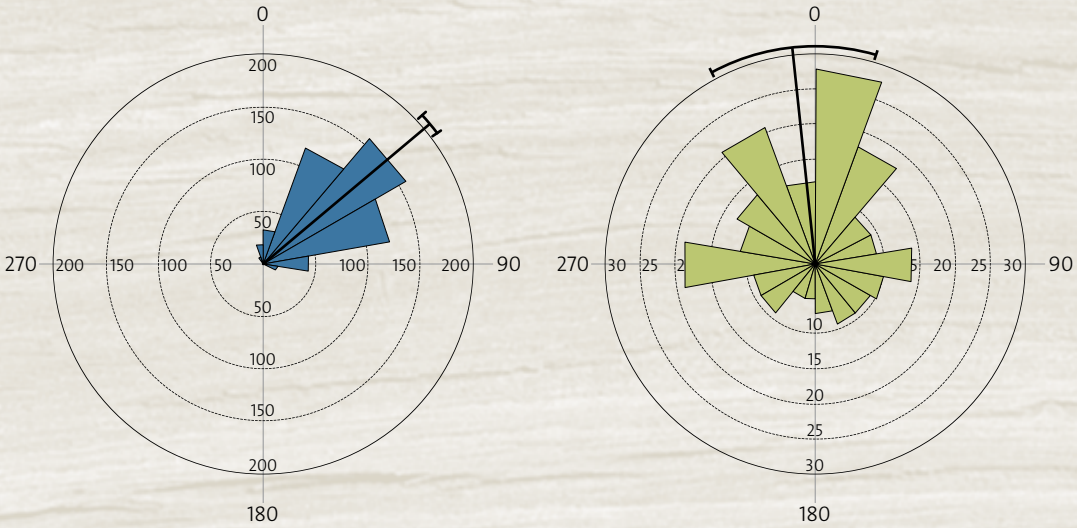

Figure 2: Variability of flow direction at simple (left) and complex (right). Discharge is 15,000 megalitres per day. The solid black line shows the mean flow direction, and the coloured segments show how many flows are going in other directions.

Opposite: Vic Hughes in a snag pile recording details of the snags.

Something else that varied between simple and complex snags was the variability of flow direction. We can show this with a circular histogram, which depicts how many flows are going in different directions. Figure 2 illustrates a simple and a complex snag.

The simple snag has most flows concentrated in a 90-degree arc close to the mean flow direction. The complex snag has flows going to all points. While a fish can't read a histogram (!), it can use areas where the flow is not going downstream to help it maintain stream position with minimal energy use. These findings show how hydraulic conditions vary between different snags at the same (high) discharge.

I also looked at how conditions changed between low to high discharges, and found some broad general trends. Unsurprisingly, mean and maximum velocities increased as discharge did, but they increased more at simple snags than at complex ones. Variability of horizontal velocity decreased as discharge increased, and velocity distribution became less positively skewed (meaning fewer areas of low velocity for fish refuge). Variability of flow direction also declined, again suggesting less hydraulic refuge for fish.

A 'snag rich' stretch of the Murray. Photo Vic Hughes.

Do these hydraulic differences make any difference to fish?

My work found that fish were more abundant at large instream wood that was physically and hydraulically more complex, and which had lower average horizontal velocities. I also investigated whether there was any relationship between different hydraulic conditions and the type of fish recorded at snags. This work is ongoing but some preliminary results that show Trout cod are associated with faster flowing water, both in horizontal and vertical directions.

I have only briefly touched on the results of this study, and once my data is fully analysed I will let you know more results through the Finterest website (finterest.com.au) and other 'fishy' publications. In the meantime, there are a couple of take home messages I would like to leave you with:

1. Snags aren't just snags—they vary hugely in their complexity and in the hydraulic habitat they provide.
2. For a fish trying to maintain stream position with minimal energy expenditure, there is much more to hydraulic habitat than simply the average flow speed at a snag.

These points are important for anyone re-snagging rivers. Ideally, we want complex snag piles because putting in single, simple snags is unlikely to provide the hydraulic diversity that is useful for fish habitat.