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Hello everyone, and welcome to this edition of FISH!

While lockdown has prevented much fishing and fisheries fieldwork taking place, we're sure you've all appreciated at least reading about fish!

The previous few months have brought about some fascinating news stories and advances in our knowledge, and because of this, we have decided to focus this edition on a broad spectrum of fisheries research that is currently being undertaken globally. We are sure that this is a theme that will be revisited as there will always be work to showcase and things to learn!

The FISH team are still working through all of the topics suggested by our readers during the IFM survey last winter, but if there is anything in particular that you would like to see in FISH, then please do get in touch. We are also always keen to share photos of members and their fish and your reviews of fisheries related books - please send them to fish@ifm.org.uk.

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If you would like to contribute to FISH please get in touch.

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River snorkelling – an effective fish survey method for fisheries managers and wildlife enthusiasts | Daniel S Hayes

Data-based sustainable fisheries management

The angler of the twenty-first century has come to treasure vital wild fish populations. In light of many pressures acting upon our streams and rivers, many recreational fishing clubs and associations are careful not to increase the heat through short-sighted management decisions. Indeed, the principle of sustainability guides many of today's fisheries management approaches, for example, using the fish population's maximum sustainable yield as well as annual recruitment numbers to determine bag limits. In this regard, the knowledge of some stock parameters, such as stock density and population structure, can already be sufficient to provide decision-making aids necessary to implement and adapt fishing regulations, especially if these parameters are regularly monitored.

Choice of method: electrofishing vs snorkelling

Electrofishing is often the first choice for fish stock assessments; however, this method also poses disadvantages such as the need for specially trained personnel and the high costs involved – reasons that can easily discourage regular surveys. In this regard, underwater fish counts through snorkelling may be a suitable and easy alternative for the angling community to acquire data relevant for management actions. This thought gave rise to the question if snorkelers – and particularly inexperienced snorkelers – are capable of generating good-quality data.

To answer this question, a team of freshwater ecologists conducted a method comparison in an Austrian clear water trout stream. The researchers compared fish numbers and distribution of three size-classes (small, medium, large) of brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) sampled by electrofishing to underwater fish counts by novice snorkelers. Sampling was

conducted in two years, and twelve habitat units (four pools, four runs, four riffles) per year. A new team of two inexperienced snorkelers counted fish each year: they only received a short training session on fish identification, length-size estimation (in the water, fish appear 25% larger!), and underwater movement (which can be quite tricky in a fast-flowing mountain stream). Two snorkelers moved through the habitats in the upstream direction, whereby each surveyor counted fish in separate halves of the river cross-section, ensuring that they together cover the entire river width. They recorded fish counts on a plastic plate attached to the arm once a fish passed the observer in the downstream direction. Due to high fish densities in the pools, the method had to be adapted: one snorkeler counted brown trout and the other rainbow trout.



Counting fish through snorkel surveys is a reliable method and provides an exciting time in an underwater wonderworld (Photo credit: Kristof Reuther).

Yes, we can!

The study showed that novice snorkelling crews are indeed capable of gathering reliable data, as both methods yielded similar results regarding overall trout abundance and size-class distribution. In detail, however, some differences did emerge. For example, in the first year, snorkelers underestimated brown trout numbers in riffles and overestimated rainbow trout in pools and



A wild-grown rainbow trout in the Ois River, an Austrian mountain stream, as seen through the eyes of a snorkeler (Photo credit: Kristof Reuther).

runs. Breaking it down to size-classes, snorkelers underestimated numbers of large- and medium-sized trout in pools in one or the other year. In the first year, they also counted fewer smaller size brown trout in shallow riffle sections.

Species-specific behaviour can, however, explain these differences. The secretive lifestyle of brown trout, for example, makes it more difficult for snorkelers to find fish hiding between boulder cracks in deep river sections. Rainbow trout, in contrast, tend to occupy midwater positions and are generally more active than brown trout, making it easier for snorkelers to detect rainbow trout. Lower snorkelling counts of small brown trout in riffles may have been due to the difficulty in carefully searching a shallow area (often <30 cm) of high flow velocities and coarse substrates. Generally, however, in this mountain stream, the combination of few woody debris piles, macrophytes or emergent plants, with high underwater visibility (mean: 3.8 m) seemed to provide favourable conditions for snorkelers to count trout.

Moreover, results also showed that, even though both teams had no prior experience, the effort and ability of the team mattered: one snorkelling team had higher accordance of sampling results with electrofishing estimates than the other. It can be expected that yearly snorkelling surveys with the same people can increase experience and thus, fish detection rates. In the best case, these results could be regularly validated through electrofishing to estimate reliability.

Conclusions: snorkelling for sustainable fisheries management

The study results commend that snorkelling can be an appropriate method for sustainable fisheries management to quantify trout populations in clearwater streams – even if surveyors have no previous snorkelling experience.

Finally, river snorkelling offers unique experiences for wildlife enthusiasts. My most-memorable underwater moment was when I approached an arm-long brown trout that held a trout half its size across its mouth! Snorkelling, therefore, provides the possibility of developing a more holistic picture of underwater habitats. Observing fish in their natural environment not only enhanced my understanding of life underwater, but I have found this knowledge also to be useful in selecting the best fishing holes as one gets a good feeling on where the fish like to hang out.

The entire study can be downloaded free of charge: <https://doi.org/10.1002/nafm.10246>

For further reading on this topic, please see: Pinter, K., Lautsch, E., Unfer, G., & Hayes, D.S. (2019). Snorkeling-Based Fish Stock Assessment by Anglers—A Valuable Method for Managing Recreational Fisheries. *North American Journal of Fisheries Management*, 39(1), 82-90.

Unfer, G., & Pinter, K. (2018). Fisheries management of stream-resident Brown Trout populations—possibilities and restrictions, p. 649–665, in: J. Lobón-Cerviá & N. Sanz (eds.). *Brown Trout: biology, ecology and management*. Wiley, Hoboken, New Jersey.
