Putting the research into Research and C

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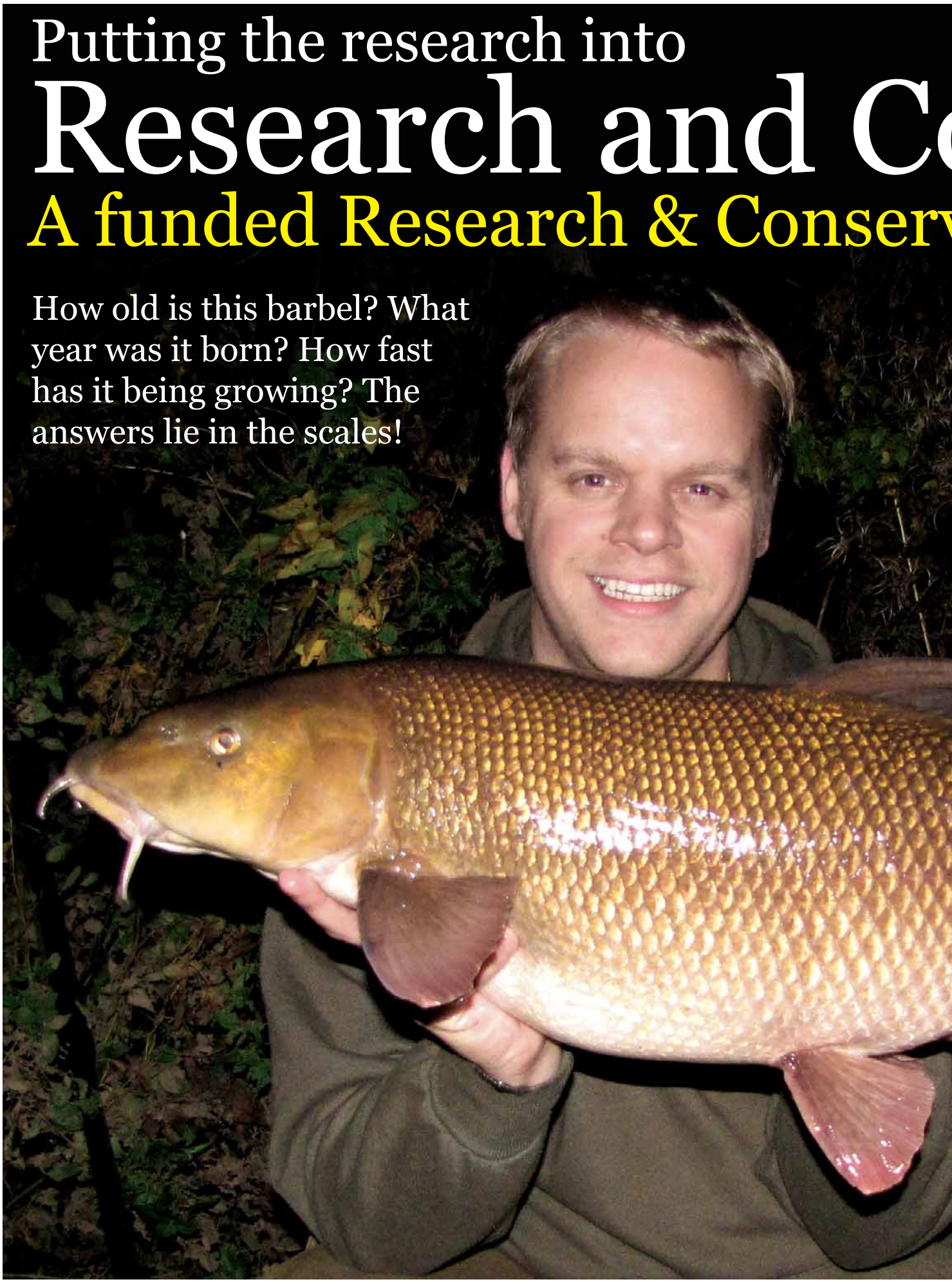
How old is this barbel? What year was it born? How fast has it being growing? The answers lie in the scales!



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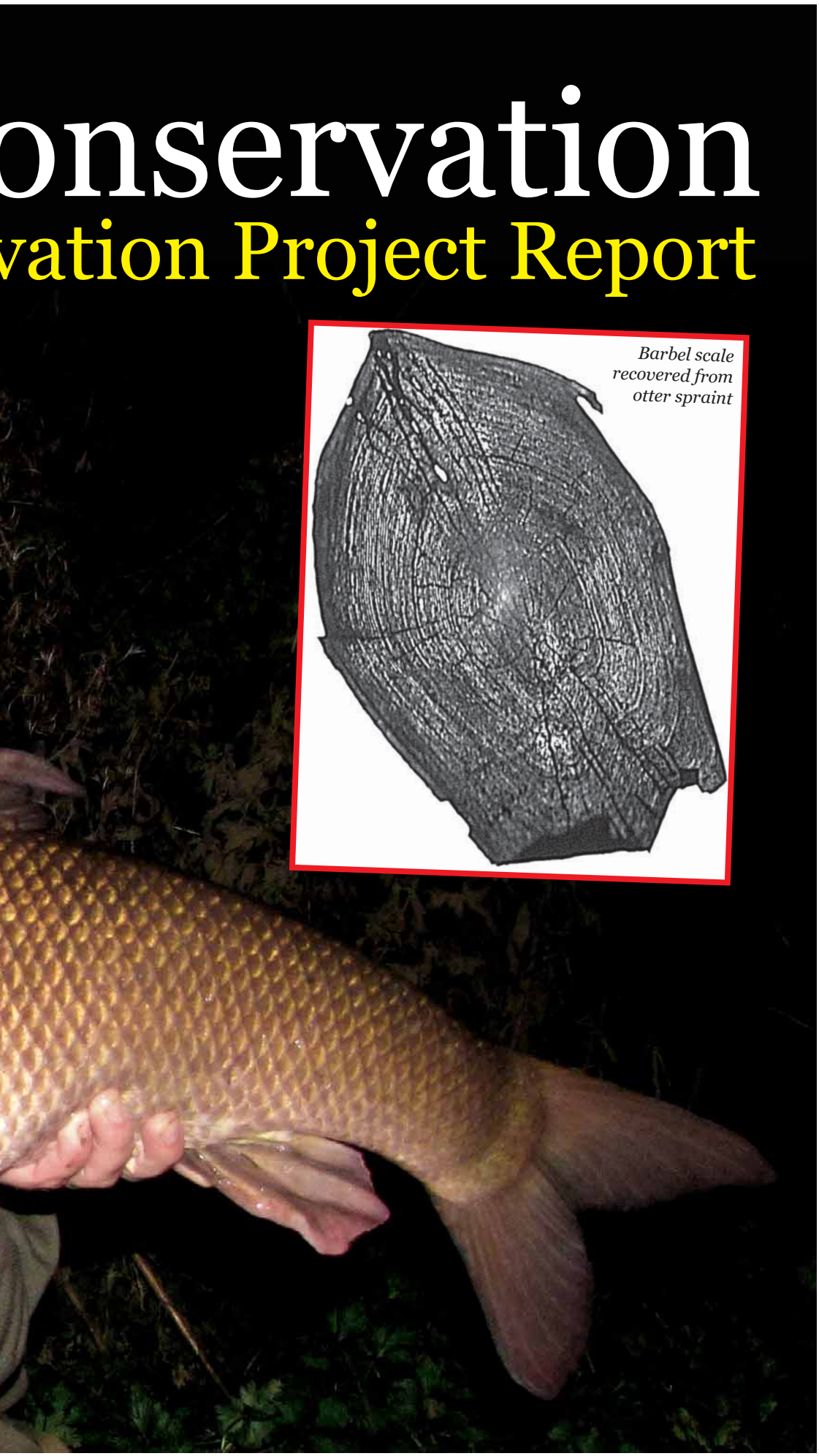

Barbel scale recovered from otter spraint

A fundamental component of any natural resource management is developing an understanding of your resource so that subsequent management programmes are based on a sound understanding of the underlying processes and mechanisms.

Whilst it is no different with fish, with barbel this tends to be more difficult as there are few long-term data sets for available on their populations, making understanding their population patterns and trends extremely difficult. This is primarily due to the difficulty of sampling the relatively large rivers where barbel tend to be found in large number and where flows and depths can be considerable - think of the Trent, Severn and Wye. Given that, then how do you develop a scientific understanding of barbel populations when it is difficult to even sample them? To answer this, I will try and explain the research that I have been doing in recent months in conjunction with Pete Reading as directed through the research and conservation efforts of the Barbel Society that has aimed to develop a better understanding of barbel populations of the UK.

Before I do so, however, perhaps I should explain a bit about me! I have been working at Bournemouth University since 2007 and in that time I have been developing a research programme based around the human, biological and environmental factors that influence freshwater fish populations. Although much of my research now centres on introduced fish, for my PhD (completed 1999) I studied the impact of cormorants on inland fish populations and during a

subsequent 7 year period of employment at the Environment Agency, I worked on issues including the diet composition of otters and the growth performance of stillwater barbel (the latter in support of the work of Ayesha Taylor that I'm sure many Barbel Society members will be aware of). To ensure my research is objective and robust then I publish studies in peer-reviewed scientific journals. This ensures that others can have confidence in the quality of my work, particularly if it is used subsequently in support of policy and management. Indeed, whenever Barbel Society members are presented with data from scientists that are described as being of high quality and as justifying further research or a new policy, it is always useful to ask whether it has been subjected to peer-review processes. If the answer is yes them you can greater confidence in its quality.

So it is this research and science background that I have been recently applying to barbel ecology. Through initial meetings with Pete, it was apparent that the research and conservation efforts of the Barbel Society had been doing some excellent work on barbel habitat restoration and enhancing barbel populations through targeted stocking (often using marked fish, which is highly useful for determining the subsequent success of the stocking and the fate of the fish). It was apparent, however, that there was a real desire to try to develop more pro-active approaches to barbel research and conservation and perhaps become less reliant on mitigation projects that tend to address very specific issues, often in small spatial areas, but that are often caused by much wider, non-fishery related problems that are more difficult to address. In doing this, we decided we initially needed to identify the current knowledge on barbel ecology through a comprehensive review of the published, peer-reviewed scientific literature.

Barbel 11lb 2oz – 74cm

Now completed, the review1 revealed that most of the research on barbel has centred on their behaviour, movements, habitats and activities. Whilst much of this work has been completed in mainland Europe, some has been done in England, including on the Rivers Severn, Lee and Nidd. Key findings included barbel being highly mobile, capable of moving considerable movements for spawning (> 20 km in some cases), and with populations comprising two types of fish - those with relatively restricted home ranges that only ever move only small distances and others that are highly mobile and, depending on the size of the river, may move several kilometres or more over short time-periods on a very regular basis. Regarding their behaviour in the summer, barbel tend to seek refuge in deeper areas during daylight and rarely forage but come dawn and dusk they move into shallow riffles to feed. This clearly allies with the difficulty that we have in catching barbel in the middle of a hot summer's day - we basically have to try and make them behave unnaturally if we are to be successful. Barbel habitat use also varies considerably over their life cycle: larval and juvenile barbel up to 5cm require water of negligible or slow flow, ideally with high weed cover, and they only move out into water of higher flow as they attain larger lengths.

The implications of these outputs for river and barbel management are stark: maintaining the longitudinal and lateral connectivity of rivers is fundamentally important if barbel populations are to be allowed to behave and move naturally, and access all of the habitats they require from larvae to adult. Maintaining habitat heterogeneity (i.e. variation) is also important as it will ensure that barbel have access to all the habitats they need over 24-hour, seasonal and spawning cycles. Unfortunately, our rivers have already lost much of their longitudinal connectivity, such as through impoundments for navigation, and lateral connectivity is generally limited through, for example, losses of back-waters. However, continued losses of connectivity will further fragment barbel habitats, potentially isolate populations from their current spawning areas and, ultimately, reduce the number of fish available for anglers to catch. So any schemes that will reduce connectivity and habitat heterogeneity (e.g. hydropower, mass weed-cutting, unsympathetic flood defence schemes) should be resisted wherever possible. Indeed, successful lobbying to have the connectivity losses and the fragmented habitats of barbel populations reversed in severely impacted rivers is likely to have a much greater benefit for barbel populations in the long-term than, for example, very small scale habitat restoration and restocking schemes. So think big and long-term wherever feasible!

What was apparent in the review was that our understanding of the environmental and biological factors influencing the growth and recruitment of barbel is relatively poor, yet these processes are crucial in understanding, for example, how and why barbel are growing so big today compared with 20 and 30

years ago. In species such as roach, dace and chub, studies completed over many years on both juvenile and adult populations and in rivers such as the Trent and Yorkshire Ouse has shown that water temperature and aspects of the flow regime in the first year of life of a year class has a large influence on the recruitment of that year class. Years of warm temperatures that have no flood events in critical periods of the summer that would otherwise cause wash-out events of juveniles tend to produce strong year-classes. For barbel, however, there are no similar data sets available to enable these types of analyses to be made and whilst it would be understandable to assume these climatic conditions would produce similar barbel recruitment patterns, this can currently only be speculated. In addition, the variability in the growth of barbel over time and space is also poorly understood. Whilst we have seen large increases in the average weights of barbel in the last 20 years, our knowledge on how this relates to their ages and their growth in length is limited. Similarly, whilst considerable variability in the growth of barbel within populations is apparent, it is not clear what enables some fish to grow to specimen proportions and others to only attain weights at a ceiling of 6 or 7 lb, despite the fish being of similar age. Obviously, female fish tend to be larger (for reproductive reasons), but the role of genetics, water chemistry, flow, temperature, climate change and increased use of high nutritive baits by anglers in driving the growth rates of barbel is far from clear.

As a consequence of this lack of knowledge, we have spent some time this year collating data sets on barbel age and growth from rivers across the country, with data now attained from 29 rivers, with this completed in conjunction with the Environment Agency. Unfortunately, for some of these rivers, the data are confined to a small number of fish, but for 21 rivers there were sufficient data to enable at least some further testing to be completed. This has shown barbel are present to at least 20 years old in most of these rivers, although it is likely older fish are present but their ages cannot be derived accurately from their scales due to issues associated with their lack of growth in length in later years (Figure 1). In general, the growth of individual fish is relatively rapid in their early years (up to age 4 or 5 years) by which time the fish may be as large as 35 to 40 cm. As the fish become sexually mature then growth tends to slow slightly as some energy is diverted from body growth to gonad growth. After the age of 12 years, growth slows considerably and for the remainder of their life, growth in length is limited, with annual growth increments of less than 5 cm per year and usually much less (Figure 1).

These data have also enabled the growth variation of barbel between rivers to be analysed. This has shown considerable variation in growth between rivers. Faster growth rates are apparent in rivers with higher biological water quality and lower levels of phosphate loading, i.e. rivers that continue to have high organic inputs and eutrophic conditions will have a population of relatively slow growing barbel. This is in contrast to species such as roach that tend to grow much faster (but whose life spans may be compromised) in eutrophic conditions. Given the considerable improvements in water quality in rivers such as the Trent then this helps to explain the resurgence in their barbel populations in recent years. It was also apparent that fish in the east of the country are faster growing (in length) compared with the west. Reasons for this are not completely clear, as testing of data against flow regimes, habitat factors and water quality did not show any significant patterns. There are, however, some temperature differences going east to west that do help explain some of the growth variation, but a similar temperature trend is apparent from south to north and this had no effect on barbel growth. Thus, trying to explain the variability in barbel growth is not straight forward, but this is important to understand if there is a desire to promote the restoration of the optimal conditions in our rivers for barbel growth.

> "We can be confident in stating barbel are highly mobile in rivers and require very varied habitats for the requirements of all their lifecycle"

A further component of our work has been looking at the influence of inter-specific competition on barbel growth in situations of limited food availability and restricted habitats2, as may be found in some lakes stocked with barbel. Previous work on barbel growth in lakes in the early 2000s revealed that in lake fisheries where carp were also present, barbel growth was inhibited3. The work and analyses that we have recently completed has now shown that the growth of barbel is not only inhibited in carp presence, but also when they are present with any bottom feeding fish. Thus, where there is a fish community comprised of bottom feeding species in high population densities and there is limited food availability and space, then barbel growth rates will be significantly reduced, irrespective of the identity of their competitors.

So to return to the original question of 'how do you develop a scientific understanding of barbel populations when it is difficult to even sample their populations', then what we have tried to do so far is to understand what is and what is not currently known on their ecology. We can be confident in stating barbel are highly mobile in rivers and require very varied habitats for the requirements of all their lifecycle. Should river management schemes be put forward for approval that would restrict their movements, fragment their populations and lose valuable habitats then robust opposition ought to be made through appropriate channels. The difficulty of sampling their populations has resulted in little being known on the factors influencing their growth and annual recruitment rates. Whilst we have not yet been able to fully understand these processes, by trawling the country for data we have started to develop this scientific understanding and we now know, for example, that clean rivers with low organic inputs support faster growing and larger barbel. As individual fish are so long-lived then although we do not know the exact conditions required to produce a strong year class, we can say that when a strong year class is produced, that year class should support angler catches and the spawning stock of the population for many years to come.

So where do we go from here? There are still many knowledge gaps in our ecological understanding of barbel populations. For example, there is little current understanding of the impact of otter predation on barbel stocks and the fisheries they support. Whilst fish losses to otters are obviously apparent from around the country (Figure 2), are barbel now a common food item in otter diet? Has otter predation impacted the sustainability of barbel populations? Has it impacted aspects of barbel fishery performance? Can this be quantified in economic terms? These are crucial questions that require robust answers that I believe can only be really gained through applied and - ultimately - peer-reviewed research. We also have a limited understanding of the social and economic benefits that river barbel fisheries provide - just think of the money the Wye and Severn barbel fisheries bring to their local economies as they attract barbel anglers from across the country who then spend money locally on accommodation, food and bait. Understanding the values of these fisheries to local economies should then help provide more support for proposals to improve river habitats and connectivity to enhance the long-term viability of barbel populations and so the fisheries they support.

Irrespective of the questions being asked about barbel, completing research can be an expensive business. The type of research questions posed in the paragraph above would require some in-depth study and would be typically gained through PhD research. This tends to be a relatively cheap manner in which to complete high quality research over a three year period, but it is still an expensive process. Thus, if there is a desire to build strong research and conservation themes and associated questions whose answers will form the basis of the successful management of barbel populations and the fisheries they support then building networks of supporting organisations with the pooling of financial resources may be required. Whilst this may mean some of the questions may need to have relevance and resonance beyond barbel, for example for river cyprinid populations or aquatic environments more generally, a strong support network may also help build bridges between disparate groups. Irrespective, the work Pete and I have started this year has already provided an improved understanding of barbel ecology with some of the outputs highlighted above.

If you are interested in any of my fish-related research, then please visit my website: http://onlineservices.bournemouth.ac.uk/academicstaff/Profile.aspx?staff=rbritton

[1]Britton JR & Pegg J (2011) Ecology of European barbel Barbus barbus: implications for river, fishery and conservation management. Reviews in Fisheries Science 19, 321-330.
[2]Pegg J & Britton JR (2011) Effects of inter- and intra-specific competition on the growth rates of juvenile European barbel Barbus barbus used in the stock enhancement of UK fisheries. Fisheries Research 11, 8-12
[3]Taylor AA, Britton JR & Cowx IG (2004) Does the stock density of stillwater catch and release fisheries affect the growth performance of introduced cultured barbel? Journal of Fish Biology 65, 308-313

REVIEWS

Skee-Tex Barbel Trekker Boots

- User report
- Test Period over 2 years

The best thermal boots I have ever owned are my original Skee-Tex moon boots, very warm, comfortable and hard wearing. So when the team at Skee-Tex released a lightweight waterproof walking boot I liked what I saw so purchased a pair.

Over 2 years later they are still going strong and show little signs of the hard use they have had. Constructed with a suede and mesh upper complete with a 100% waterproof membrane and a tough rugged rubber sole, they fit my requirements well.

In all but the coldest conditions these are my first choice of footwear for a day's fishing, worn with a good pair of socks they are warm and because of their lightweight construction they are comfortable to wear. The rubber sole has good grip in both rocky and muddy conditions, having used these in Holland and on the Tidal Trent to clamber over the flood defence rocks, I am more than happy with how they handle the terrain. Rocky and broken ground can be hard on both footwear and ankles the Barbel Trekker show no signs of splitting at the seams or cracking of the soles, I have also on many occasions been glad of the protection they offer against a twisted ankle.

To keep mine in tip top condition I try to wash off any mud before it dries on and afterwards allow the boots to dry naturally and I have on a couple of occasions given them a spray with a footwear waterproofer. In all honesty they look as good now as they did when they were new

Verdict: Hard to fault after 2 years of hard wear.
Performance: 9/10
Durability: 10/10
Value: 8/10
Dislikes: If I had a choice they would be in a darker colour, £45 might seem a bit steep but for such a comfortable hard wearing and durable boot that's not bad value for money.

Ade Kiddell
November 2011