Wild Broodstock Schemes: A Good Idea?

For many river-angling clubs, there is an enduring feeling that supplemental stocking of trout is required in order to provide sport for rods.

Where extensive catch and kill angling is routinely carried out, this may well be true. In those circumstances the best currently-available compromise will be to stock with appropriate numbers and sizes of sterile (triploid) fish (for more detail on the rationale for this, see the information on this dedicated WTT page: http://www.wildtrout.org/content/trout-stocking).

However, there are a large number of anglers who do not regularly take fish for the table, instead, accepting that the wild fish are a valuable resource to naturally support a fishery. Similarly, for many, the prospect of farmed fish with little connection to the river-systems into which they are released detracts from the angling experience. In these circumstances, a seemingly ideal solution presents itself: "Why not strip native fish and rear their young as a means of boosting the population of our river(s) with fish of the local blood-line?". On the face of it, this seems the perfect solution. However, as with many things in nature, there are a lot of hidden complexities and pitfalls that can actually harm rather than help your fish populations.

Broad-scale problems:

Number of eggs or number of alevins (baby trout) <u>does not</u> = number of adults

The idea that boosting baby trout numbers will result in more adult fish depends on whether there is a spawning habitat bottleneck on your river. In rivers that have wild fish in them, this is very often NOT the case (i.e. rivers lacking sufficient spawning habitat could not support an adult population with the *surplus* to provide wild brood stock). It is extremely common for the numbers of adult fish to be limited, instead, by the availability of good JUVENILE and good ADULT habitat. Even where wild egg survival is relatively poor (e.g. many chalk-stream environments), there is often a compensation in the form of enhanced growth rate and survival in rich juvenile and adult habitat. Furthermore, the trout's breeding strategy allows for the (inevitably) massive mortality within the first year of life (typically fewer than 5% of hatchling trout survive their first year). Consequently, the number surviving the first 12 months is more strongly influenced by habitat characteristics and predation pressures than the raw number of alevins – as long as that initial number is above a minimum threshold.

Taking eggs and milt from wild fish removes the offspring that those fish would have produced all by themselves in the wild

This is not often factored in to the equation when examining how numbers of baby trout are being "boosted". As outlined in subsequent paragraphs, this loss of breeding in the wild becomes even more significant when comparing how well hatchery-reared versus naturally-spawned juveniles survive in the wild.

Wild brood fish often die when held in hatcheries

The factors that make fish well-adapted to life in the wild are different from those that are favoured in captivity. Consequently, a large proportion of the captured wild fish can die before they can have their milt or eggs harvested. If wild fish were all perfectly "ripe" on exactly the same day, it would be possible to catch them and strip them at the riverside in sufficient numbers. Unfortunately, the variation in dates over which fish are ready to breed means that they often need to be held after capture until they come into breeding condition. The combination of taking breeding fish from the river and the potential for death of adult fish held until they ripen means that it is very easy to end up with fewer fish in the river. This process also crosses fish that would never naturally breed together…

Fine-scale problems:

Breeding by natural mate-choice is significantly different from artificial fertilisation

In order to avoid the problem of mating close relatives together and increasing the numbers of offspring carrying damaging pairings of genes (inbreeding), artificial mating needs to combine eggs and milt from many males and females. Not only that, because it is impossible to catch the precisely-desired ratios of male and female fish from the wild, the numbers of fish taken from the wild soon escalates.

In the wild, fish avoid problems of inbreeding by *using sight, smell - and other factors such as spawning timing - to avoid potential partners with an unfavourable genetic match*. There is, consequently, a stark contrast between offspring from artificially-mixed milt and eggs (which cannot account for hidden optimal genetic compatibility of parent fish) versus pairings determined by genetic compatibility. Artificial mating cannot produce offspring that are as closely adapted to survival in a particular stream compared to natural, evolved, mate choice.

Even worse, you may combine fish that would otherwise never breed together (e.g. "gillaroo" and "ferox" trout) and dilute-away unique life-history characteristics. The pitfalls of intervening in natural mating systems when we are unaware of the factors that determine crucial characteristics exist in many areas of nature (e.g. lessons from the black robin assisted breeding project: http://bit.ly/1k8TgJ1). Consequences of the process of *inadvertently changing the characteristics of offspring* (see http://bit.ly/1k9KHgX for evidence in fish) - even when only wild parents taken from a stream are used as brood stock - are explained further in the next paragraph.

The pattern of mortality in a specific stream produces local adaptation

Wild-spawned fish that turn out to be poorly adapted to survival and reproduction in the stream tend to perish before breeding. By "allowing for the survival of the not-so-fit" in the hatchery (which is compounded by the higher proportion of eggs that survive and hatch in captivity) the wild streams are flooded by a greater number of competing juvenile fish. This has a twofold effect:

1. *On average, there is a lower proportion of well-adapted fish in the stream*
2. *The few well-adapted fish must compete with a greater number of rivals (even though those rivals are ultimately much more likely to die before they can breed)*

This explains why just boosting the numbers of artificially-bred fish is unlikely to boost the size of the adult fish population. Not only do you risk artificially breeding valuable wild characteristics out of existence at the hatchery stage, there is then a risk of placing a greater strain on the smaller proportion of well-adapted fish that remain in stream. It also explains why it is a poor idea to put lots of maladapted fish into a stream and expect "nature to sort them out". Territorial fish (like trout) expend energy defending their "patch". Exposing well-adapted trout to more (draining) contests with competitors - who go on to perish anyway - will hinder the prospects of even "fit" fish. This is why trout populations often flourish when stocking ceases.

Natural selection works more like whittling than joinery – it shapes things by taking away rather than building up. What you are left with depends strongly on the amount and quality of raw material at the beginning of the process. There are very few circumstances where wild brood stock schemes will boost in-stream populations of wild fish. In other words, if there are sufficient numbers of wild brood stock from which to strip eggs and milt, their breeding efforts are better maintained within the natural habitat of the river in which they must ultimately survive. *Management efforts are, by the same token, best directed at maximising quality of (and access to) spawning, juvenile and adult habitat.*