A review and perspective of the Fish Surveys carried out on Loe Pool and the Cober River and its tributaries

Possibly the starkest, and most disappointing, result of the 2015 ECON Fisheries Survey and Review of Loe Pool was that, for the first time in all the surveys that have been carried out on the Pool, there was no recording of a brown trout in Loe Pool.

Although the survey does not provide incontrovertible evidence that brown trout have been totally lost from the Pool, it does indicate a very worrying trend over the last 20 years.

In previous surveys 70 trout were recorded in 1998 and only one in the 2006 EA seine net survey. The 2006 EA study was specifically aimed at sampling the open water of Loe Pool. Anecdotal information supports the lack of trout in the Pool, as a local licence holder, retired local vet John Head, had failed to catch a brown trout on the fly for at least two years up to 2015.

The years of eutrophication in Loe Pool which peaked in the late 1960's and 1970's would appear to be a major problem and anglers reported mortalities of up to 2,000 fish (mainly brown trout), during peak algal blooms in the late 1970's. The warm summer and drought of 1976 was particularly bad and large quantities of trout could be seen being washed out of the adit outlet on Loe Bar in the summer months.

The NT has also suggested that heavy fishing of the River Cober during the spawning season may also have contributed to the decline (See Wilson & Dinsdale, 1998).

The twenty year period of fish surveys in which the decline of brown trout has been monitored unfortunately coincides with the efforts of the Loe Pool Forum to improve water quality in the Pool. Reasons for the continuous decline and the non-recovery in the brown trout population in the Pool are difficult to ascertain. Apart from the period of intense eutrophication hey could include:

1. **Removal of spawning habitat** - In recent years the Lower Cober has been lowered by dredging which removed much of the natural channel floor gravels and small rocks which formed part of a natural riffle and pool system which re-established itself following the straightening/canalisation of the channel over a one and a quarter mile section in 1947 below Zacharys Bridge on the Helston to Porthleven road. Similarly, the Carminowe and Penrose streams no longer follow a natural route and have been dredged.

   The dredging removed the **Redds**, the nests made in the gravel by spawning fish and much of the Lower Cober channel is now finer silt and mud.

   Redds are clean oval patches of small to medium-sized gravel which are typically 60-100 cms wide and are small depressions and mounds in the gravel of the riffles which indicate nest sites and eggs.

   The female brown trout prepares a redd by fanning it with her tail. This cleans out the fine clay and silt and algae in the gravel and creates a space for the eggs to fall in. It also ensures that the eggs get adequate oxygen from the running water and any mud/clay/silt sized material or dirt is removed which could suffocate the eggs.

   The female deposits the eggs onto the redd and the male brown trout then fertilises them. They are then covered up by gravel by the female. The strongest male occupies the nest with the female after competing with other trout. After breeding is finished the female leaves the area and the male will remain in the area for some time protecting the nest.

   The odds of an individual egg surviving to adulthood are very slim. Almost everything in the water wants to eat the eggs and small trout. Potential predators include smaller fish, especially the Perch and Rudd which are both carnivorous, and even some insects such as dragonfly nymphs will consume trout eggs. For the first days after hatching, the young brown trout (fry) derive their nutrients from their large yolk sacs; they then feed on small arthropods, such as insect larvae. Once the brown trout reach a few centimetres in size they have a much greater survival rate.

The EUCN report highlights the lack of redds in the Lower Cober and the need to reinstate/encourage their presence in the Lower Cober channel.

The **large number of dogs** that are encouraged by their owners to walk and play in the channel bed between the Causeway bridge and Zacharys bridge could also be a major disturbance to the whole brown trout spawning process, even if the redds were to reappear.

2. **The introduction of Perch in 1994/1995 and Roach in 2006** - these two fish, now much more abundant than either the brown trout or the **Rudd,** compete for habitat, and, as mentioned, in the case of the Perch, may be a major predator of young brown trout.

   Rudd (Scardinius erythrophthalmus) have been present in Loe Pool and the Cober since the 1940's, having been introduced from Coronation Lake (the boating lake) in 1943.
   Perch (Perca fluviatilis) have been recorded in Loe Pool since 1994 and are thought to have colonised the lake after escaping from a coarse fishery upstream of Helston (Environment Agency 1998, Wilson & Dinsdale 1998).
   More recently, in 2006, **Roach (Rutilus rutilus)** have been recorded in Loe Pool suggesting they have either been introduced deliberately or escaped from another water body.

   Along with these fish species found in Loe Pool, the **European eel (Anguilla Anguilla), minnow (Phoxinus phoxinus)** and the **three-spined stickleback (Gasterosteus aculeatus)** have been recorded in the River Cober (Cornwall River Project) and therefore are also likely to occur in Loe Pool.

   Unfortunately, the poor water quality in the Cober and algal blooms favour species other than brown trout, such as the perch and rudd. Where water quality is good, brown trout should spawn very successfully.

3. **Mining activities** – these had, and still have, considerable environmental impact on the water environment in the Cober and its tributaries. The Cober carried mine waste comprising of sands, silts and tin slimes, which were deposited on the Cober flood plain, delta and bed of Loe Pool. This was particularly intense from 1920 to 1938, when the lake was virtually being used as a settling pond with 80 cm of silt being deposited in the last seven years of mining operations. Tin streaming has also taken place in the floodplain deposits all the way through the Cober river basin and its tributaries for centuries, leading to the comment '…foul with mining water. There was no fishing in the Cober, but when it reached the Loe it seemed to deposit its refuse. It would have been a lovely river without the mines. There were only one or two streams near Helston unpolluted by the mines…' (Collier, 1899 p.120)

   Porkellis Mine stopped operating in 1938, possibly following pressure from the Rogers family. They owned many of the mining rights in the Wendron and Porkellis area, and had objected for many years to the levels of pollution in the Loe and its impact on the trout fishery in the Pool. The Rogers family is said to have bought up the remaining mining rights to prevent further mining from taking place, or agreed to a cash settlement. The increase in sediment load and deposition from tin streaming and mining sediments has led to a one third reduction in the Pool area to its current 50 hectares.
4. **The impact of agriculture** - the agricultural economy in Cornwall has undergone many changes in the last 70 years. These changes were considerably accelerated by entry into the EEC/EU and the implementation of the Common Agricultural Policy. There has been an increase in farm specialisation, intensification and farm diversification. Specialisation in particular crops or animals and the intensification of farming processes has led to an enormous increase in the use of artificial chemical fertilisers, pesticides and herbicides along with increased slurry production all of which have found their way into the fluvial environment of the Cober, its tributaries and the Pool.
5. **Urban pollution** – run off from the **Helston urban drainage network** has produced not only physical pollution through plastics and polystyrene, but chemical pollution from road residues, oil

and petrol spills and dumping of these into road drains. All these may have had an impact on the fish population and especially the more sensitive brown trout population.

The issue of **combined sewer overflows (CSO's)** is still unresolved A combined sewerage system, accommodating both foul sewage and storm water within the same pipes, currently operates across the majority of Helston (Wilson & Dinsdale, 1998). During times of dry weather the sewage is treated before discharge. However, following a storm event, overflow structures limit the volume that is carried to the **Sewage Treatment Works in Helston** and the excess, potentially a mix of storm water and untreated sewage is discharged directly into the River Cober. CSO's are usually designed to operate when the current exceeds six times dry weather flow, but there is currently no information available regarding the discharge frequency of untreated sewage into the Cober (P. McNie, Principal Scientist, SWW, pers. Comm to Dr Timothy Walker). The EA Environment and Planning Team explain that CSO's are difficult to model as no data is available on volumes or how many times CSO's are set out (JD, 2017). Further, when sampling in wet weather any event discharge would get diluted so proportionally a CSO event would look less significant. Therefore, the role of CSO's remains an unknown factor in the pollution of the Lower Cober and Loe Pool. Investigation into CSO discharge in Helston is an action point for 2017-18. This investigation will include looking at the connection between Helston CSO and SWW's storm overflow tanks.

Discharge from the **septic tanks** in the catchment is still an unquantified potential source of pollution. Due to relatively densely populated rural nature of the Cober catchment, septic tanks may contribute a significant portion of the Phosphate budget (Dinsdale, 2009).

6. **Illegal fishing** – the impact of this is almost impossible to quantify though it has been going on for a long time with both nets and rods using spinners and the case of the drowning of an otter in an illegal net in August 2018 has highlighted that it is still a problem.
7. **The extension of the adit outlet to the sea** – this took place in 1986 when the Water Authority provided the adit with a smooth bore concrete lining to improve its flow. They also lengthened the tunnel by 100 metres and provided a sluice gate which was meant to control the water flow and the level of water in the Pool. The sluice gate was rendered inoperative almost immediately, but by putting it into place it cut off access to the Pool for any migrating fish species.

Migrating fish may have included **Brown Trout**, the **European Eel** and, possibly, **Lampreys** – though these have not been recorded in the Cober. This may be due to them being such a secretive fish.

There has been substantial decline, 90-95%, in the **European Eel** population across wide areas of its geographic range during the last 45 years due to a range of threats facing freshwater eels at multiple life history stages. An analysis carried out as part of the IUCN Red List indicates that the European Eel population is currently at its lowest historical level of 1-10% the population of the 1980s, (ICES WGEEL 2013). Further, there is concern that due to the period of time eels spend feeding and growing, prior to silvering and migrating to spawn, that eels may continue to decline. Locally, an eel passage at Chyandour Stream near Penzance has been made possible by the installation of a **bristle board eel pass** and similar work on **fish and eel passages** have been investigated at the local Trevaylor Stream near Penzance – links below.

https://www.cornwall.gov.uk/media/28181185/chyandour-stream-report.pdf

https://www.cornwall.gov.uk/media/28181201/fish-passage-at-penzance.pdf

https://www.cornwall.gov.uk/media/28181181/trevaylor-stream-report.pdf

Lampreys, the world's oldest living vertebrates, are snake-like creatures with a circular disc of razor sharp teeth instead of jaws. The largest of the UK lamprey species - the sea lamprey – can grow up to 1 metre in length. Once a common sight in the UK, river and sea lampreys are now endangered across Europe. The pollution caused by mining, along with the construction of weirs that blocked their migration, had a devastating effect on their numbers.

Lampreys are slowly returning to their old habitats, thanks to the lowest levels of pollution for more than 100 years and the Environment Agency's work to remove some river structures like weirs. Where barriers cannot be removed a range of innovative techniques are being trialled, including the fitting of lamprey 'tiles', to help them navigate back to their old spawning grounds. The Loe Pool Forum could encourage the return, if it is not already there, of the Lamprey.

Lamprey tiles are low-cost, low-maintenance tiles with broad cones that enable lamprey to squirm upwards using their sucker-like mouths to anchor themselves. It is hoped that lamprey tiles could help in many more rivers.

Historical data and background to the fish in the Cober and Pool

There is not all that much historical data on the fish populations in Loe Pool, although it is thought that it's mainly been trout, eel and possibly sticklebacks up until the last century.

In 1943 **Rudd**, which is a type of coarse fish, were introduced to the Pool. This was followed by **Perch** in 1994/1995 and **Roach** in 2006.

Rudd are known to have originated from Coronation Lake where they were introduced to reduce the amount of weed. However, the outlet from the Lake to the Cober River allowed them to immediately colonise the Cober and the Pool. It is not clear how the Perch and Roach got into the Pool.

Rudd prefer clear waters rich in plants. They also feed on aquatic vegetation when the temperature exceeds 18 °C. They hunt for living prey in the upper levels. They prefer mesotrophic waters, while the roach is sometimes found together with the perch in waters that are nutrient poor. Rudd appear to prefer non-acidic water.

Rudd prefer shallow weedy areas in lakes and river backwaters, where mature females lay up to 200,000 eggs on submerged vegetation. Young Rudd eat zooplankton, aquatic insects, and occasionally other small fish. Mature Rudd, which are about 45cms in length and weigh over 2kgs, eat mostly aquatic vegetation. Rudd can consume up to 40% of their body weight in vegetation per day, as much as 80% of which is discharged as waste, releasing nutrients into the water column. They can tolerate a wide range of temperatures and water conditions, including eutrophic or polluted waters.

Their maximum lifespan has been reported as 17 years. Sexual maturity has been reported at 2–3 years

Perch are typically greenish in colour with dark vertical bars on its sides with a red or orange colouring in the tips of its fins. They are a carnivorous fish and feed on smaller fish, shellfish, or insect larvae, but can be caught with nearly any bait. They commonly spawn during the spring, when the females lay strings of eggs in covered areas such as near branches or underwater plants.

Roach can reach about 35 cms in length. The body has a bluish silvery colour and becomes white at the belly. The fins are red. Young specimens have a slender build; older specimens acquire a higher and broader body shape. The roach can often be recognised by the big red spot in the iris above and beside the pupil. Colours of the eye and fins can be very pale, however, in some environments. It will feed at any depth, although its preferred food sources tend to be in shallower water. It tolerates organic pollution and is one of the last species to disappear in polluted waters.

In most parts of its distribution, it is the most numerous fish and is a shoaling fish. It mostly inhabits freshwater ecosystems that are vegetated, because larval and young fish are protected by the vegetation and the mature fish can use it for food. The common roach eats a wide range of foods, from plant material, bottom-dwelling (benthic) invertebrates, to worms and maggots

Roach can most easily be confused with the common Rudd. They can be distinguished by these characteristics:

The common Rudd has a more yellow/greenish or golden colour. The back fin is placed more backwards and between the tip of the ventral scales and the first ray of the anal fin are only one or two scales. The roach has four or five scales there. The mouth of the Rudd is more upturned and the head appears sharper

It is thought that the Roach and Perch spawn in Loe Pool and spend their first year in the lake, before migrating to live in the Lower Cober. In the lower sections of the Cober dense shoals of small Roach have been observed in recent years, including the summer months of 2018.

While there is a sparse amount of quantitative historical data on fish populations the National Trust gathers some really interesting information from local anglers. As part of the anglers permit the National Trust issue they are asked to report back on how long they spend fishing and what they catch. In the 1970s anglers were catching 3 to 5 trout an hour; by the 1990s it took 4 or 5 hours to catch a single trout, and the fall in catch rate has continued. In 2003-2008 it took almost 9 hours on average to catch a trout in Loe Pool.

In the last 15 years water quality has dramatically improved; nutrient levels in the water are now 75% lower than they were and, consequently, the algal blooms have disappeared.

In 2014 the National Trust commissioned ECON Ecological Consultants Ltd, with funding from Natural England's Conservation Enhancement Scheme to investigate whether the native trout have reacted to the cleaner water and also how the numbers of the recently arrived coarse fish had changed.

Trout caught in Cober during survey

Unfortunately, ECON did not catch any brown trout in the Pool during their survey. However, the consultants thought that some large mature fish are still present in the deeper open waters. The fish consultants did find good numbers of small young trout in the River Cober around Helston.

On a more positive note, the density of brown trout in the Lower Cober was greater in 2014 than in 1998. This could be a sign that the fish population are expanding or, as ECON believe, just that the trout remain in the river. These fish are all part of the same population and could move into the lake at any time. It just seems they prefer to take refuge in the river for now. It's clear though that the elevated nutrient levels, and consequent eutrophication, have had a huge impact on the trout and that they are still not thriving in the lake itself yet.

Roach caught in Cober during survey

With regard to the other species, it's the Roach which are now dominant, while the Perch are still present in reasonably high numbers, the Rudd population is small. This is because Roach are particularly efficient at selectively predating on large zooplankton in turbid water, whereas trout need clear water in order to see their prey.

We are all aware that Loe Pool is still in an advanced stage of eutrophication. The standing water unit of the SSSI is currently in "**unfavourable – no change'** (NE, 2016); both the ecological and chemical status of Loe Pool are classified as **'Moderate'** under the 2015 Water Framework Directive (WFD). Eutrophic standing waters are also a priority habitat under the UK Biodiversity Action Plan (JNCC, 2011).

We also know that Outcome 1A of the Government's 'Biodiversity 2020 - A Strategy for England's Wildlife and Ecosystem Services' is for 90% of priority habitats to be in **favourable** or **recovering** condition and at least 50% of SSSIs in favourable condition; while maintaining at least 95% in favourable or recovering condition. Also, that the National Trust has a strategic objective to improve the condition of SSSI and priority habitats within its ownership. The WFD target is for all waterbodies be in **'good'** condition by 2027.

The future of the Pool's trout relies on a healthy **macrophyte (aquatic plants) community** to oxygenate the water. However, macrophytes rely on sufficient light to get rooted in the sediment and this is still a challenge because of the turbidity from diffuse nutrient and sediment inputs. The increase in contract farming where more fields in the catchment are being used for arable farming may be further adding to this problem as increased erosion from these fields will be delivering more suspended sediment into the Pool. It is hoped that if we can continue to get closer to the water quality threshold a climatic factor, such as a particularly warm spring, could trigger germination from the macrophyte seedbank and in doing so enable the trout to populate the lake once again.

Brown Trout in the River Cober and its tributaries

Between 1986 and 2012 (current extent of dataset) the EA conducted brown trout surveys at a total of 15 sites within the River Cober and its tributaries.

The results of these surveys indicate that when records began both brown trout fry and parr were present in good or excellent densities throughout the system.

In 1986 only three sites of the 13 sampled were classed as poor or worse for fry, dropping to two sites out of 13 in 1992.

In 1995, 11 sites were sampled, with two sites, albeit different ones, again being classed as poor or worse for fry. The highest value of 174 brown trout fry per 100 m², was recorded in 1986 in a tributary of the Cober - the Sithney Stream, also known as the Mellangoose Stream - that joins the main river to the west of Helston. This stream clearly acts as a for the system nursery, with the two sites sampled consistently classified as 'A' with estimates of >50 per 100 m² recorded on every occasion.

Unfortunately, the intensity of sampling then dropped significantly, with surveys seemingly only conducted at between one and three sites during the five monitoring years between 2004 and 2012.

Only one site, the newly surveyed Boscadjack (SW 673 306) several kilometers north of Helston, has achieved 'A' classification for fry since 2004.

River Cober fish removals

In addition to the fish surveys between 1986 and 2012 there have been two fish removals in 1998 and 2014.

In 1998 a fish rescue was carried out on a stretch (1.3 km in length) of the River Cober prior to its dredging. The dredging was undertaken as part of essential flood defence works. Brown trout, perch, eel and three-spined stickleback were the only species recorded and removed. Brown trout were by far the most dominant species present – 193 fish, followed by perch - 95, eel – 46 and stickleback - 2.

In 2014 the EA conducted a fish rescue in the town section of the River Cober (adjacent to Coronation lake) due to scheduled dredging activity. In total, 19 brown trout fry, 15 brown trout parr and three eels were found.

Also in 2014 a survey of Loe Pool and the River Cober was conducted between 30th September and 2nd October 2014 by ECON. Five species of fish were captured in Loe Pool. In order of abundance these were, roach - 372, perch - 30, rudd - 12, eel - 3 and a single three-spined stickleback.

ECON suggested that when their sample population was put into the context of the whole Pool that there was a minimum whole lake population (based on a Pool area of 56.3 hectares) of around 84,000 fish in October 2014. **A key issue was the complete lack of brown trout**.

Possible ways forward

The management options put forward by ECON are being acted on currently to a greater or lesser degree with the **fish exclosures** being a possible first step. The exclosures could possibly allow us to monitor how the whole Pool might be put into recovery.

We may also like to investigate the introduction of gravel sized material into the channel in the dredged section below the Helston Sewage Works outlet to re-establish redds in this section. Similar projects have been carried out on the River Stiffkey in North Norfolk for example.
https://www.wildtrout.org/content/anglian-rivers-sea-trout-project#Stiffkey%20gravel

Riverfly projects are in operation in parts of the catchment and it would be logical for these need to be rolled out across the whole catchment – starting with the tributaries discharging directly into the Pool. Calum Macintosh and David Davies, by coincidence, are attending a Riverfly training day on the day before the next committee meeting so can feedback.

http://www.riverflies.org/morph

However, it may be more pertinent to establish why the Sithney stream tributary manages to provide such a high level of brown trout fry and YOY fish, as both a spawning and nursery location in comparison to the other ten major Cober tributaries. If something were to remove this particular site as a spawning and nursery site we could find the whole catchment and Pool in a perilous state. The Sithney sub catchment does need closer investigation as to why it is so successful in comparison to all the other sites in the catchment.

In this context, a new fish survey is fairly crucial to assess the state of the fish population on the catchment and Pool as the ECON survey was carried out in 2015. There was a thought that there may have been undetected large brown trout in the Pool at depth. It is possible to detect large fish down to a depth of 15 metres, well below the Pool's 8.2 metre depth, using green beam LiDAR – see link below – if we had access to this form of technology!

https://www.fondriest.com/news/using-lidar-in-the-hunt-for-an-invasive-species-in-yellowstone-lake.htm

David Davies Oct 2018