

## The complexities of water quality management for WADAA

The challenge for WADAA during the summer months is maintaining a good level of water quality to support aquatic life, obviously including the fish, in order to provide the best possible sport.

Not only do we have differences between venues, but also in the requirements of different fish species. In general, game species are far more susceptible to oxygen levels than coarse, and as such, our focus in the summer has primarily been on trout venues – however, we can't take our eye off the coarse venues either.

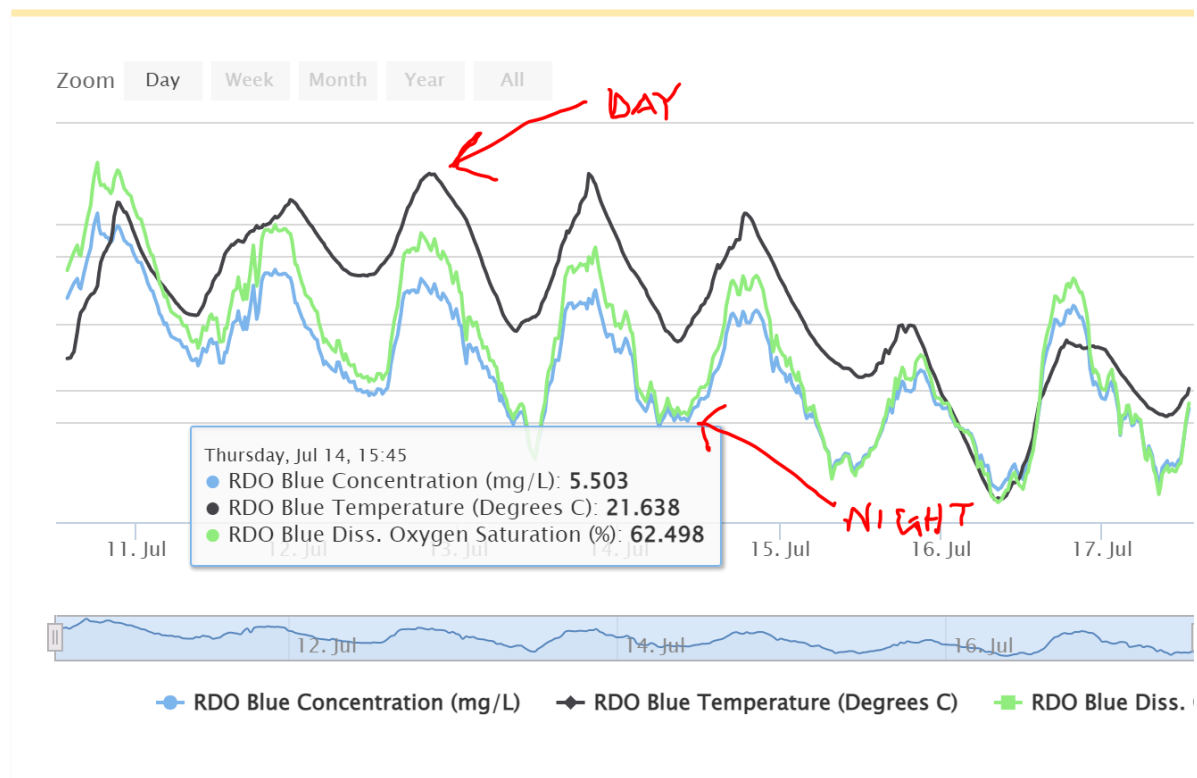
Over the past few years we have invested heavily in water monitoring and aeration solutions. The aim of these is to allow us to manage conditions over the longer term, hopefully preventing catastrophic events occurring.

These techniques have been matched with a plan to improve the quality of the entire aquatic environment, in order to make venues more naturally resilient in response to a warming climate.

However, there are often conflicting parameters and we have to try and manage our way through these as best we can.

## Weed

Weed is a natural oxygenator as it photosynthesises in sunlight. The effect of this can be seen in what is called 'diurnal fluctuations' – dissolved oxygen (DO) increases during the day and reduces at night when there is no sun.



This explains one of the reasons why low oxygen events are usually worse at night – and why direct solar powered aeration is of little benefit.

So in this case, weed is a vital factor in maintaining oxygen levels. However, excessive weed also makes fishing harder (we probably get more complaints of weed on our fisheries than anything else). This is

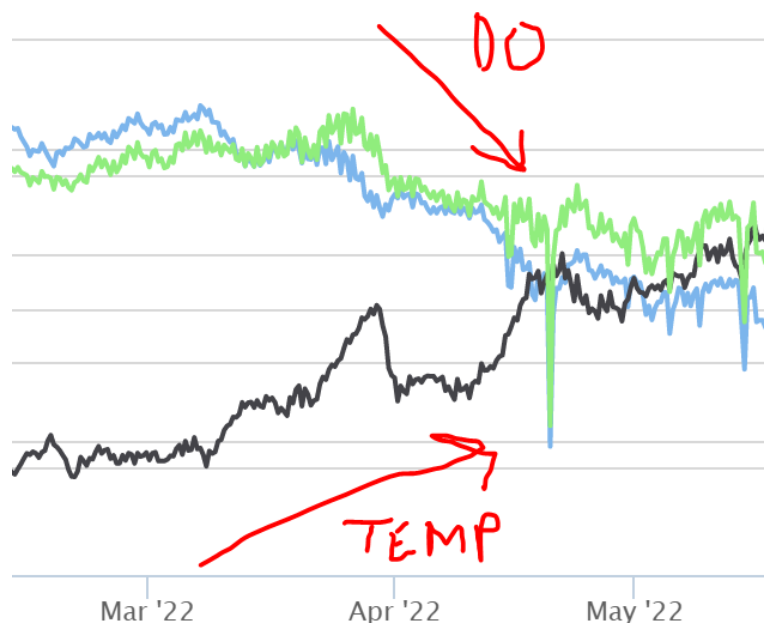
a challenge; how to manage weed to allow good fishing whilst maintaining a natural oxygenator.

A further complexity is that the act of weeding disturbs the silt layer, releasing bacteria into the water. These bacteria rapidly consume oxygen, further lowering levels.

Where possible, we have increased controlled planting ie in the margins, lily beds and floating islands, to offset removal of the plants (such as Canadian Pond Weed and Potamogeton) that are most problematic for angling.

### Water Temperature

The oxygen carrying capacity of water is to some degree, a factor of temperature. The warmer the water, the less oxygen it can hold. It is very easy to see this relationship in our measurements:



We don't have a great deal of control over temperature, but shading and bankside cover does have a beneficial impact. Again, removing all the trees from around a venue helps casting, but also removes the shade and cover.

In simple terms, once water exceeds around 20 degrees, trout stop feeding. Above 22 degrees they are in total survival mode, above 25 degrees and you'd expect significant mortalities.

## **Algae**

Friend or foe?

As a plant, algae adds significantly to the DO levels during the day. Additionally, it creates water turbidity which greatly improves coarse fishing (the fish are more confident and less aware of predators, including anglers!)

Algae also significantly reduces light penetration, therefore cutting off the supply of a critical ingredient of weed growth.

Increasing turbidity is one of the tools which we have very successfully deployed in the last 3 years on our coarse waters to combat heavy pond weed infestations.

Additionally, some studies suggest that fish growth rates are far higher on venues with high algal growth:

<https://www.youtube.com/watch?v=G9c-Fq3qDQ>

However, as ever, things are not simple. Heavily coloured water is not desirable on game venues. And, oxygenation delivered by the algae has to be balanced with a reduction of oxygenation resulting from reduced weed levels.

But of greater concern is what happens when it goes wrong. Algae is susceptible to rapid die-back when climatic conditions suddenly alter – such as a summer thunderstorm. When this occurs there are two immediate and catastrophic effects:

1. There is a large reduction in oxygen producing algae (it dies) – fish had become reliant on this source of production.
2. The dead algae then becomes ‘food’ for bacteria. This causes a massive bacteria spike, resulting in a rapid depletion of available oxygen.

If this happens to occur at night, the impact is further exaggerated, as any surviving algae (or plants) are not photosynthesizing in the dark.

Such crashes can be seen by rapidly clearing water – the green algae no longer suspended in the water column.

Algae growth is triggered by sunlight and nutrients in the water (nitrates and phosphates). These nutrients have 2 usual sources, fertilisers and pollution (usually toilets, septic tanks etc). These levels can be controlled either by reducing the sources or by filtering them out. Though there are mechanical filtration systems available, they are not practical for us. As such, we can achieve a filtering effect

by intercepting incoming water through reed beds. You will see that WADAA has greatly increased margin planting, particularly around inflows, on its venues in order to reduce nutrient loading.

Again, there is a compromise. Inflowing water maintains water levels (more water, less temperature, more oxygen) and therefore is good for fisheries. However, inbound water flows, particularly those which pass through populated or industrial areas are also high pollution risks. Additionally, septic tank discharges from homes or sites such as caravan parks also carry this risk if treatment equipment is not properly specified and maintained.

The club has used blue dye (this is a harmless vegetable dye) on venues for the last 3 years. Blue dye reduces light penetration, reducing algae growth rates. We appear to have seen some success in reduced algal levels as a result of this approach in Farletonview. This is key given it was the likely cause of the major fish kill in 2019.

Barley straw has been used on multiple venues to good effect. As this straw rots it produces a chemical, hydrogen peroxide, which breaks down the algae. However, its effectiveness is patchy, though we have seen improving conditions at Bigland, Farletonview and Capernwray since its introduction.

As previously noted however, we stopped using these methods on the coarse waters, as the clearer water conditions had a detrimental impact on sport and also fed the rampant pond weed growth on venues such as Ratherheath.

## **Aeration**

Aeration comes in many different forms and is widely used in fisheries. However, the beneficial effects are very limited. The use of aeration is very much in managing a deteriorating condition rather than fixing the cause.

It is also complex, expensive and takes a lot of maintenance. However, during deteriorating conditions, it will provide 'safe-havens' for fish.

Aeration aims to increase DO levels by a variety of means:

### **Flow**

Creating flow creates a friction between water surface and air. This has a dragging effect, sucking oxygen into the water

### **Mixing**

It mixes the water, breaking up stratified layers. Often deep lying water becomes very de-oxygenated. A sudden mixing of this water (such as by a significant atmospheric event like rapid air pressure reductions during thunder storms), can cause steep dips in DO levels.

### **Oxygen addition**

By creating turbulence, oxygen is forced into the water, increasing the absorption rate.

WADAA utilizes different methods depending on the nature of the venue. Bigland, as a big, shallow water uses a large water circulator to move water down its length. The effects of surface agitators, such as paddle wheels, on this venue would be negated as a result of its size and the venue is too shallow to benefit from air diffusers.

Many of the WADAA coarse venues are shallow and silty. Aeration which disturbs the silt can have the opposite effect (as previously described). In this case, methods such as paddle wheels, which only effect the surface layers, are used.

There are other factors which also have to be taken into account. At Hall More on the coarse lake and series of air diffusers are used. Though not ideal due to water depth and venue shape, they have been selected because of their silent running. Noisier solutions, such as paddle wheels, would be inappropriate due to the proximity of the caravans. Constraints come in many varied forms!

So, as can be seen, the picture is very complicated, there is no single answer and the parameters are constantly moving.

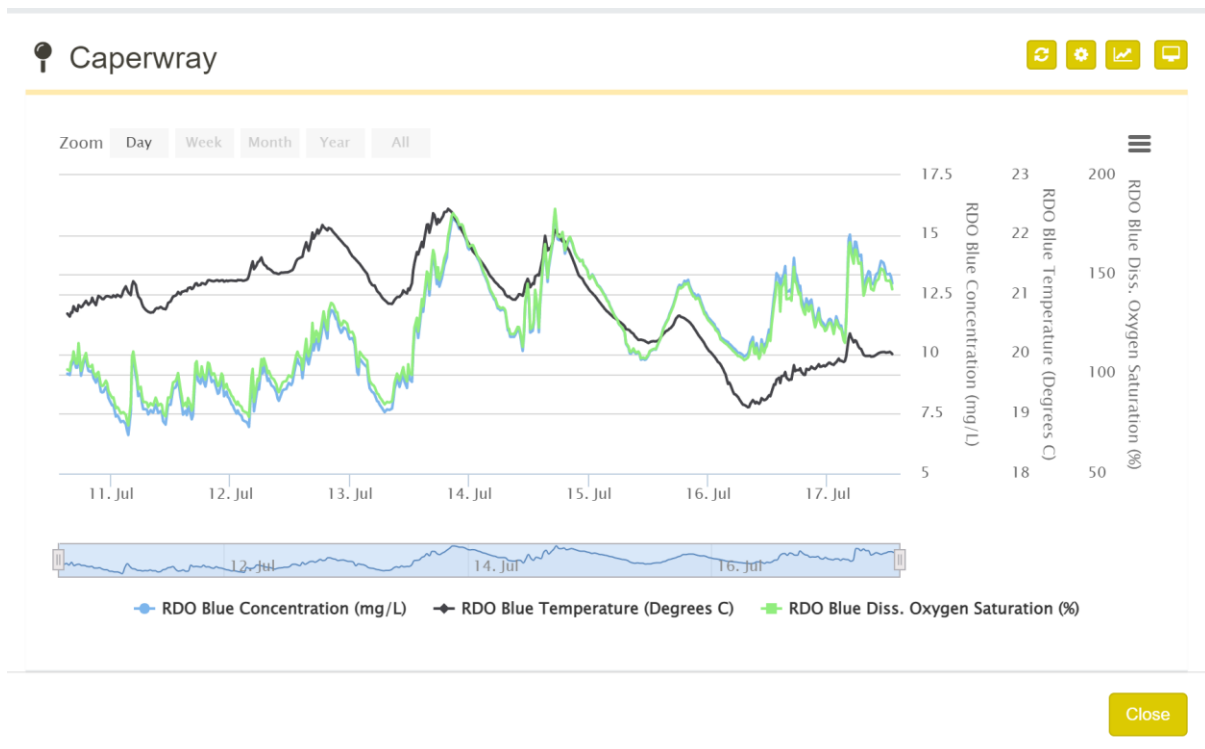
Using the data now available to us, we try to make the best decisions and these are reviewed on a daily basis. Throughout the summer this takes up a huge amount of time and effort, but is the difference between live and dead fish.



To finish, I can give you 2 real examples of the complexity.

Castlehead is a coarse water just outside of Grange-over-Sands and Capernwray is a trout venue near Carnforth, less than 10 miles away from each other.

## Capernwray



Water temperature 20 degrees

12.9mg/l DO

Saturation 143%

On the face of it, things look great, plenty of oxygen, temperatures good. However, there are warning signs.....

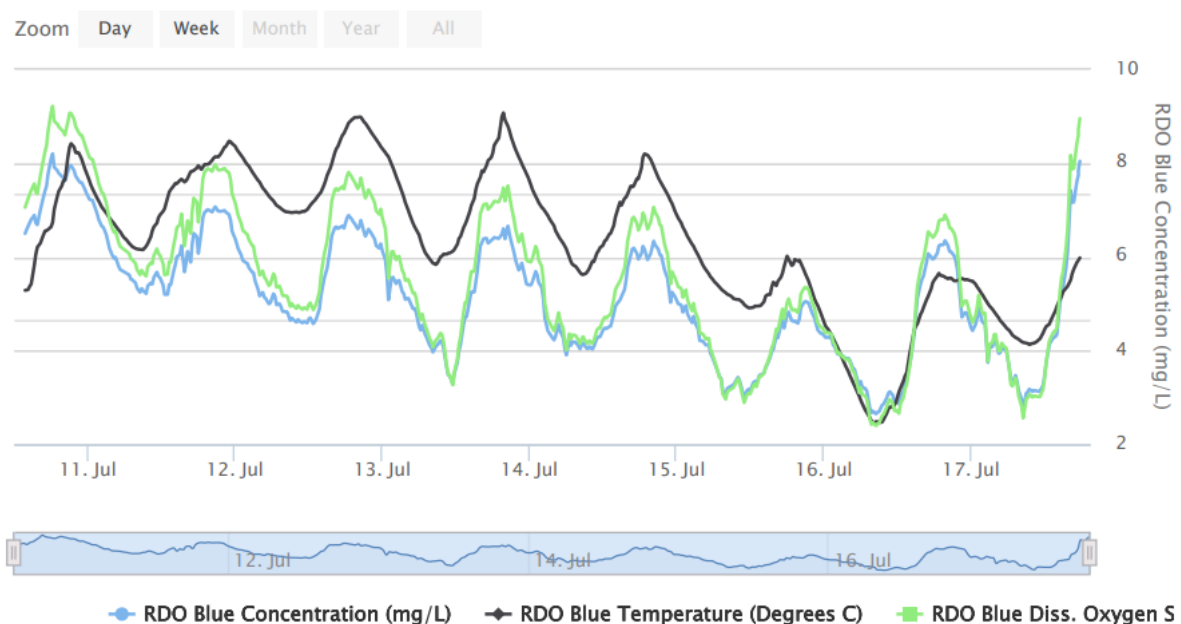
This venue has a constantly running inlet which maintains levels and keeps temperatures about 2 degrees below where they'd normally be expected to be. This is good!

However, flowing through farmland and a big caravan park area, it also brings higher nutrient levels. These are creating a high level of algae growth which is significantly elevating DO levels above what would be expected. Whilst this growth is maintained, there is no problem.

However, were we to get a large die back, triggered probably by an atmospheric event, we could see a catastrophic oxygen reduction.

On this venue we are currently trying to reduce the algal levels.

## Castlehead



Water temperature 20 degrees

2.75mg/l DO

Saturation 30%

These night-time figures are worrying low. We believe this is caused by large quantities of bacteria bound up in the thick silt layer. This layer was built-up during 15 years of uncontrolled weed growth (before WADAA took control of the venue)

Here we are taking steps to encourage algae growth to improve daytime oxygenation rates. However, this comes with an increased risk if we suffer an atmospheric event.....arghhh!

We also need weed growth to add oxygen to the water – whilst at the same time fully aware that uncontrolled weed growth caused the problem in the first place.....arghhh!

Furthermore, mechanically harvesting the weed (to allow better fishing) would disturb the silts which are responsible for the sub-optimal conditions we are currently seeing.....arghhh!

## Summary

These 2 examples illustrate how complex the overall management of water quality and the environment is, and we haven't even talked about the impact of stock yet.....

We are deploying every technique we can in order to maintain the best balance of all the parameters.

Sometimes compromises have to be made. When you may think:

- There needs to be more fish in here
- Can we remove that tree because it's getting in the way
- This venue is too weedy

there is very often a lot of other contributing factors being taken into account.

Summer is the critical time for these conditions and this year, it is looking like the next month is going to be key.

We can't guarantee that there won't be any issues, but we've done all we can to maintain safe environments, taking in the very best advice that we can.

Anglers are our eyes and ears. If you see anything strange:

- Significant changes to water clarity
- Distressed fish
- Dead fish

Please let the club know immediately.