

British Water Ski & Wakeboard believes that the introduction of Environmental Policy Notes (EPN) provides a framework for the development of new sites and for the continued use of existing sites and clubs. As our society becomes increasingly environmentally aware, we are confident that the EPNs will be of considerable benefit to water skiers, local authorities, the general public and environmental organisations alike. British Water Ski & Wakeboard hopes that the EPNs will go a long way to dispel many of the myths and prejudices that exist about water skiing and its environmental impacts.

British Water Ski & Wakeboard would recommend that the information within this document is used in conjunction with its codes of conduct. BWSW also administers the Ski Boat Driver Level 2 (SBD2) and recommends every driver towing a skier to complete the award which covers safe and considerate boat handling.

For the purpose of this document, the umbrella term Water Skiing implies all the related disciplines including:

- Slalom Skiing
- Trick Skiing
- Jump Skiing
- Wakeboarding
- Kneeboarding
- Barefooting
- Recreational Skiing
- Cable Skiing

Due to the nature of ski racing in Britain being mainly a coastal activity, it is not covered within this document

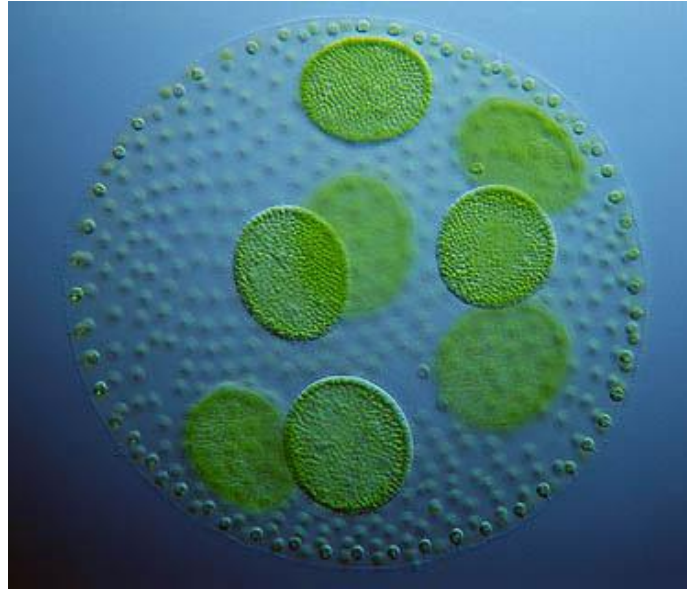
Background

Blue Green Algae takes the form of a scum, which appears to look like 'thick green paint' on the surface of the water. Blue Green Algae will generally accumulate and drift towards the windward corner of the lake and in many cases can be toxic. For this reason it can be a hazard to humans, animals and the wildlife that come into contact with it. During recent hot summers a number of clubs were closed and on water activity was stopped by the local Environmental Health Officers. At one club there were reports of skiers suffering from gastrointestinal upsets and skin rashes and was closed for two months.



What is Blue Green Algae?

Blue Green Algae's are natural aquatic plants that inhabit inland waters (e.g. lakes, broads, rivers) and are found in suspension at the bottom of lakes and rivers. Blue Green Algae's are very small organisms that are normally single cell species which aren't visible to the naked eye. However they will accumulate together and form clumps or balls, which appear as green or brown flecks in the water. They can also be present as strings of cells known as tricots. In small numbers they are an important contributor to the biology of lakes and rivers and present no hazard to health. It is only when the algae 'blooms' that toxins may form. Blue Green Algae can also be called cyanophytes, cyanobacteria and cyanoprokaryotes.



What causes Algae 'Blooms'?

If the conditions are correct, particularly in still waters, the population of Blue Green Algae can grow to extremely high densities, which may form a scum on the surface accumulating downwind. These algae can then produce toxins that are harmful to humans. Blue Green Algae grow relatively slowly therefore a number of conditions must exist for blooms to occur and flourish. The first factor is the presence of nutrients such as Nitrogen and Phosphorus. Algae need nutrients in order to grow and water enriched with nitrogen and phosphorus is necessary. A long period of stable weather with warm temperatures will cause large populations of Blue Green Algae to develop. Another essential ingredient is the stratification of the water levels through mixing or wind induced waves. The reasoning behind this is that Blue Green Algae can regulate their own buoyancy, normally keeping them away from the surface. Wind induced waves will mix the water layers and the algae buoyancy cannot be adjusted quickly enough, causing them to rise to the surface and create an algae 'bloom' or scum.

Can wake from boats cause blooms or add to the effect?

Generally, if anything the wake from boats will actually aerate the water slightly thus adding oxygen. However if the wake is too strong and regular it could cause the water layers to mix affecting the buoyancy of the algae which can't adjust quickly enough forcing algae scums to the surface. Strong wake could also cause erosion on the shores releasing eroded sediments into the water that could potentially affect the makeup of the water body i.e. cuts off light, oxygen to plants and layers causing the forming of algae.

What are the risks and problems that occur from the presence of Blue Green Algae?

About 75% of all algae 'blooms' have been found to be toxic. They can be extremely serious. Dogs and sheep died at Rutland water in 1989, but there is no record of any humans dying from this cause. If you have Blue Green Algae at your lake, stay clear of any scum that forms, shower thoroughly and wash your equipment after each ski.

Toxins can be highly potent and harmful to animals, humans and the habitat. The most common toxins and their risks include:

- **Hepatotoxins** – These attack the liver and other internal organs. Some can also be cancer promoting substances.
- **Neurotoxins** – Cause respiratory attacks
- **Endotoxins** – Can cause dermatitis and conjunctivitis. These are contact irritants (i.e. skin contact with algae whilst swimming). They can cause stomach cramps, nausea, fever and headaches, asthma.
- **Non-Specific toxins** – Damage most organs, including liver. These tend to be slow acting.

Due to the health risks associated with the toxins that occur in Blue Green Algae water is closed until the bloom is under control. Some areas of Blue Green Algae have higher concentrations of toxins than others however, so tests on the infected areas are important. As blooms age or die the concentration of toxins often increases, certain toxins can persist for more than 3 months before they are degraded by sunlight and microbial activity. Tests can be carried out to measure the toxicity of the water to determine whether it is safe to enter the water again. Streaks of blue green algae and scums should be visible if it is still existing in the lake. Tests can be carried out on samples of water from various parts of the lake to determine the safety of the water and whether a club could reopen.

The main risks and problems that occur from Blue Green Algae are:

- Contact with BGA can cause skin rashes, swollen lips, eye irritation and redness, earache, sore throats, hay fever symptoms, asthma and possibly the promotion of skin tumours.
- The risk grows as contact time increases.
- Wearing a wetsuit doesn't protect you as it may result in a greater risk of skin irritation because algal material might be trapped inside the wetsuit next to the skin.
- Dangerous for humans and animals to drink the water.
- Skin contact with BGA is the main risk
- There are aesthetic effects too – mainly that the scum can be unsightly and smelly.
- Some animals' health can be affected – e.g. fish affected as oxygen levels are reduced due to the algae using it up.

However there can be some positive effects from BGA too. There can be some positive ecological effects (nitrogen fixing blooms provide valuable source of nitrogen). It can also promote a larger diversity of microscopic animals.

How can you prevent Algae Blooms?

You cannot get rid of all algae or control the production of toxins if the Blue Green algae 'blooms'. However it is possible to control the formation of the 'blooms'. There are several methods need to be considered to help mitigate the problems caused by Blue Green Algae. These solutions all have several pros and cons and when deciding how to treat an affected area around your water ski club the decision should be carefully considered. Factors can include environmental impacts, cost, aesthetics, noise, labour and effectiveness. There are other solutions that need to be considered to help mitigate the problems caused by Blue Green Algae.

What are the different treatments and solutions?

Barley Straws

The Aquatic Weeds Research Unit have developed a method of controlling algae blooms using barley straw. The straw is placed in the water and allowed to rot. During this process a chemical is released which inhibits the growth of algae. In a heavily infested lake the Unit are currently recommending 20 to 30gms/m². This is about 4-6 bales of straw to every acre of lake. Straw will rot more quickly in the summer than it does in the winter and it is essential to apply the first dose before algae growth takes place. Once the algae problem has been controlled, a further addition of straw should be made to prevent a recurrence of the problem; the dose can be reduced. In still water, straw bales are normally too tightly packed and do not allow adequate water

movement. It is preferable to apply the straw in a loose form, retained in some form of netting. Tubular netting normally used for wrapping Christmas trees or agricultural purposes are ideal. Straw sausages can also be constructed with a float in the net to prevent the sausage sinking – about every 3m. It is essential that the straw is retained near the surface.



Effectiveness

The use of barley straw in infested lakes is an effective way of reducing the growth of Blue Green Algae. However it doesn't treat the Blue Green Algae that's already there or the toxins that occur there. Therefore planning is involved in where and when it is used. Furthermore, if the water is muddy, the barley straw has less effect on the BGA. Barley straw works by lowering the pH and carbonate hardness of the water to a more suitable water quality, resulting in the algae finding it tougher to grow.

Politics/environment

The use of barley straw is a reasonably environmentally friendly form of algae control as the chemicals released don't harm the organisms in the lake but does slow algae growth. It also decomposes after 6 months and therefore doesn't clog up or litter the environment.

Labour

The labour for distributing and delivering the barley straw isn't too intense and only has to be undertaken twice a year. In a large lake however, a large quantity of Barley straw needs to be applied.

Cost

Not as expensive as more sophisticated technologies to implement and is a fairly cost efficient way of treating lakes.

Noise

This treatment is not noisy once it is in place. No problems for water users and humans in the local area. Transportation and implementation of the bales could cause some disruption and noise however.

Aesthetics

The presence of the straw in the lake may be seen by some people to be unattractive and can clutter up the lake. However aesthetically better than the scum seen with Blue Green Algae.

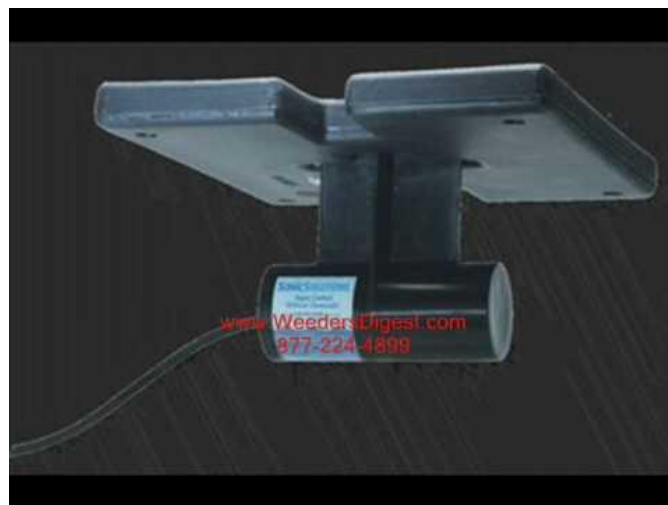
How conditions affect it

Barley straw doesn't work as well in warmer conditions where decomposition will occur quicker and Blue Green Algae is more of a problem. If not properly secured or located in the correct place it can drift or become lost in wet and windy conditions.

Ultrasonics

Effectiveness

Ultrasonics are sound waves that penetrate downwards through the water and kill off Blue Green Algae. A piece of equipment that sends out these waves will damage the Blue Green Algae by affecting the gas vacuole which entails them to float to the surface. This treatment is better than barley straw in that it can kill of the algae rather than just controlling it but the results of it can sometimes be ineffective and variable. Some species of Blue Green Algae have unusually strong cell walls which might cause Ultrasonics to be ineffective. Water-skiers may feel the devices are problematic as they can be hidden.



Politics/environment

There is no evidence to suggest that the Ultrasonics causes any harm to fish or any other natural wildlife.

Labour

The installation of the devices is not too labour intensive and the devices do not have to be replaced as often as barley straw. The monitoring, preparation, operation and tracking of the devices would add to labour.

Cost

The main sticking point with Ultrasonics is the price of each device. It is by far the costliest solution due to the technology involved and the uptake that occurs. To cover a large area a lot of devices are needed as well. One ultrasonic device covering a 6 acre radius can cost up to £5000, prices can be reduced by purchasing in bulk.

Noise

Installation could cause some noise but this is minimal.

Aesthetics

Small devices, which can be hidden.

How conditions affect it?

Monitored closely so it can adapt to conditions and the technology should ensure it can cope with the British climate during the main algae seasons.

Chemicals

Effectiveness

The use of chemical algaecides can prove very effective in killing off algae, also the use of coppers and pesticides can kill off the algae incredibly quickly.

Politics/environment

The use of chemicals is incredibly controversial and can prove very harmful to the environment. Other wildlife in the area can be poisoned. The use of chemicals can kill algae very quickly which can cause oxygen levels of the lake to plummet. Additionally, levels of carbon dioxide, Nitrites and Ammonia can increase due to bacteria that feed on the dead matter. With the impact upon the environment this method is not recommended.

Labour

Labour levels for this method are high.

Cost

Costs can be higher than other solutions if chemicals are applied in large quantities as the production of it on a large scale involves a high economic input.

Noise

Minimal, just a small amount of noise for the application and monitoring.

Aesthetics

Minimal change to the environment in theory but if it starts to affect the environment harmful ways it can only have an adverse effect on the natural habitats aesthetics.

Case studies of places affected by the Blue Green Algae

Anglesey Lake – Blue Green Algae warning

A freshwater lake in Anglesey was tested positive for toxins in July 2010 because of the growth of Blue Green Algae. The scum on the surface of this lake particularly was suspected to have a variety of toxins in it. The 80 acre stretch of the 'Llyn Coron' was the area mainly affected and as it was used by people for swimming and watersports it was closed whilst the threat remained leading to a loss in tourism. The Environment Agency of Wales felt it was a necessary action to take. A number of precautionary measures are being undertaken:

- The water board are monitoring the drinking quality that occurs at the reservoir.
- Llyn Coron has been designated as an NVZ area. An NVZ area is a nitrate vulnerable zone where the surrounding area has nitrate draining into the water at an excess of the European Union recommended levels, over 50mg/l. This will mean the algae more likely to grow.
- Pollution prevention measures have been taken

Clear water 2000 project – Broads Authority

The 'Clear water 2000 project' was planned by the Broads Authority after some areas in the broads waterways system were being affected by high nutrient levels. The algae, growing unchecked in the nutrient-rich water, shaded out the other water plants, and at the start of the Clear Water 2000 project, the broad appeared murky and lifeless, with a thick layer of mud on the bottom, which restricted boating to the central navigation channel.

The Broads Authority worked with Anglian Water by investing in better sewage treatment facilities upstream of the broads which led to less pollution and limited the overload of nutrients such as phosphate and nitrates. In addition to these two techniques were implemented to improve the water quality.

Bio-manipulation – This entails altering the current ecosystem by adding or removing certain species in order to get the best balance for good water quality. Using Barton Broad as an example- species encouraged to be introduced were grazer zooplankton (particularly daphnia species). Predators of zooplankton such as Pike were removed (captured using electro fishing - caught the species but they weren't killed just removed from areas that needed restoring and put back in a designated area). Other species that have been grown in population since bio-manipulation include:

Pondweeds (*Potamogeton crispus*, *P. pectinatus*, *P. pusillus*) Stoneworts (*Chara vulgaris*, *C. virgata*, *C. hispida*) Water-crowfoot (*Ranunculus circinatus*) Canadian pondweed (*Elodea canadensis*) Holly leaved naiad (*Najas marina*) Hornwort (*Ceratophyllum demersum*)

Suction dredging – Suction dredging reduces nutrient leaking from the sediment water and also increases the depth of the water (which helps boat navigation). The process was long and labour intensive, requiring the use of heavy machinery over a 6 year period (1996-2001). This did lead to some disturbance of noise and aesthetics throughout the project. 305,000m³ of sediment was removed and pumped into specially constructed settlement lagoons on adjacent agricultural land. At the end of the project 50 tonnes of phosphorus was removed from the Broads water system which significantly reduced the nutrient level, reducing the conditions that cause BGA blooms. This work has resulted in improved water quality with 60% less phosphorus release from the sediment and 75% fewer algal cells in the area. This intervention was expensive costing £3million.

Summary of case studies

The case studies show that the presence of BGA can be a very common one and the solution to stopping it can be a very tricky one. Several treatments have been used with varying successes and scepticism still occurs over the environmental and monetary effects of certain procedures such as Ultrasonics and chemical treatment. The most accessible and effective treatment for Blue Green Algae appears to be the use of Barley Straw as a treatment particularly as a primary treatment. If however, this alone hasn't worked due to it not being strong enough, Ultrasonics tend to be considered over chemical treatments that could harm the environment. Long term management is also important to nip the threat of BGA in the bud before it can become a serious problem. This includes managing pollution in the area, managing the inflows of water area better, Bio-manipulation; suction dredging, chemical profiles being produced and extensive testing of the water being undertaken.

Conclusions

The threat of Blue Green Algae to watersports such as water skiing and wakeboarding can be a particularly serious one if it isn't monitored and dealt with properly. This is shown in previous cases where it has closed down watersports sites for periods. Plus, more seriously it can harm humans, animals and the environment with its toxins. If there is a risk from Blue Green Algae in a water skiing area then nobody should enter the body of water. The best solutions to the problem involve long term strategy rather than getting rid of it in the short term as long term climate conditions are likely to mean British waters will become more susceptible to its growth. Therefore many local councils and environmental bodies are now looking at cutting off pollution in the local area and dealing with conditions that cause Blue Green Algae rather than treating BGA itself, as shown by the work undertaken in the Norfolk Broads with the clear water project. The most commonly

chosen short term treatment when dealing with the actual Blue Green Algae is the use of Barley straw. However in the future if there is further development in the ultrasonic field, this could become a more viable approach.

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