



PHYTOPLANKTON (ALGAE)

- Phytoplankton (Algae) are a natural and very important component of the earth's ecosystem; producing 50% of the earth's oxygen they are a huge food source for aquatic animals up the food chain.
- Salmon farming is often wrongly accused as being the sole contributor to the presence of Phytoplankton. Outbreaks of algae killed up to a million fish in the Murray Darling Basin in 2019 without a salmon farm in site.
- For a number of reasons, it is in our best interest to limit excessive algae growth as it can affect fish in a number of ways including reducing dissolved oxygen (DO) in the water, mechanical irritation of the gills as well as the possible production of toxins. This is why algae species and numbers are monitored closely on all Huon's farming sites.
- Algae toxins sometimes become concentrated in shellfish at levels that can adversely affect human health. However, algae toxins are not concentrated in fish, therefore there are no human health risks from eating fish. Safety of shellfish is monitored and managed by the Tasmanian Government's ShellMAP Regulatory Services. Huon collaborates with the ShellMAP Program by providing all of Huon's algae reports from Analytical Services Tasmania (at no cost) in exchange for access to ShellMAP algae reports.
- Algal blooms are a phenomenon caused by increases in water temperature and nutrient availability, either through anthropogenic inputs or natural environmental fluctuation. However, it is not always necessarily a local event that creates a bloom, as blooms are regularly transported by ocean currents and wind.
- When humans channel agricultural run-off, sewerage and stormwater discharge into waterways, the amount of nutrients such as nitrogen and phosphorus dramatically increases. This creates an imbalance, and because some microscopic algae are supremely effective at mopping up nutrients and can grow very quickly, dividing up to once a day and quickly overtaking other species, the result can be an algal bloom.
- Huon monitors the number and species of algae in the water on a routine basis through the use of high quality on-site microscopes and internet capability for liaising between Huon and external experts for rapid identification and guidance. This is enhanced through having cameras in every pen that relay video back to Huon's central control room at in Hobart. Huon also regularly submits water samples from lease sites to Analytical Services Tasmania (AST) - over 2,000 water samples to AST since January 2001.
- The results of all our regular algae monitoring are utilised by government authorities to inform of possible threats and outbreaks which then enables public health messaging to be immediately communicated despite our industry not being the cause, nor contributing to the outbreak.
- Huon provides internal training to staff to improve their skills in algae identification and knowledge of the impacts algae can have on farmed salmon.



PHYTOPLANKTON OVERVIEW

Phytoplankton (often just called algae) are microscopic plant organisms that live in well-lit surface layers of oceans, seas, lakes and other water bodies. Algae are like trees and other plants in that they produce oxygen during the day and use up oxygen during the night. This is why the dissolved oxygen (DO) level at our salmon leases is often lowest first thing in the morning and higher later in the day when large numbers of algae are present.

Algae are a natural and very important component of the earth's ecosystem as they produce about 50% of the earth's oxygen and they are a huge food source for aquatic animals up the food chain.

Certain algae can be responsible for fish kills and this is why algae species and numbers are monitored closely on all salmon farming sites.

Most algae are too small to see without a microscope. However, when present in high enough numbers, they can make the water turbid (discoloured). They may appear as a green discolouration of the water due to the presence of chlorophyll (same green pigment that is in green leaves of trees) within their cells. However, the actual colour may vary with each algae species due to other pigments also in cells (e.g. red pigments).

Salmon farming has been accused of causing the outbreaks of the toxic algae *Gymnodinium Catenatum*. This particular algae was first brought to Tasmanian waters in the ballast of international trading ships some of which regularly visited Port Huon in the days of both apple and paper pellets exports from the now closed APM mill. This algae causes toxic shellfish poisoning in humans and the blooms are associated with freshwater run off scenarios. The introduction of marine invasive species is still a major threat to all Tasmanian waters and was of great concern to our industry when an oil rig was towed for repairs into the Derwent River (late 2019).

HOW CAN ALGAE AFFECT FISH?

Not all algae species will kill fish. However, certain algae species and large concentrations of algae can be problematic.

Large concentrations of algae are known to use up oxygen during the night, resulting in low DO levels early in the day. In addition, when very large numbers of algae die off at the end of their bloom, they cause a significant reduction in DO as a result of bacteria decaying the dead algae (in the same way as happens during composting).

Certain spikey algae (particularly with barbs on the spikes) can cause mechanical irritation to the fish gills. In some circumstances, fish respond to this by producing excessive mucus, which can cause suffocation. The irritation and injury caused to the gills can also become a focus for infection.

Barbed algae are the most dangerous among the spiky algae varieties because the barbs on their spines get stuck in the gills of fish and are difficult to dislodge.

Certain algae also contain toxins that cause physical damage to the gill surface, which if severe enough, can result in suffocation. In some algae, these toxins can affect other areas of the body (e.g. neurotoxins or hepatic toxins).

TOXIC ALGAE AND SHELLFISH

The Tasmanian community is probably most familiar with some species of algae that may produce natural toxins that adversely affect human health. These toxins can become concentrated in the tissues of filter feeding shellfish (e.g. oysters, mussels, scallops and clams) at levels which may become potentially harmful to people who eat them. There are four major classes of human illnesses caused by the ingestion of shellfish containing these toxins. The toxins don't cause any health issues for the shellfish containing them.



However, it is important to note that none of these four toxins cause any health issues in fish and are not concentrated in fish, so there is no danger to human health from eating fish.

The presence of algae toxins in shellfish is monitored closely by the Tasmanian shellfish industry and the government. This program was previously named the “Tasmanian Shellfish Quality Assurance Program (TSQAP)” but has now become part of the Shellfish Market Access Program (ShellMAP) and has been renamed ShellMAP Regulatory Services.

For more details on the ShellMAP Program you can go to the following link on the Tasmanian DPIWWE website <https://dpiwwe.tas.gov.au/biosecurity-tasmania/product-integrity/food-safety/seafood/shellfish-quality>.

Huon has been collaborating with the shellfish monitoring program for many years by routinely providing all of Huon’s algae monitoring reports from Analytical Services Tasmania (AST) to the Shellfish Program at no cost in exchange for Huon receiving algae reports from the Program.

HUON’S ALGAE MONITORING PROGRAM

Huon monitor the water for algae species in two ways:

- **On Site Monitoring:** Every farm zone has a dedicated high-quality stereo microscope allowing on water staff to routinely study water samples (or immediately if they have any suspicion that algae may be causing problems, e.g. change in colour of the water, unusual fish behaviour).

Fish behaviour and water turbidity are also monitored by cameras in every pen at all marine leases, with the video relayed to screens located in the central control room at Huon’s Hobart Office. This provides another level of observation, increasing the opportunity for rapid identification and mitigation of potential issues associated with algae.

The microscope also has the capability of capturing and sending images of algae to other key Huon staff (e.g. the Fish Health or Marine Environment Managers) for guidance or confirmation, or to a large number of staff for notification and alert purposes. This enables rapid response where needed to potential algae problems. This capability also enables Huon staff to send these images anywhere in the world to people with expertise in algae for confirmation of species, identification of new species and guidance.

Huon also has a well-equipped laboratory facility located at our Hideaway Bay facility near Dover.

- **Submission of Water Samples to Analytical Services Tasmania (AST):** In addition to on site monitoring by Huon staff, Huon submits regular water samples from every lease to AST. The number of samples varies depending on time of year, but in summer it is often weekly. These submissions provide an expert detailed assessment of algae numbers and species. An example of an AST Report is provided as an attachment.

As above, all of Huon’s AST Reports are routinely forwarded to the Tasmanian Shellfish Quality Assurance Program.

Huon has submitted over 2,000 water samples to AST for algae assessment since January 2001.

Huon provides internal training and a range of documents and reference materials to staff to improve their skills in algae identification and knowledge of the impacts algae can have on farmed salmon. Huon also has a number of Standard Operating Procedures relating to the measures staff must implement in the event of an algae event.

