February 2021

JELLYFISH AND SALMON FARMING

- Jellyfish blooms have been occurring globally for hundreds of millions of years and there is no conclusive evidence that jellyfish blooms are increasing in frequency or severity globally, according to peer-reviewed scientific literature involving numerous scientists from multiple countries.
- Moon Jellyfish (*Aurelia aurita*) blooms have been recorded as occurring in Tasmania before salmon farming started in the state.
- Moon Jellyfish blooms occur in some years and not in others in south east Tasmania. Gaps of several years with very low to nil Moon Jellyfish have occurred between significant jellyfish seasons.
- Prior to the 2018/19 Summer, the last significant Moon Jellyfish season was in the 2012/13 Summer. No instances of significant jellyfish blooms were recorded near Huon's leases in either the summer of 2019/20 or 2020/21. While blooms were experienced in the 2021/22 Summer, no mortalities of fish were recorded as a result.
- There are several theories regarding what environmental factors or combination of factors predispose to serious jellyfish impacts. Huon currently liaises and collaborates with several international jellyfish and environmental DNA experts both in Australia and overseas. This can be due to the stinging cells (nematocysts) in the jellyfish tentacles that contain toxins, or the blooms can suffocate fish if large blooms clog nets causing oxygen levels to significantly decrease.
- In significant numbers, jellyfish can have a negative impact on the health and wellbeing of salmon which is why Huon monitors the waterways in and around our leases throughout the day; both on-water and via in-pen cameras located in every single pen to identify pests and predators.

HISTORY & RESEARCH

Jellyfish blooms have been occurring globally for a very long time; archaeological records show 500-year-old fossils of jellyfish blooms in consecutive layers of the sediments in a quarry in Wisconsin USA. In Tasmania, jellyfish blooms have also been around for a long time with blooms of Moon Jellyfish known to have been occurring before salmon farming even started (over 35 years ago).

There has been some suggestion that jellyfish are present due to climate change, over-fishing, near shore human development (e.g. marinas, boats, jetties, pontoons, aquaculture) and plastic pollution, however, a 2013 article in the Proceedings of the National Academy of Sciences of the USA by Dr Robert Condon, along with 22 co-authors across nine countries, states that, overall, *there has been no significant increase in jellyfish abundance over the period 1874 to 2011* (www.gulfbase.org/people/dr-robert-condon). While the report states there is a weak signal that abundance has increased since 1970, it also states that jellyfish blooms demonstrate a 20-year cycle of increasing and decreasing occurrence globally, so it is not possible to be sure of such a conclusion with confidence.

In the journal *Frontiers in Marine Science* (2018), Professor Kylie Pitt, a recognised jellyfish expert at Griffith University in Queensland, along with several overseas experts concluded that:

> "*The idea that anthropogenic stressors cause jellyfish blooms appears to have been amplified beyond the evidence provided by primary data. As a research community we should qualify the statements we issue about jellyfish, more critically evaluate and accurately portraying the state of knowledge, both in our scientific papers and in the way we convey our results to the public and policy makers*".

Professor Pitt has responded to recent media assertions (2019) about the frequency and severity of jellyfish blooms in Tasmania by saying that, "*If there are, indeed, data available to support claims that Moon Jellyfish and other species have increased substantially in areas of salmon operations, then that data should be made available to other scientists. Normally this would be done by publishing them in peer-reviewed scientific literature*." (www.catchmenttocoast.org/2018/12/).

TASMANIAN RESEARCH

In 2003, a PhD thesis was released by Dr Simon Wilcox in conjunction with staff at the (then) Tasmanian Aquaculture and Fisheries Institute (now the Institute for Marine and Antarctic Studies – IMAS) and CSIRO. This project was funded collaboratively by the Tasmanian salmon industry and the Australian Research Council (ARC). The central theme of the research was to determine why Moon Jellyfish blooms occur in south east Tasmania in some years and not others. The thesis noted that "*extreme inter-annual variability in the occurrence of jellyfish blooms is a common phenomenon"*.

The project found that environmental conditions that correlated with jellyfish abundance include local scale factors such as water temperature, salinity, wind strength, stratification and circulation; and global scale factors such as the southern oscillation index (e.g. El Niño patterns). Again, there are many hypothesises put forward regarding what drives jellyfish blooms, but any proposed worsening of blooms in southern Tasmania is not supported by scientific evidence.

Several jellyfish and jellyfish-like species occur in South East Tasmanian waters. Some species are toxic, and some aren't. Huon Aquaculture continues to liaise with several recognised jellyfish and environmental DNA experts on jellyfish related topics both in Australia (from CSIRO, Griffith University, James Cook University) and overseas (from VetAqua International and SINTEF, one of Europe's largest independent research organisations). Communication with these internationally recognised experts increases our understanding of jellyfish issues and provide excellent ongoing opportunities to minimise the impact of jellyfish on our operations now and into the future through research and communication.

MITIGATION OF IMPACTS

To improve staff understanding and minimise the impacts of jellyfish on Huon's salmon operations, Huon's veterinarians have collated documents on jellyfish and related topics which are also used routinely by staff as a reference on jellyfish matters. Moon Jellyfish tend to be the most common species associated with fish mortality and are most dangerous when they are small enough to fit through the net mesh and contact the fish.

Until they are large enough to remain outside the pens, the most effective way to minimise fish mortality is to get the pen under tow as quickly as possible after a bloom is detected to push the jellyfish to the back, and out of the pen.