**The hazards of farming salmon – an employee perspective**

Interview with Richard Baker\* on 4 March 2022, North West Tasmania.

Background

Most, if not all, discussions of salmon farming have been written from either the perspective of the industry (profit), government (jobs), or the environment (damage). Few have bothered to talk to those directly involved as employees. Given its controversial nature, current employees of the industry may well feel inhibited in revealing or highlighting its practices. However previous workers face fewer real or perceived pressures to be silent. Baker was an employee of the salmon company Aquatas (now Tassal) for several years in the first decade of the present century, working in North-West Bay, near Margate in the D’Entrecasteaux Channel, and near Tinderbox in Southern Tasmania, where Aquatas headquarters was then located. He agreed to discuss some of his experiences and perspectives over that period, as well as in relation to his ongoing interest in the industry as a participant in recreational marine activities. During our conversation he outlined several major hazards of the industry and its impact on marine ecosystems in Tasmania, where almost all Australian salmon farms are located.

Jellyfish

Baker said that jellyfish swarms were a big issue, especially in summer. They consisted mainly of ‘Moon’ *(Aurelia aurita)* and ‘Lion’s Mane’ (*Cyanea capillata*) jellyfish. The swarms were dispersed by using pumped compressed air running through pipes – one on either side of the prevailing tide. Yet while these efforts had some temporary effect, the jellyfish problem remains. For example, in 2018-19 Tasmania’s second largest producer, Huon Aquaculture, ascribed a 64 percent drop in annual profit to jellyfish.[[1]](#footnote-1) Further, in a submission to a parliamentary enquiry into fin fish farming in 2019, a marine biologist specialising in jellyfish said that salmon farming is exacerbating jellyfish blooms, which in turn are impacting ecosystem stability and industry viability:

*Salmon farming is exacerbating jellyfish blooms, which are in turn impacting ecosystem stability and industry viability. Peculiarities of the jellyfish life cycle mean that two quite different life forms are both threatening the health of salmon and other species. Threats from jellyfish include direct stinging, suffocation by mucus, gill damage leading to necrosis, hydroid seeding whereby the pest problem is multiplied each time the holding pens are cleaned, adding to the nutrient load, and legacy degradation of the ecosystem. I make this submission to the Fin Fish Farming in Tasmania Inquiry out of great concern over a worsening ecological problem that is already influencing long term viability of the industry; my concerns specifically address all the Inquiry’s terms of reference.*[[2]](#footnote-2)

Effluent

Effluent from the salmon pens was a significant problem from the early days of the industry. Baker was involved in trials of ‘sea bags’ as an attempt to control the issue. The method used was based on a Canadian semi-enclosed system, whereby eight bags with surrounding circular platforms were deployed from a barge. Effluent was pumped with seawater to a trap point within the bags. As an important side-issue, if feed pellets were also trapped then there was too much feed being given. However, after a two-year trial the experiment was abandoned. It didn’t cope well with rough weather and it only worked with smaller fish. Later, such was the concentration of effluent beneath the pens, that sites were “rested” for some time until concentrations were reduced and then returned to production. Baker said that he much preferred closed land-based systems where effluent dispersal could be properly controlled without affecting the marine environment. We also discussed existing systems whereby salmon are farmed using river water which is then cleaned using a series of wetland settling ponds before returning to the environment downstream, such as the 41° South salmon farm near Deloraine in Northern Tasmania:

*The salmon farm is an inland fish farm rearing salmon in the cold and pristine fresh water sourced from the Montana Falls. There are twenty fresh-water ponds which at any one time house around 10,000 Tasmanian Atlantic Salmon in various stages of grow-out.  The smallest are 10 cm in length and the salmon are generally harvested at a length of about 45 cm... All salmon that are grown in Tasmania are born in fresh water in a hatchery and then usually farmed in the ocean. The salmon at 41 degrees south are unique in that the fish live in fresh water through their life. Another unique aspect to the salmon farm is that, the water that feeds the fish farm and carries organic waste products from the growing fish, is reticulated from the ponds and through various levels and stages of native wetlands. The wetlands act as a 100 per cent natural filter removing all the organic waste, feeding the native flora and returning pristine water back into the Western Creek Rivulet, the very creek that creates the Montana Falls and is the source of farm’s water. 41 degrees South Tasmania is arguably the most environmentally friendly inland salmon farm in Australia.*[[3]](#footnote-3)

Amoebic gill disease

The salmon must be bathed quite frequently in fresh water in order to control infestations of gill amoeba, which is an expensive operation and now involves large ships or “well boats” designed especially for the purpose. Previously, bathing was by hand using hoses after the fish were sufficiently elevated out of the sea. After a long period of rain, however, the fish were rather elevated into the shallow layer of fresh water and left in it for long enough - a few hours - to kill most of the parasites. However, no process is completely effective. According to one landmark study involving researchers from both market-leading Norway[[4]](#footnote-4) and Tasmania:

*Amoebic gill disease (AGD) is the most serious health problem in Atlantic salmon culture in Tasmania, Australia. This disease is caused by an amoeboid protozoan, Paramoeba pemaquidensis and has resulted in sea cage mortalities as high as 50%. Current treatment involves fish being bathed in freshwater for periods of 2–3 hours. The aim of this project was to determine the effectiveness of commercial freshwater bathing. Gill samples were collected from Atlantic salmon before and after routine freshwater bathing. Each fish was weighed, measured (fork length), gross AGD score determined, gill smears stained with “Diff Quick” and trypan blue and gill arches examined using routine histology. Freshwater bathing significantly reduced the prevalence of characteristic mucoid patches on the gills, presence of paramoebae on gill smears and the number of paramoebae per lesion in histological sections (P<0.05). Trypan blue staining of gill smears revealed that 27% of the paramoebae were still alive after 2-h freshwater bathing, although the numbers appeared to be lower than before freshwater bathing. Paramoebae were commonly found (71.2%) in cysts formed by fused gill lamellae within AGD lesions. Before the bathing, only 31.9% of paramoebae were present within the cysts and the remaining parasites were present on the surface of the hyperplastic lesions. Results of this study showed that freshwater bathing is effective in the removal of the majority of paramoebae associated with fish infected with AGD. However, alterations in bathing procedure or an alternative treatment may be required to achieve the total removal of paramoebae from gills of Atlantic salmon.*[[5]](#footnote-5)

Baker observed that bathing fish is difficult in the sea, whereas it would be much easier on land where the water can be strictly controlled. In Tasmania there have been many complaints about the use of the “well boats” that are now used to wash the fish before returning them to sea cages. This is due to the noise they generate as well as their heavy use of valuable fresh water. One of the Huon Aquaculture ships is the world’s largest at 116 metres long and 23 metres wide. It is pictured below:[[6]](#footnote-6)



As an alternative in Ireland, where the use of well boats has been found to be very expensive, freshwater “tow bags” with 500 cubic metre capacity have been successfully trialled. According to the report:

*New methods for performing freshwater treatments against sea lice and amoebic gill disease (AGD) in salmon farms have been successfully developed and trialled in Ireland. Bord Iascaigh Mhara, Ireland’s seafood development agency, has been working with Irish salmon farmers and equipment suppliers to develop and refine eco-friendly methods for freshwater treatment and transport. This has been a very successful project, yielding cost-effective technological advances of benefit to the salmon farming sector... AGD is a recurring health issue for marine salmon farms. Recent epidemiological studies have shown that significant losses can be incurred if gill issues are left untreated. The preferred treatment method is bathing salmon in fresh water, but for a treatment to be effective, all fish on a site should be treated within a short time period. While this treatment method is environmentally benign and effective****,*** *the transportation of fresh water to the marine sites is problematic. Wellboats have been used to transport fresh water, but this has proven extremely costly and they are not always available when treatments are required. Open tarpaulins have been used to tow water out to the cages, but this can only be done in very calm weather, otherwise sea water can contaminate the fresh water. Towing open tarpaulins is also a very slow process, as maximum tow speeds rarely exceed two knots. The lengthy transport stage further reduces the overall time available for the treatment of the salmon and limits the ability to treat a full site within the desired time period. Following consultation with industry members and manufacturers, it was decided to produce and test a freshwater tow bag prototype, with a maximum capacity of 500 cubic metres. This tow bag is closed to seawater contamination and is safer to tow and handle than open tarpaulins.*



Irish freshwater tow bag.

*...The bag has been tested and can safely be towed at speeds of six knots. It has multiple anchoring points, several loading and discharge points, 12 independent air chambers for flotation and can be filled in approximately one hour. The tow bag has now undergone lengthy field tests, with positive results, showing it is impervious to saltwater ingress over a six-week period, demonstrated by stable salinity inside the bag.*[[7]](#footnote-7)

But while such an invention appears to both reduce cost and increase efficiency, it has yet to demonstrate effectiveness in the abolition of AGD. Baker’s comments about the control available through land-based farming remain pertinent.

Seals

Seals are a protected species in Tasmania, as they are in the rest of the country. However, because they are inevitably attracted to fish pens, various means have been used to minimise the threat they represent. Until recently, some seals were sedated using darts fired from guns, and then relocated – often by land to other parts of the state. Over 2,000 seals were relocated from around the salmon farms in 2016 until relocations were banned in 2017.[[8]](#footnote-8) The industry is still permitted to deploy extremely unpleasant means to deter them from fish farms, nevertheless. As well as “bean bags” or lead-filled bags, “seal scare caps” (blunt pre-stressed darts which detonate on impact[[9]](#footnote-9)) and sedation darts, all fired from guns, the industry also uses vast numbers of “crackers” or “seal bombs” − at least 77,000 in a three-year period. These are explosive sticks with fuses that continue to ignite underwater and emit very loud bangs to deter the seals:

*The* [*A$1 billion industry*](https://www.abc.net.au/news/rural/2020-12-01/tasmanian-atlantic-salmon-industry-growth-over-30-years/12923592) *uses the technique to deter seals and protect fish farming operations. Cracker bombs are underwater explosive devices that emit sharp, extremely loud noise impulses. Combined, Tasmania’s three major salmon farm operators have* [*detonated*](https://dpipwe.tas.gov.au/Documents/RTI%20075%20-%202020-21.pdf) *at least 77,000 crackers since 2018. The industry says the deterrent is necessary, but international research shows the devices pose a* [*significant threat*](https://montereybay.noaa.gov/research/techreports/trkerr2018.html) *to some marine life. Unless the salmon industry is more strictly controlled, native species will likely be killed or injured as the industry expands.*[[10]](#footnote-10)

Unlike the other deterrents, seal bombs are usually thrown by hand. Tens of thousands are detonated each year. However industry practice has been so lax that the exact number used is not known. According to Baker, there was no register enforced and it was normal practice for employees to often take several seal bombs home to use as amusements at outdoor parties, for example. The kind of ‘protection’ that seals have from the industry is limited to the torture of pain rather than death. Land-based operations of course do not face such conundrums and there is no effect on marine wildlife.

Bacteria

Although downplayed by the industry, the extensive use of antibiotics to control for a range of bacteria was routine, at least up until 2008, according to Baker. He personally used to access large quantities of a white powder that was added to feed and was known to be a broad spectrum antibiotic. He used to blend it with feed in a concrete mixer. In fact in 2008-09, Tassal, Tasmania’s largest salmon producer, pumped an astonishing 4.1 tonnes of antibiotics into its salmon, before reducing such amounts following pressure from the government department to do so.[[11]](#footnote-11) According to a report from the producer itself, that 4.1 tonnes of antibiotic was ingested by only 14,000 tonnes of fish.[[12]](#footnote-12) At a typical slaughter weight of five kilograms,[[13]](#footnote-13) each fish on average represented about 1.5 grams of antibiotic – equivalent in weight to 1.5 cubic centimetres of water per fish. Since then, however, it is difficult to find precise figures. Tassal for example says that in 2021, no antibiotic residue remained in farm salmon because antibiotics were only given with veterinary prescription and the surviving fish must go through a ‘withdrawal period’ before they are killed for consumption:

*We do not treat our fish prophylactically or use any antibiotics listed as critically important for human health by the World Health Organisation (WHO). Antibiotics are never included in our aquaculture feeds without veterinary prescription for the specific purpose of treating sick fish. They are not used to enhance growth. Antibiotic use is reported to regulators by farming companies. We have increased our vaccination programs to respond to emerging situations which has reduced the need for antibiotics in most of our farms. Before harvest, any salmon that are treated with antibiotics must go through a lengthy withdrawal period as  
required by the authorities to ensure no residue.*[[14]](#footnote-14)

This extract illustrates how certain reassuring phrases are used to obfuscate the issue. As to what is meant by ‘critically important for human health’ is not clear. It implies that the antibiotics used are not ‘critically important for human health’; presumably and unsurprisingly, they are more important for sick fish. Also that veterinary prescription is required for antibiotics is unremarkable; it is simply normal practice in all industries.

Netwashing

Baker said that the early practice of ‘netwashing’ resulted in many disgruntled workers, because, as he put it, the process was ‘not much fun’. It used to involve two or three workers who used to antifoul the cage nets with paint designed inhibit marine growth. Later, workers would haul the nets on land to scrub by hand the growth that nevertheless occurred. The nets were large – from 80 to 120 metres long and often could not be completely removed from the sea. He said each net was treated this way, perhaps once or twice a year. Now, however, much cleaning is done with the nets in situ. The cages are now deployed as part of structural grids, which makes them easier to scrub – by divers using motorised brushes. Thus the hazard of netwashing appears to have diminished.

Feed

Baker highlighted the critical ratio on which the industry depends. That figure is the ‘food conversion ratio’ – the amount of fish food input to the amount of salmon ultimately harvested. Hence it was very important not to overfeed. In the morning, lots were given to the fish as they were very hungry and there was a need to avoid damage to them as they competed for food in a confined space. Later in the day a further two rounds were fed, but much lesser quantities than the morning feed.

A related ratio is the fish in – fish out ratio (FIFO), which means “the amounts of fish oil, fish meal and excess meal extracted from forage fish that ultimately goes into producing a full kilogram of salmon”. This ratio is obviously critical for the sustainability of salmon farming and its impact on wild species. Tassal “aims to produce more fish per kilogram than we utilise in the production process”,[[15]](#footnote-15) or in other words that aim has yet to be reached as large quantities of wild fish are used in salmon feed. The remainder of the feed is composed of chicken waste, grain and food colouring. At present it takes 1.73 kilograms of wild fish, (plus the chicken, grain and colouring) to produce one kilogram of salmon in Tasmanian fish farms.[[16]](#footnote-16) That 1.73 figure is very much more than the global industry average for salmon and trout, which is approximately 1.00.[[17]](#footnote-17)

Wages

As is true of most industries, wages are a major cost. While Baker described the pay as ‘OK’, he also remarked that conditions were based on two 14-hour per day shifts over summer. The work was “very hands-on” he said and there was far less automation than at present. In fact automatic feed control has evolved now to a point where a single operator can now automatically feed pens from a series of screens located in the state capital, Hobart. This control is enabled by underwater cameras – now at least four per pen – so that the centralised operator can see when the right amount of feed has been dispensed. To reduce the wages bill it is inevitable that this sort of automation will continue to be implemented.

The trade union representing workers in the industry, the Australian Workers’ Union, is not known for its strength or militancy. It is difficult to organise workers over a dispersed environment both geographically over land and sea, and in time over the shifts. The state government is keen to foster the industry as it remains a major employer of many who desperately need jobs in rural areas. It is reasonable to conclude therefore that wages will not increase over the medium term, even as productivity increases.

Jobs

This has been a highly contentious issue, and Baker observed that the continuous strategy of the industry is to reduce human input as far as possible using automation. Further, the industry routinely claims that it supports 12,000 jobs in Tasmania. However, such figures are wildly extravagant. According to the Tasmanian Seafood Industry Council, based on industry figures, in 2015 salmonid aquaculture contributed 1.2 per cent of Tasmania’s total employment, or about 2000 full-time equivalent (FTE) jobs.[[18]](#footnote-18) The largest of the four Tasmanian salmon farmers, Tassal, recently published Australia-wide employment figures in its sustainability report.[[19]](#footnote-19) It shows that the company had 767 full time employees in Tasmania, with another 248 casual, part time, seasonal or fixed termers. The report does not state the full-time equivalent figure, but assuming the non-full-time workforce averages 50 per cent hours per year, then the FTE would be about 891:

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| --- | --- | --- | --- | --- | --- | --- | --- |
| Tassal employment 2020-2021 (from data in Tassal Sustainability Report 2021) | | | | | | | |
|  | casual | temporary seasonal | fixed term | part time | full time | total | estimated full-time equivalent (FTE) |
| TAS | 175 | 16 | 9 | 48 | 767 | 1015 | 891 |
| NSW | 230 | 0 | 4 | 1 | 195 | 430 | 243 |
| QLD | 92 | 0 | 4 | 0 | 113 | 209 | 161 |
| VIC | 0 | 0 | 1 | 2 | 20 | 23 | 21.5 |
| WA | 0 | 0 | 0 | 0 | 3 | 3 | 3 |
| SA | 2 | 0 | 0 | 0 | 1 | 3 | 2 |
| ACT | 1 | 0 | 0 | 1 | 1 | 3 | 2 |
| NT | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| International | 0 | 0 | 0 | 0 | 1 | 1 | 1 |

Note that the figures for NSW and Queensland (243 and 161 FTE respectively) are based on Tassal’s prawn farming operations, whereas the Tasmania figures are almost entirely due to salmon farming. Overall, the Tassal figure (891) is consistent with the total industry figure of about 2000 in Tasmania. As automation continues, however, in the pursuit of efficiency and profit, it is unlikely that this figure will change much, irrespective of industry expansion.

Expansion

At present, the Industry and the state government appear to be bent on expanding production considerably, from what is already Tasmania’s largest primary industry. What began in Tasmania in 1986 with a few boutique operators has evolved into an industrial operation worth $887 million in 2020, generating 65,800 tonnes of salmon a year.[[20]](#footnote-20) That is forecast to become $1 billion by 2025 and $2 billion by 2030. Some of that expansion is earmarked for more offshore environments around Storm Bay in the South-East, while for the first time sea farming is proposed for the North-West, in Bass Strait. Bass Strait is not unused to extensive pollution, however. Once brown-coloured outflows from industrial plants in Burnie stained many miles of the seacoast. While that pollution has since been cleaned up due to closure of the industries, a new industry may yet herald a return and a threat to marine ecosystems in the same area. The impact of that threat will be borne by marine life, the tens of thousands who live in the area, as well as employees of the industry.

Dr Dain Bolwell

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1. \*’Richard Baker’ is a pseudonym to protect the identity of the informant

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3. 41 South Tasmania 2022, ‘Salmon’, March, https://www.41southtasmania.com/sample-page/: [↑](#footnote-ref-3)
4. Norway produces about 55 percent of the world’s farmed salmon at relatively low-cost. See Ascher, F, Hermansen, Ø and Nystøyl, R 2020, ‘Production cost and competitiveness in major salmon farming countries 2003–2018’, *Aquaculture,* Volume 522, 30 May. [↑](#footnote-ref-4)
5. Parsons, H, [Nowak](https://www.researchgate.net/profile/Bf-Nowak), B, [University of Tasmania](https://www.researchgate.net/institution/University_of_Tasmania),  [Fisk](https://www.researchgate.net/scientific-contributions/Daniel-Fisk-2191337543), D, Powell, M, [Norwegian Institute for Water Research](https://www.researchgate.net/institution/Norwegian_Institute_for_Water_Research) 2001, ‘Effectiveness of commercial freshwater bathing as treatment against amoebic gill disease in Atlantic salmon’, [*Aquaculture*](https://www.researchgate.net/journal/Aquaculture-0044-8486), April 195(3-4):205-210, DOI:[10.1016/S0044-8486(00)00567-6](http://dx.doi.org/10.1016/S0044-8486(00)00567-6). [↑](#footnote-ref-5)
6. Huon Aquaculture 2021, Fact Sheet, February. https://www.huonaqua.com.au/wp-content/uploads/2021/02/Wellboats-Other-Vessels-Fact-Sheet-FINAL.pdf. “The *Ronja Storm* is a highly sophisticated wellboat designed to withstand the world’s roughest salmon  
   farming area, Storm Bay. She is the largest wellboat in the world currently in active operation both in terms  
   of ship size and water holding capacity; at 116 metres long and 23 metres wide, she has a total water  
   storage volume (including treatment tanks) of over 13,000 cubic metres (4 tanks @ 1780 m3) and holds 800  
   tonnes of fish at a time (equivalent to an entire 240 metre Fortress Pen)”. [↑](#footnote-ref-6)
7. [Robinson, G](https://thefishsite.com/contributors/geoff-robinson)  2020, ‘A new tool in the battle against sea lice and AGD’, *The Fish Site*, 31 July: [↑](#footnote-ref-7)
8. Good Fish website ‘Salmon’: 2022https://goodfish.org.au/species/atlantic-salmon/ [↑](#footnote-ref-8)
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    https://www.tassal.com.au/wp-content/uploads/2013/11/Tassal-2008-AGM-Chairman-and-CEO-Address.pdf [↑](#footnote-ref-12)
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18. Tasmanian Seafood Industry Council May 2017, Seafood industry Workforce Profile, p.16. https://www.tsic.org.au/uploads/9/6/8/7/96879568/1\_final\_seafood\_industry\_workforce\_profile.pdf:

    *The Tasmanian Salmonid Growers Association has indicated that salmonid aquaculture creates approximately 2,090 direct full-time equivalent (FTE) jobs in Tasmania.* [↑](#footnote-ref-18)
19. Tassal 2021, ‘Our People Footprint’, *Sustainability Report* 2021, p.20, https://tassalgroup.com.au/wp-content/uploads/sites/2/2021/11/Tassal-Sustainability-Report-Final-Interactive\_FINAL.pdf [↑](#footnote-ref-19)
20. Kurmelovs, R 2021, ‘Landing salmon: can Tasmania clean up the industry by bringing it onshore?’*, The Guardian,* 5 September. https://www.theguardian.com/australia-news/2021/sep/05/landing-salmon-can-tasmania-clean-up-the-industry-by-bringing-it-onshore. [↑](#footnote-ref-20)