From:	Bruce Ransley
To:	Tasmanian Salmon Study Secretariat
Subject:	Draft Salmon Study feedback
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Attachments:	Salmon study feedback_Bruce Ransley.docx

Hi there.

Please find attached my feedback on the Draft Salmon Study.

Regards
Bruce Ransley

Salmon industry draft study plan – feedback

Topic #2: Assessment of environmental values …

Questions/issues – recommendations

That the following questions be added:

- How will Industry manage decommissioning (removal of underwater mooring systems) and rehabilitation of lease sites once they are eventually abandoned? Is decommissioning liability accounted for by Industry, or will expenses be borne by taxpayers? Should a bond be paid?
- If a lease is abandoned, what plans are in place for long-term environmental monitoring to gauge recovery times?
- What water current modelling has been undertaken to identify areas most prone to nutrient accumulation from farm activities ('source and sink')?
- How does Industry manage marine debris fallout as a result of net, cage ring and line cleaning, whether in situ or onshore? Are these inputs measured and accounted for in nutrient modelling and reporting?

Engagement > Modes of engagement > Site visits/study tours – recommendation

- That the scope of site visits be expanded to include summertime underwater video inspections of several working marine farm leases selected by qualified independent observers – prioritising those deemed most likely to negatively affect the local environment (e.g. considering age of lease, biomass of fish, stocking density and duration, depth, prevailing currents).

Topic #5: Contribution of the salmon industry to the Tasmanian economy …

Questions/issues – recommendation

That the scope be expanded to ask:

- To what extent does 'locking in' local businesses and community to relying on a single industry create economic vulnerability? How is local government fostering community resilience in the event of industry collapse? Are such risks considered alongside the perceived benefits when decisions are made about granting licences?

Bruce Ransley BSc (UTAS)

I'm a former Tasmanian fish farm dive contractor and the first to establish routine benthic surveys to optimise cage rotation practices (Aquatas, 1992), later with other farms and DPIPWE. In 1996 I led the team of divers tasked with cleaning up the mass tuna death event in Port Lincoln, which was caused by off-gassing from bad cage management practices. Following community concern about the mass mortality events in Tasmania in 2024–25, I wrote a plain English explainer describing how nutrient fallout and buildup from cages affects the benthic environment, pasted overleaf and available online here.

I have not been involved with the salmon industry since 1999 but I maintain an interest in farming technology and practice. I do not live in an area affected by farming operations.

A layman’s guide to the environmental effects of fish farming

February 2025

You’ve no doubt seen the coverage of mass salmon kills and rotting fish washing up on the shores of the Huon estuary in southern Tasmania. It’s apparent to me, having been a diver on various fish farms for a decade or so in the 90s, that opportunities are being missed by both journalists and activist groups because they don’t know the full story of how a fish farm works. So, I’ve written this explainer. I’ll add a caveat that I haven’t been on a fish farm in more than 20 years – then again, if you’ve seen one pile of rotting salmon, you’ve seen ‘em all.

Salmon are raised in freshwater hatcheries and transferred by truck to sea cages when they’re old and strong enough. The cages are attached with thick ropes to a network of heavy anchors on the sea floor. The fish are fed with pellets made partially from other fish (which is a topic for another day) by ‘spraying’ them onto the surface of the water; the fish go nuts, gobbling up the pellets in a frenzy. In the early days, the feed was delivered by a guy in a dinghy using a garden trowel and a bucket; a skilled feeder knew just when the fish had had enough. It’s now all automated, and because feed is expensive a lot of research and development has gone into minimising waste.

But regardless of how efficient the food delivery process is, some of the pellets end up being missed by the fish and fall through the bottom of the net onto the sea floor. Of course, the fish poop ends up there too, which is by far the bigger problem. Pollution is inevitable, as it is with any intensive animal farming operation.

This fallout of organic material has two outcomes.

1. It causes ‘disturbance’ to the sediment on the sea floor and to the tiny invertebrates that live within: worms, molluscs, and other bugs that you can barely see but play an important role in marine ecology. These sediment bugs are collectively known as the benthic community, or benthos. A diverse and healthy benthos, when covered in organic material, is replaced by an unhealthy one with ever decreasing species diversity.
2. The organic material breaks down. If there is a lot of material, the resulting sludge becomes anoxic. The lack of oxygen results in the production and subsequent release of toxic gases like hydrogen sulphide (rotten-egg gas). These toxic gases can bubble up and kill the fish.

The first outcome of fish poop fallout is of no real concern to the farmers. No one from the public can see that the healthy benthic community is being replaced by an unhealthy one, nor in the scheme of things is it a big deal when the farm itself is small.

The second outcome – toxic gas production – is, however, a big deal, as an entire pen of fish can be wiped out if the event is sudden and severe enough.

An underwater observer can see signs of problems early on. One is the formation of a white mat on top of the sediment formed by the activity of a bacteria called *Beggiatoa*. One of our jobs was regular monitoring of the sediment, where we’d collect samples and identify the bugs within. There’s a direct correlation between species abundance and sediment health.

A heavily used farm lease is characterised by poor visibility and a sea floor that where once was hard sand is now a blanket of silt that you can drive your arm into up to the elbow.

There's a third component to the volume of organic material that accumulates in the vicinity of a farm: marine growth. Every cage ring, net, rope, anchor and cable under the sea provides a growing surface for marine plant life and invertebrates, and soon you have an entire mini-ecosystem covering everything in the water throughout the lease. (Fun fact: Tasmania's early farmed mussel industry comprised of a guy called Dave on his hands and knees collecting mussels growing on fish pen rings.) A 40-millimetre-diameter rope soon becomes a universe of weed and bugs, which is great for the weed and bugs but a real problem for the farmers. Ropes get heavy and unmanageable and put stress on the anchor system and cages. One job we had was to clean all these underwater nets, ropes and cables, consigning the accumulated growth to – you guessed it – the sea floor.

Growth on the nets in which the fish live blocks the holes of the net and restricts water flow. The fish begin to 'gasp', constantly flaring their gills as they struggle to breathe. Nets are therefore regularly changed (through a remarkably inventive switcheroo technique so as not to lose any fish; when that goes wrong, local fishers rejoice). The dirty net is taken ashore, where it's cleaned in a huge washing machine. Other times, divers with high-pressure sprayers simply blast the nets clean. In either case, guess where the detritus goes.

The need to not damage the sediment too much (with the survival of the fish in mind) is a good thing for the benthos. The farmers continually shift their cages around, giving the sediment a chance to recover and avoiding any nasty rotten-egg-gas-related surprises. It's an aquatic form of crop rotation. Still, over time the problem grows and it gets harder and harder to maintain a healthy system.

The tragedy of the commons

The inevitable next step a small fish farm takes is to become a bigger fish farm. Why have only a cage of 60 metres circumference (as they originally were) when you can have one that's 120 metres round? Why have only 12 pens in a lease when there's easily room for 24? As long as you keep expanding territory, what could go wrong? If I put one more pen on this lease and I get richer, while everyone else in the community shares the cost.

Well, you get an event like that which occurred in Port Lincoln in South Australia in 1996. The tuna industry was in its infancy and the farmers hadn't yet identified how much organic material buildup the fish could tolerate. A single storm caused the sediment to erupt, spewing toxic gas into the water column and killing millions upon millions of dollars worth of fish. They called on us to help clean it up as their own divers didn't yet have much experience with aquaculture work. It took us three weeks to collect all the dead tuna, which were then dumped out at sea.

The reason fish farms are eager to expand their lease size isn't just because of natural expansion, it's because they've literally shit in their own nest and need to continually move their cages to an area where the sediment isn't dangerously disturbed. Give the organic sludge a chance to wash away and be somebody else's problem. Interestingly, Macquarie Harbour is rather enclosed so there's little chance of flushing the rapidly accumulating organic material out to sea. I suspect that the whole harbour is irrevocably damaged already.

All about the dead fish you're seeing

Unlike salmon farm locations in northern Europe, Tasmania enjoys water temperatures that, in summer, are on the upper limit of a salmon's tolerance. Macquarie Harbour is an exception – it's a bit colder than the waters of southern Tasmania, which is why west coast operators are keen to continue farming there for as long as they can. Warm water holds less oxygen than

cold water (it's a chemistry thing) and in summer fish become stressed more easily. Mortality rates are naturally higher. Furthermore, the warmer months are conducive to salmon contracting conditions like amoebic gill disease (AGD) and bacterial infections. For AGD it's common practice to 'bathe' the fish. A huge tarp is lowered into the pen, where it's filled with fresh water. Fish are shunted into this temporary pool. The fresh water kills the amoeba but the salmon are unharmed. It's a labour-intensive practice long accepted by farmers, who have knows since the late 80s that Tassie waters were a little on the warm side for salmon.

Whatever killed the fish you're seeing on TV is likely a combination of factors, each exacerbated by high water temperatures. With climate change and warming waters there's no hope for anything but decline in conditions for salmon in the future.

Ghosties and the benefits of fish oil

Those white-and-red rotting monstrosities that you're seeing floating on the water's surface and washing up at beaches are salmon that have died and were left in the water too long. As a fish is dying it sinks to the bottom of the cage, where it can struggle and gasp for many hours before it's over. Ninety-five per cent of the time the dead fish (called 'morts') are collected while they're still relatively fresh. But if a mort is left in the water for more than a few days the breakdown and resulting gas production causes the carcass to float to the surface, where they're exposed to the sun and the rotting process accelerates.

We called these fish 'floaties', or 'ghosties' owing to their colour and general unpleasantness.

If something goes badly wrong and a lot of fish die at once – particularly if it occurs when a mort dive isn't scheduled for a few days – the first sign is typically a bunch of ghosties floating on the surface.

We often had major summer fish kills to clean up. A team of divers with catch bags would scoop up ghosties from the surface and the more-recently departed fish from the bottom of the cage, then hand them up to the crew in the boat. A major kill meant that our 'mort bin' soon filled up and we had no choice but to dump the morts straight on to the deck of the boat. It became a vile, oily mess of rotten fish, sometimes knee deep. The oil lingers on your skin, your wetsuit, all your equipment, for a long time after. The smell makes you retch and it's virtually impossible to wash away. I certainly don't recall experiencing any of the 'fish oil is good for you' benefits claimed in the media recently. I'm sure that with today's tech they've developed ways to remove the diving team from the equation. I'd love to know.

There's a rule of thumb here: if you see a ghostie, there are five dead fish that you can't see from the surface. The photos we're seeing probably represent only a fraction of the scale of the kill event the farmers are dealing with.

Furthermore, if you are seeing rotten fish … err … I mean 'fish oil' on a beach at some distance from a cage, then it's possible that the scale of the kill is greater than any I ever experienced in a decade of mort diving. I expect we'll never know the true numbers of mortalities, however – commercial-in-confidence and all that.

The tip of the iceberg

To many, the sight of rows of black fish pens in Tasmania's calm rivers and estuaries looks idyllic and low impact. Beneath the surface it's another story.

We not only retrieved dead fish for a living, but also built and maintained the mooring systems that anchor the pens to the sea floor, as well as the giant seal fences of the early days; one that we built was 600 metres in length and 25 metres 'high' at its deepest point. To say that the

underwater vista resembles a construction site is an understatement – think about a building site where no one can see if you drop unused ropes, nets, cables, plastic ties, wire … and then you never have to clean it up. The sediment beneath a working farm isn't just contaminated with organics, it's a major dumping ground.

Sammy the seal

While it doesn't have much to do with recent kill events, you might be interested in the seal problem.

During winter, for obvious reasons some seals hang around the farm leases. To get a feed, the seal charges a cage's net, mouth open, hoping to take a chunk of salmon meat off its intended and very surprised victim. It's not an easy thing for a seal to do, having to bite through the net. Often the prey animal was badly bitten but not eaten; the seal would get enough of a taste to keep on trying. We would often get a call at 5.30 am on our off days from the night watch crew: 'Sammy's been in'. Someone had to get in the water ASAP to check for any damage to the nets and retrieve the wounded and dead fish.

I can't talk of more recent practices, but in the 90s a seal seen hanging around the cages was eventually caught in a huge submerged cage like a possum trap. These animals were relocated on a trailer to somewhere in the north of the state. I believe that tracking data revealed that the record for a relocated seal swimming all the way home was four days.

Apparently, preventing damage from seals works much better these days. But back then, if trapping didn't work, and underwater explosives didn't frighten the seal away, it was shot.

I have a question

Now you know the basics behind what we're seeing in the news – but there's one more issue that's not being talked about.

Who will be responsible for decommissioning the farm infrastructure once a lease's life is deemed to have ended? The tonnes of concrete anchors, cables and old ropes? I don't buy the 'it's creating a reef for the fishies' argument. Will there be a requirement for rehabilitating the sediment and its benthic communities? I wonder – as with the hundred or so oil and gas rigs that have been abandoned throughout Australian waters by their operators, who walked away without penalty – will there be any decommissioning?

Who am I?

When I started fish farm diving I had recently graduated from the University of Tasmania with a science degree with a half-major in aquatic zoology. I had a working knowledge of the potential for 'disturbance' of the fauna from the effects of the fallout of organic material from salmon cages. I began running impact surveys on one of our client's leases, devising experiments to assess the impact under a range of conditions. My conclusion was that if the lease is small with a reasonable stocking density – as they all were back then – then the impacts are significant in the immediate vicinity of the pens but negligible or zero at distances of around 60 metres from the lease (depending on prevailing currents, size of the lease, storm events etc.) We were soon doing surveys for other leases as the state government began mandating routine assessments.

salmonstudy@tas.gov.au