

Submission to the Tasmanian Legislative Council Finfish Inquiry

The Price of Salmon

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November 2019**



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In the supermarket recently, smoked Tasmanian Atlantic salmon was selling for a profitable \$70 a kilo. Salmon farming is a lucrative business and growing rapidly, and it is easy to see why if one only looks at the thin façade of profit. While this form of aquaculture has several unique advantages, it also brings with it significant downsides that have resulted in constantly evolving ‘whack-a-mole’ strategies over ever-widening fronts. Below, we discuss four urgent challenges that are rarely considered, but about which we hold great concern. We also discuss several others that are more established, but would benefit from closer scrutiny. Collectively, these points address all elements of the Terms of Reference (TOR) for this Inquiry, as shown following each point.

The sustainability of any industry lies at the triple intersection of its economic, social, and environmental viability over the long term. It must be reasonably profitable – but at the same time it requires social approval, and it should not degrade natural resources. These three aspects of sustainability are inter-related. Economic viability is threatened by both social attitudes as well as environmental damage. The salmon industry in Tasmania is particularly vulnerable to the latter two facets, especially due to its high visibility and its potential for harm of precious waterways.

URGENT CHALLENGES

The following four safety issues have yet to be addressed within the legislation but we feel are important to the discussion:

1. Heavy metal contamination

Many coastal waterways, especially including the Derwent estuary and Storm Bay, have legacy heavy metal contamination. Heavy metals are known to cause severe neurological impairment, many types of cancers and other chronic diseases, and horrific birth defects. In healthy waters, heavy metal molecules bind with sediments and are rendered inert. However, oxygen-depleted conditions, such as those resulting from salmon farming, unbind these metals, resuspend them in the seawater, and make them more likely to be taken into the human food chain (Banks & Ross 2009; DEP 2010, Coughanowr et al. 2015). Thus, waste from the salmon farms is likely to exacerbate the heavy metal toxicity problem that already exists, and may result in raising food for human consumption in waters enriched with heavy metals. We find it alarming that fish farming is already taking place in waters with a heavy metal legacy, without research on safe stocking densities and toxic impacts on other species and without a robust monitoring program in place.

TOR 1a – We suggest that public health aspects of salmon farming should be taken into account in all current and future monitoring, and that the data be made public as a matter of public health and safety.

TOR 2a – Any marine farming development plan must embrace the Precautionary Principle where public safety is concerned, and as such, must demonstrate that public safety research has been performed, that the plan complies with public safety principles, and that a rigorous monitoring plan is in place with regard to heavy metal resuspension.

TOR 2b – The Marine Farm Planning Act should be broadened to mandate that applications and granting of leases is dependent on demonstration that the lease will not harm or potentially harm human health.

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² Director, Australian Marine Stinger Advisory Services and author of *Stung! On Jellyfish Blooms and the Future of the Ocean*, University of Chicago Press 2013.

TOR 2c – While heavy metals are known to cause severe health problems in humans, they may cause problems for native species; most of these effects are unresearched and unknown. Research and monitoring should include impacts on native species and their food sources.

TOR 3 – Given the severe health problems associated with heavy metal toxicity, any aspect of heavy metal contamination that is not covered under TOR 1 or 2 must be accounted for some other way. For example, if salmon farming-related hypoxia resuspends heavy metals, then the salmon industry should be responsible for its cleanup back to or cleaner than it was prior to the resuspension. Salmon farms should be taxed a per-fish charge to be kept in a reparations fund.

2. Contamination of municipal drinking water

Salmon hatcheries are usually located inland upriver, where there is abundant fresh water. Hatchery effluents, including fecal material, antibiotics, and pesticides are released into surrounding rivers – and thus into human water supplies. This is the case with Tassal's hatchery located in the upper Derwent, which supplies the city of Hobart. This was raised in the Tasmanian House of Assembly in August 2019 by Greens MHA, Dr Rosalie Woodruff (O'Connor & Woodruff 2019a). There was no clear response to this question, except for an unsubstantiated statement that the downstream water quality was within legal limits. We find it alarming that fish farming effluents are being discharged into sources of municipal drinking water, without research on safe stocking densities and without a robust monitoring program firmly in place. To our knowledge, antibiotics and pesticides have not been tested. Regardless, routine drinking water test results for fecal, antibiotic and pesticide contamination must be made available for public scrutiny as a matter of public safety.

TOR 1a – Public health aspects of salmon hatcheries should be taken into account in all monitoring, and data be made public as a matter of public health and safety.

TOR 2a – Any hatchery development plan must embrace the Precautionary Principle where matters of public safety are concerned, and as such, must demonstrate that public safety research has been performed, that the plan is compliant with public safety principles, and that a rigorous monitoring plan is in place with regard to hatchery effluents and their presence in human water supplies.

TOR 2b – The Marine Farm Planning Act should be broadened to mandate safety retrofitting of existing hatcheries, and that applications and granting of new hatcheries or expansion of existing hatcheries is dependent on demonstration that they will not harm human health.

TOR 2c – Research and monitoring should include impacts on native species and their food sources.

TOR 3 – Hatcheries should be taxed per-fish or per-litre, to be kept in a reparations fund.

3. Diseases

Farmed salmon are prone to gill disease and other conditions, which have caused hundreds of millions of dollar losses in several countries as unrestrained industry growth has continued. These include the US\$800 million loss in Chile in 2016 (Graham 2016, Reuters 2016), the more than US\$82 million loss in Norway in 2019 (Klesty 2019, Magra 2019) as well as the US\$18 million loss in Tasmania's Macquarie Harbour in 2016-17 (Morton 2018, Spring 2018); and other big losses in British Columbia, Scotland, Ireland and New Zealand. All appear due to interactions between the environment and salmon farms as a source of concentrated effluent, chemicals and as attractors of native pests. As such, natural capital is degraded while short-term profit is maximised.

The most effective treatment for gill disease is to bathe the fish in fresh water for several hours. A dam and pipeline on Tasmania's East Coast that would have enabled this for one producer – Tassal – failed to materialise despite spending millions of taxpayer dollars. This proposed infrastructure was funded from by a state government loan to the local council (O'Connor & Woodruff 2019b). However, Tassal (2019) had earlier signed a ten-year lease for a large 84 metre ship or 'well boat' with an onboard desalinator that may be adequate for the task. Yet the highly salty residue will be pumped

back into the (shallow) marine environment, in turn creating another problem to be fixed. At the same time, the ship will enable 25 jobs to be cut. Huon Aquaculture already uses a similar vessel.

The impact of farmed salmon as a source of disease for native fish has not been examined in Tasmania, but has been of strong concern in red-listing farmed salmon overseas. Importantly, native fish do not have the benefit of freshwater bathing to treat their disease. Moreover, the effect of these pathogens on human health, should they infect fish that are caught recreationally, must be considered and mitigated.

TOR 1b – An effective biosecurity plan must consider the transfer of pathogens in both directions, i.e., from farmed salmon to native species, and back again.

TOR 2c – Environmental harm includes the effect of fish farming on native species: pathogens from industry to its surrounding environment must be controlled, monitored, and mitigated.

TOR 3 – The extent to which diseases related to salmon farming spread to native fish needs to be investigated and managed. So does the issue of salty residue and its impact on native species, both marine and avian.

4. Hydroid colony seeding

Routine cleaning of salmon pens results in clouds of stinging hydroid fragments – jellyfish-like polyps – which seed new colonies downstream. Some are native while others are introduced; regardless, they use the farming infrastructure to grow out of control. Moreover, the mechanical action of the cleaning stimulates the hydroids to grow more vigorously (Carl et al. 2011). These hydroid clouds cause and exacerbate gill disease in salmon (Bloecher et al. 2018), in bivalves (mussels, oysters, and scallops), and likely in native species. Yet the pens must be cleaned and the proposed double-walled seal-proof cages mean that yet more cleaning is required. Seeding of hydroid colonies may permanently shift the ecosystem into a more degraded state, which will cause increasingly higher losses for the salmon industry and make the ecosystem less usable for meaningful recreation or enterprise. Similarly, seeding creates richer, more frequent, more resilient pest problems, which will negatively impact the safety of salmon as well as native species.

TOR 1a – Data on monitoring of net-wash should be made publicly available because it affects public waterways and other downstream industries.

TOR 1b – Biosecurity monitoring should include comparative population data for native and non-native hydroid species, to detect introduced species as well as population changes in native species affected by farming.

TOR 2c – These types of environmental harm must be assertively guarded against and be reflected in the legislation governing management.

ESTABLISHED CHALLENGES

The following issues are more familiar to many involved with the industry and remain important:

1. Production

Farmed salmon is now one of the world’s most popular fish. Some 2.4 million tonnes are consumed each year – more than a thousand times that of wild salmon (FAO 2017) – with an average 5.5 percent annual growth since 2000 (FAO 2018, p. 23), much more than global GDP growth of less than two percent. Notably, the world’s largest producer, Norway, each year produces an amount of salmon about three times the total weight of its entire human population.

Tacon (2018) lists the top eight salmon producing countries as:

- Norway 1,233,619 tonnes (51.1percent)
- Chile 643,205 tonnes (26.6 percent)

- UK 163,140 tonnes (6.8 percent)
- Canada 149,110 tonnes (6.2 percent)
- Faroe Islands 83,300 tonnes (3.4 percent)
- Australia 56,115 tonnes (2.3 percent)
- Ireland 16,300 tonnes (0.7 percent)
- US 16,185 tonnes (0.7 percent)

While the Tasmanian salmon industry is relatively small by global standards, it is nevertheless now the state's most valuable primary industry, approaching a billion dollars a year in revenue with continuing high growth, all spread amongst only three firms. As such, and because it effectively privatises public waterways, the industry warrants close scrutiny of its effects on communities and their environment.

2. Regional jobs

All Atlantic salmon is necessarily produced in cold-water, high-latitude regions, including British Columbia, the Faroes, Scotland and Norway, in the Northern Hemisphere, and in Patagonia (Quiñones 2019) and Tasmania, in the South. New Zealand farms a different (Pacific) species, 'King' salmon around the South Island. Salmon farming thrives in such small regional economies, especially in rural areas with few other industries. But while its perceived employment and economic benefits tend to magnify its political clout, in fact salmon farming employs few people and is increasingly automated. In Tasmania, feeding operations are increasingly controlled centrally from land-based headquarters such as Huon Aquaculture's office on Collins Street and Tassal's on Franklin Wharf in Hobart. Despite all the political and industry attention to the importance of jobs, the salmon industry represents considerably less than 0.6 percent of total employment in Tasmania or less than 1300 jobs (ABS 2016, Minshull & Browne 2019)³.

TOR 1a, 3 – In accordance with the above points, it is appropriate that this more accurate picture of this industry is made better known, especially amongst politicians.

3. Common practice vs. best practice

Tasmanian salmon farming is typical of world practice. It consists of sheltered coastal (inshore) groupings of large sea pens where fish can be easily fed and raised to maturity, combined with smaller hatcheries upriver inland where abundant fresh water can be assured. However one significant difference from many other regions is that Tasmanian farms tend to be in relatively shallow waters of perhaps ten to twenty metres depth (e.g. CSIRO 2000, p.16, Parsons 2012, p.28 and 39), whereas the fjords of Norway, New Zealand and Chile can be more than a thousand metres deep, where the impact of fish excrement and chemicals is minimised.

At the Legislative Council salmon briefing in July 2019, the industry claimed that it was adhering to world best practice. Presumably by this it meant the sort of farming arrangement described above. Yet other aspects which may be considered best practice, are not apparent in Tasmania. For example, fully self-contained land-based aquaculture with maturing fish in tanks is becoming evident elsewhere around the world (Seafood Watch 2016), and a commitment to data transparency is also practiced in Norway in particular (Ibid), yet data are difficult to find and compare in this state. Social license is therefore threatened, as is the health of the fish and their environment.

³ The industry currently says there are more than 2,290 direct full-time equivalent jobs (or over one percent of employment in Tasmania) plus more than 6000 'indirect jobs' (TSGA 2019). Other sources cite around 5000 jobs (Burgess 2016). However according to ABS 2016 WO9, 0.6 percent of total employment in the state (or 1300 jobs) is in aquaculture, which as well as salmon, includes trout, oyster and mussel farming. Further, as Minshull & Browne point out, industry and state government figures tend to feature jobs in other industries 'supported by salmon farming', which results in an overestimation of job numbers – if all 'indirect' jobs are counted then the overall result is far more than the total jobs available.

TOR 1a – The claim by industry to be following best practice is not borne out by the evidence. Their code of practice should be made publicly available as a matter of transparency and good business practice.

4. Risks

The Tasmanian industry's business risks are shared with salmon producers elsewhere. Salmon farming dramatically affects water quality, leading to low oxygen, toxic algae, jellyfish blooms, and 'dead zones' beneath the salmon pens. The farms are highly visible from watercraft and from coastal residences. As such, they attract criticism from other marine users and people living nearby. In Tasmania, a group called Neighbours of Fish Farms ('NoFF') protest the industry and its expansion. Other groups have fought leases on the East Coast (Humphries 2016) as well as proposed leases in the North-West. In Chile, large protests prevented the industry expanding into the unspoiled Beagle Channel in Tierra del Fuego, about 55 degrees South (Summers 2019).

Besides having strained community social license, much-valued sustainability certification is at risk. Consumer and sustainability organisations have 'red-listed' salmon producers from the world's four largest production regions (Seafood Watch 2019) and from Tasmania (Spring 2018, Meder 2018). The World Wildlife Fund has continued certification of leases of one major Tasmanian producer (Tassal), but along with the Australian Stewardship Council, receives \$500,000 a year from the company for its efforts (Meldrum-Hanna et al. 2016), which strains the credibility of independent certification.

TOR 3 – An independent review of certification arrangements is recommended here, especially in relation to any quid pro quo between the industry and certifying organisations.

5. Strategic response

One strategic response to many of these issues is to expand more and more offshore into the open sea where it is hoped that environmental impact will be diluted by stronger wave action, greater depth and sheer volume of seawater. Much sturdier 'fortress' cages are being constructed to enable this in Tasmania's Storm Bay near Hobart for salmon – a practice also undertaken overseas by the Chinese and Hawaiians for other species. This approach has been lauded by the World Economic Forum (Whiting 2019), yet brings with it greater threats of damage, to navigation and loss of fish.

Another response is to pro-actively engage with the community and marine groups. Both major Tasmanian producers have sophisticated 'community engagement' public relations departments that act to head off and blunt adverse publicity. One technique to prevent unified opposition now used at community forums run by one company is to break up the meetings into small groups using laptop displays and several different individual 'facilitators'. However, this approach fails to address the community concerns raised by those affected and is cynically undemocratic.

TOR 3 – We suggest that this multiple small group approach be discouraged and instead normal single-focus public meetings be reintroduced.

6. Native wildlife

Salmon pens are strong attractors of native predators such as seals. While these protected mammals were formerly shot in Tasmania, beginning in the 1990s this protected species was instead caught and transported overland to remote parts of the state, tagged and released by the state primary industry and environment department (Barracough 2006). This expensive practice ceased in 2017 (DPIPWE 2017, p.3) and other ways of reducing seal impact have been implemented, especially better-designed stronger pens, which were earlier regarded as impractical. These double-walled pens nevertheless

have the downside of double the cleaning and hence debris, as well as reduced water flow (Denholm 2016).

TOR 2c – We recommend that a study of other ways of reducing impact on seals be commissioned from research groups such as the CSIRO or IMAS, and that the legislation should mandate programs funded by industry to minimise impacts and monitor results.

7. Water temperature

Tasmania is in a lower (warmer) latitude than other salmon farming areas at only about 43 degrees South, with a relatively short coastline. As global warming brings about higher seawater temperatures, threats to fish health will increase. Pests associated with salmon farming, such as amoeba, jellyfish, toxic algae, and sea lice, are likely to become more abundant, and also potentially impact native species. Further, warmer water holds less dissolved oxygen than colder water, so all the low oxygen problems associated with Macquarie Harbour will happen with increasingly less stimulus as our waters warm. As the industry in Tasmania cannot simply move further South as it can in New Zealand and Chile, instead local salmon companies are attempting to develop temperature-tolerant fish through selective breeding (Alvarez 2019). This requires considerable research and investment – and is yet to show that it works. And, to the extent that it is used, genetic manipulation may risk Tasmania’s GMO-free status.

TOR 2c – We recommend an independent investigation into the genetic modification of finfish to ascertain its extent and whether it risks breaching of Tasmania’s GMO-free status.

8. Public subsidy: inshore, offshore or onshore?

The temperature phenomenon above points to moving farms from inshore to offshore, as temperatures in deeper waters increase less rapidly. However, not only does this response represent a threat to navigation and increased marine debris, it is also more difficult to service and feed the fish, as well as increasing the likelihood of fish escapes.

Rather than the hazards of offshore, ultimately the best solution is land-based self-contained tanks where all conditions including water temperature can be directly controlled (Seafood Watch 2016 and 2018). Such land-based production of marketable fish is a solution with minimal environmental or political downsides. Yet the industry in Tasmania says it is not feasible. What they rather mean is it is less profitable. It is certainly understandable that the industry would view it this way when natural waterways are freely provided for their exclusive use, with very little public return – despite continuing expansion, pollution and degradation.

In contrast to Tasmania, the market leader, Norway, imposes considerable rent on its salmon industry. In this way, taxpayers are not left subsidising the operating costs of this lucrative business, nor its clean-up costs. And self-contained, land-based operations already exist in Norway, and their products receive very high consumer ratings (Ibid). They are also sustainable over the longer term.

TOR 2b – We recommend that the industry be required to pay fair market value rent for the use of public waterways.

TOR 2c and 3 – We recommend that the government encourage the long-term development of onshore salmon farms in Tasmania, through either mandate or incentive.

9. Muddying the waters

The industry – supported by the State government – paints a rosy picture of salmon farming in Tasmania using figures, concepts, and sweet sounding words on their websites and in their publications that can be interpreted in different ways: “strict monitoring shows minimal impact”;

“culture of care and collaboration”; “exercising an abundance of caution” (TSGA 2019). Rather than muddying the waters further, in our opinion it is time for better regulation. It is important to emphasise the need for better rather than just more regulation. We assert that such regulation must involve few easily understandable criteria that are frequently measured and publicly reported on. Examples of existing desirable data criteria are at Appendix 2, sourced from Seafood Watch, which assesses many different salmon producers around the world.

TOR 1a – We recommend that the key data created and monitored by Tasmanian regulation be consistent with that of the globally recognised Seafood Watch, as shown in Appendix 2.

RECOMMENDATIONS

In summary, our recommendations are:

- Monitor heavy metal contamination and resuspension near fish farms (TOR 1a, 2c, 3)
- Make public routine drinking water tests (TOR 1a, 2c, 3)
- Investigate the impact of gill disease and measures on native species (TOR 1b, 2c, 3)
- Monitor risks associated with net cleaning and impact of hydroid colonies (TOR 1a, 1b and 2c)
- Use and publicise ABS census estimates for industry employment (TOR 1a, 3)
- Make the industry code of practice publicly available (TOR 1a)
- Commission an independent review of certification arrangements (TOR 3)
- Discourage multiple small groups facilitation at community forums (TOR 3)
- Research better ways to reduce industry impacts on seals and other native species (TOR 1b, 2c, 3)
- Investigate the genetic modification of finfish to ascertain its extent and whether it risks breaching of Tasmania’s GMO-free status (TOR 2c)
- Encourage onshore fish farms through mandate or incentive (TOR 2a-c, 3)
- Establish common data criteria in line with Seafood Watch (see Appendix 2) (TOR 1a, 2).

Minimum measures

While we argue that the above recommendations should be seriously considered, we suggest five minimum measures that would help to resolve the challenge of salmon production and the price it exacts upon our communities and waterways:

- Evidence-based global standards for (1) stocking densities and (2) the safe proportion of waterways that can be used for salmon farming (TOR 1a, 2c, 3);
- Much greater industry transparency so that growers are required to post performance against globally-recognised criteria on the industry website at least quarterly (TOR 1a, 3);
- A requirement to clean-up damaged waterways, similar to mining pollution mitigation requirements (TOR 2c, 3);
- Fully self-contained fingerling hatcheries (TOR 1b, 2c, 3); and
- Industry payment of rent for use of public waterways (TOR 2b, 3).

We encourage this Inquiry into finfish farming in Tasmania to address these issues. We are aware that some were reviewed in the 2015 Senate inquiry, which produced only “weak” recommendations as the major parties backed industry expansion for ‘jobs and profit’ against much of the evidence presented (Ryan 2015). We hope that the recommendations from this inquiry are more balanced towards community benefit, environmental protection and overall sustainability of the industry.

__(signed)_____

Dr Dain Bolwell
18 November 2019

__(signed)_____

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18 November 2019

[References listed in Appendix 1]

APPENDICES

Appendix 1: References

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Appendix 2: Examples of Seafood Watch data standards and categories

Source: Seafood Watch 2016, pp.6-8.

Table 1 shows how data quality standards are rated (high, moderate, low etc) against examples that would meet such ratings and the numerical score that results.

Table 1. Data standards

Quality	Examples of data availability, quality and confidence	Score
High	<p>Assessor confidence is high that the operation and its impacts are fully understood, examples include:</p> <ul style="list-style-type: none"> ♣ Independently verified, peer-reviewed research, official regulatory monitoring results or government statistics ♣ Complete, detailed, and available without averaging or aggregation ♣ Up to date within reason, and covering relevant timeframes ♣ Collected using appropriate methods (e.g., frequency of collection, number of data points, etc.) 	10
Moderate-high	<p>Data are considered to give a reliable representation of the operation(s) and/or impacts examples include:</p> <ul style="list-style-type: none"> ♣ Data quality does not meet the 'High' standards above but are complete and accurate in relation to this assessment ♣ Up to date within reason, and covering relevant timeframes; data gaps may be present but are non-critical ♣ Some non-critical aggregation or averaging may have taken place ♣ Data collection methods (e.g., frequency of collection, number of data points, etc.) are considered robust 	7.5
Moderate	<p>Data provide some useful information, but the assessor (subjectively) is uncertain whether data fully represent the farming operations</p> <ul style="list-style-type: none"> ♣ Data may not be verified ♣ Some loss of relevant information may have occurred through data gaps, averaging or aggregation ♣ Data collection methods are questionable or unknown. ♣ Questions or uncertainties remain in key information 	5
Low-moderate	<p>Data provide little useful information and are not sufficient to give confidence that the operation and its impacts are well understood</p> <ul style="list-style-type: none"> ♣ Data probably not verified ♣ Weaknesses in time frames or collection methods; data gaps or aggregation and averaging mean that critical interpretation is not possible ♣ Questions and uncertainties about the data mean it is difficult or impossible to draw reliable conclusions 	2.5
Low	<p>Data do not provide useful information and are not considered to represent the operation(s) and/or impacts</p> <ul style="list-style-type: none"> ♣ Data are incomplete or out of date, unverified, or collection methods are inappropriate 	0

Table 2 shows the 12 categories of data that are used to reach an overall assessment of the salmon farming operation. Each category is scored between 0-10 (or n/a) on the basis of table 1 data quality and availability. Scores are then totalled and divided by the number of categories scored, which may be up to 12, to reach a mean score out of 10.

Table 2. Categories

Category	Data Description	Score 0-10 or n/a
Production	Industry or farm size and production volumes, species, number and locations of farms or sites, general production methods	
Management	National, regional, and local laws and regulations and/or industry management measures, inclusion of area-based or cumulative impact measures, implementation and enforcement at the individual farm level	
Effluent	Water quality testing, impact monitoring, regulatory control and enforcement	
Habitat	Farm locations, habitat types, impact assessments, history of conversion, habitat monitoring, habitat regulatory control and enforcement	
Chemicals	Type, frequency, dose and discharge characteristics, impact monitoring, regulatory restrictions	
Feed	eFCR ⁴ , inclusion rates of fishmeal and oil (including by-products) and of other ingredient groups (vegetable or crop meals and oils, land animal products and by-products). Sustainability of fisheries supplying marine ingredients	
Escapes	Numbers and size of animals, recapture or survival rates, impacts of escapees.	
Disease	Disease outbreaks, mortalities, pathogen and parasite levels and treatments, biosecurity characteristics, monitoring or evidence of impacts, regulations and emergency responses	
Source	Source of farm stocks, use of wild fisheries for broodstock, larvae or juveniles	
Predators Wildlife	Predator and wildlife mortality rates and evidence of population impacts,	
Introduced species	International or trans-waterbody live animal movements, species and domestication status, biosecurity of sources and destinations	
Energy Use	Electricity, fuel use, etc.	
	Total Score (T)	
	Mean score (T/no. of scores)	

⁴ EFCR: economic feed conversion ratio = kilos of feed to produce one kilo of fish, typically c. 1:1