[redacted]

28.11.19

SUBMISSION TO THE INQUIRY INTO THE FIN-FISH FARMING INDUSTRY

Dear Sirs/Madams,

My name is Rebecca Howarth and I am a resident and rate-payer in the Tasman Municipality. I work at the Neighbourhood House in Nubeena and have lived in this beautiful region for 5 years now. I am raising my two children in an area where I feel blessed to have some of the most pristine coastlines in the world. We visit our local beaches regularly and it is a real joy to watch my children run and play safely and happily in the clean waters. I want to preserve this clean water and clean coastline for their future, for the future of all the children of the Peninsula and all the fantastic marine life that we share these coasts with.

I believe passionately that the salmon farming industry in Tasmanian is in need of immediate and dramatic reform. For this to be given the due time and attention it requires, I believe a moratorium on all fin-fish farm expansions in the state is essential. I am thrilled to be given this opportunity to share my views in my submission so I thank you wholeheartedly for calling this inquiry.

The layout of my submission refers directly to the Terms of Reference.

1) The implementation of the Sustainable Industry Growth Plan for the Salmon Industry and its impact on commercial finfish farming operations and local communities, including: a. data collection and publication; b. progress in the development of an industry wide biosecurity plan

Data collection
Previously, salmon farming companies were required to hire independent monitoring companies such as Aquenel. Nowadays, the companies are allowed to carry out much of their environmental monitoring themselves. My belief is this needs to be an external and independent process. Baseline data collection prior to salmon farm leases being granted is minimal and poor. Scientists such as Christine Coughanowr from the DEP argues that this is not enough and thorough baseline data collection takes years. [ATTACHMENT 1]

I believe the industry needs independent water quality and environmental studies before any environmental licenses are issued and not an "adaptive management" approach.

All licenses granted must set a hard cap on biomass grown and dissolved nitrogen into waterways from pens, hatcheries and other infrastucture. This must be based on taking the precautionary principle. Macquarie Harbour is a prime example of what happens when large companies who are satisfying shareholders are allowed high stocking densities. There is absolutely no space for being cautious with our very delicate and precious coastal ecosystems.

The Derwent Estuary Program's Submission on the Storm Bay Marine Farming Development Plan recommends a staged and precautionary approach to the Storm Bay expansion with full Bio-geochemical modeling completed on Storm Bay before licenses are granted. I agree with these recommendations. [ATTACHMENT 1].

I also agree with their recommendation of regular public reporting of all environmental reports on Storm Bay and making them accessible online.

Biosecurity

I believe that public reporting should be mandated for disease outbreaks and other bio-security incidents.

2) Application of the Marine Farming Planning Act 1995 relating to:
a. preparation and approval process for marine farming development plans, including modifications and amendments to marine farming development plans;
b. allocation of leases, applications for and granting of leases;
c. management of finfish farming operations with respect to the prevention of environmental harm;

Lease approval

It is alarming that any commercial fish-farming company should be allowed to put stock into historically owned leases without a full Environmental Impact Assessment, or even re-application for use of this lease under modern legislation. Two examples of this were when Huon Aquaculture utilised their historic Green Head lease for salmon with POMV in 2018 and Tassal putting stock into their Port Arthur lease in 2017. According to DEP scientist Christine Coughanowr's letter to the EPA [ATTACHMENT 2], there has been minimal baseline data collection before the re-entry of stock into Port Arthur, which constitutes a rather poor EIS. Tassal have chosen some well-flushed sites for minimal continued water quality testing, but Long Bay and other areas of Port Arthur susceptible to a high nutrient load are shallow and poorly flushed. Tassal's permit doesn't require them to monitor vulnerable seagrass beds, or the more poorly flushed parts of the bay. We are now seeing a dramatic increase in the incidence of filamentous green algae in Long Bay which thrive on high nutrients. It is entangling fishers, swimmers and divers. I have attached some photos of this unprecedented environmental event [ATTACHMENTS 3a – 3c]. This has prompted DEP scientist Christine Coughanowr to write to the EPA with her concerns and recommendations [ATTACHMENT 4]. I share her concerns and endorse her recommendations.

There is no stocking limit for Port Arthur. Christine Coughanowr has implored Wes Ford to implement a stocking limit, and he continues to refuse, a for a reason which is unknown. This needs to change before Port Arthur becomes the next Macquarie Harbour and we see the coastline of the Tasman National Park, home of the award winning 3-Capes Track, ecologically damaged.

Port Arthur is a smolt grow-out area, which is a grey area for sustainability auditing. There is no need for this area to be monitored or for there to be community consultation under the ASC standard. This is a huge loop hole and doesn't make any sense. The Port Arthur community have therefore felt extremely bi-passed and in the dark.

I believe strongly that all decisions regarding licenses and license amendments need to be referred to the EPA board, not just the Director, so that the community can have their say.

Consultation

The community consultation process for the Storm Bay expansions has been shockingly lacking. As a community member I have felt repeatedly overlooked, uninformed, misinformed and honestly have been treated with complete disdain.

There have been approximately 2 community information evenings in Nubeena each year for the last few years, but we haven't had one now for 10 months. It is apparent why they call them information evenings, because they don't truly want to consult with us, they simply want to inform us. At the Feb 2018 info evening, Tassal took up the whole evening with a confusing powerpoint presentation and wanted to cut questions down at the end to only 20 mins. The Tassal reps reluctantly agreed to stay and answer questions which went on for another 1 and a half hours! Their body language was that of total disdain for us and disrespect. I felt like we were just a nuisance to them, we did not feel truly consulted with, or that our opinions mattered to them one iota.

When I asked Tassal's environmental scientist at their Nubeena information evening in Feb 2019 about how had the ecological damage at Macquarie Harbour happened? His reply was "We didn't have the proper science back then to know that was going to happen." So I asked "So how can we trust that you have the proper science now to reassure us there will be no ecological damage to our coastline here." and he literally couldn't answer my question. At this particular community information session, I left feeling more perplexed and less trusting of the industry than ever. Tassal had hardly been able to answer a lot of our basic questions about proper scientific monitoring etc.

I was confused as to why in Tassal's highlights magazine it says they have quarterly community consultation. Then I discovered that Tassal hold closed 'Community Advisory Group' meeting every quarter. Almost no-one knew about these in Nubeena and they are advertised in a surreptitious corner of their website. If one applies, one must be vetted by the current Community Advisory Group before being approved to attend. This seems like a total farce, that Tassal can pick and choose who they consult with, and then can tick off community consultation. These meetings seem to only approve those members of the community who are amenable and 'positive' (their words) towards Tassal.

Approval Process

The credibility of the Marine Farming Planning Review Panel is in my view, extremely dubious. During the hearings for the Draft Amendment no 5. to the Marine Farming Planning Act, community members who were presenting were treated rudely, with disdain and as if we were a nuisance. To present at a hearing was a nerve-wracking and daunting thing to do for a community member, and many had spent hours preparing their presentation. I presented at the hearings and the panel members regularly huffed and puffed with either what seemed like boredom, or incredulity at what I was presenting. I was accused of making up stories and had other rude retorts directed at me, even though I backed up every statement I made. I could not believe that this panel was supposed to be impartial as it felt as though we were almost pitched against them somehow. The only person who spoke to me with humanity was Dr Louise Cherrie.

When Dr. Louise Cherrie and Dr Barbara Novak quit the MFPRP earlier this year, this would indicate very clearly that the panel is completely compromised. In their letter of resignation the two scientists stated their reasons for leaving as:

- "The panel was not serving the best interests of the state"
- "Our resignations were due to frustration with the process"
- "The panel is, as currently structured and within the confines of the legislation, inherently compromised"
- [The panel] "shows an undue propensity to support what is operationally convenient for the aquaculture industry". [ATTACHMENT 5]

I was completely shocked when Guy Barnett claimed the government still had full confidence in the panel after such a scandal, and then for the panel to advise the government to grant the Storm Bay licenses. It is completely questionable for a compromised panel who shows "undue propensity to

support for what is operationally convenient the aquaculture industry" to then still go ahead and advise the government to grant the industry their leases.

I recommend that the Marine Farming Planning Act is amended to require valuation and protection of social, recreational and visual amenity; consideration of noise impacts on surrounding residents.

The Marine Farming Planning Review Panel needs to be able to function as a truly autonomous, independent panel, and with representatives from both industries and the community sector. Industries that should be represented on the panel include tourism and commercial fishing. An important community group that should be represented on the panel is the Tasmanian Alliance for Marine Protection (TAMP). Before this can happen there needs to be an independent review of the Marine Farming Planning Review Panel, focusing on its membership, governance and ties to industry.

Collusion
I believe that there is clear evidence of regular collusion between Tasmanian State Government and the Tasmanian Salmon farming industry. This needs to stop. The head offices of the salmon farming companies should not be in the same building as DPIPWE, in the Marine Board Building. This allows for too much crossing over of individuals from either organisation and physical distance would be a first step to preventing further collusion.

Regulation
I believe that there needs to be improved transparency and enforcement by prosecuting fish escapes, fish kills, marine debris and seal and cetacean interactions.

At the Nubeena information evening Feb 2019, a member of the community asked how many demerit points did Tassal receive for the Macquarie Harbour disaster. They answered none. If they received none, do they receive any demerit points for the marine debris that is washed up on our beaches when it is reported to the EPA. I highly doubt it, and this needs to be enforced.

In my opinion significant fines and the sufficient addition of demerit points for not meeting license requirements is paramount in the regulation of this industry.

3) **Any other matter incidental thereto**

Marine Debris
Copious amounts of marine debris are still being washed up on our shores. Residents regularly pick it up on the beaches. Yes, Tassal are doing regular beach clean ups now which is great. But they pat themselves on the back for it and use it in their PR. How much plastic waste from fish farms is still floating around in the ocean if only a proportion has washed up on beaches? Fish farms are the biggest importer of plastic in the state, so this use of plastic needs to be reduced dramatically. The Zero Tolerance stance the government claims to be taking on marine debris is not being enforced and it needs to be.

Noise and light
Residents of the Tasman Peninsula are suffering regularly with noise and light pollution, particularly in Nubeena and White Beach. Some renters are reconsidering buying in the region because of the constant noise, and some residents are considering selling their homes and moving away. Some complain of lights every night and a low drone noise that never goes away. If the Storm Bay expansions goes ahead, I dread to think of the incessant issues of noise and light we will face.

Threat to endangered species
The critically endangered Red Handfish and the endangered Spotted Handfish are very vulnerable species who exist in very small precarious populations in Frederick Henry Bay and at the mouth of the Derwent River. The protection of these species habitats from sedimentation and nutrification need to be adequately considered. These are two of Tasmania's iconic flagship species.

Water and De-sal
I am extremely concerned about the water usage by the salmon farms on the Tasman Peninsula. The TP is a very dry place and already Tassal seems to struggle to find enough freshwater. Where will the water come from for the bathing with the expansion? We have never been given a clear answer. And how will the hyper-saline pollution be managed from using the well boat for desalinisation?

Jobs and economy
In my area, the subject of jobs makes talking about the salmon industry a very tricky thing. The argument of jobs often come back emphatically if one mentions concerns about the salmon industry. And yes, people need jobs. Industry is important, particularly in small rural communities. I have friends who work for Tassal and have full respect for them. But in fact, the latest Australia Institute report [ATTACHMENT 6] shows that the economic role of the salmon industry in Tasmania is exaggerated regularly, as are the number of jobs they actually provide compared to other industries in the state. According to the aforementioned report, there are 39 industries across Tasmania who employ more people than salmon.

It is very important that an industry which relies on the resources of the natural world looks after those natural resources. If these natural resources and ecosystems we rely on are spoilt, then there will be no jobs!

A prime example of this was when 22 Petuna workers lost their jobs in 2018 because the salmon companies were ordered to reduce their stock in Macquarie Harbour [ATTACHMENT 7]. This was because oxygen levels had dropped so low that 100,000 fish died, and ecological damage across the bay including inside the WHA had been reported.

My true gut feeling is that the only place for fish farming is fully onshore where the waste can be managed in a fully reticulated system or far off-shore like Salmar's trial in Norway [ATTACHMENT 8].

My final comment is that I implore you to recommend a moratorium on fin-fish farming expansions to the lower house. A moratorium, as you would know, is only a temporary pause on the industry expanding, no-one needs to lose their jobs, no industry is shut down, but it does allow for the time needed for a complete reform.

Thank you for your time,

Yours faithfully,

Rebecca Howarth

DERWENT ESTUARY PROGRAM LTD SUBMISSION ON STORM BAY MARINE FARMING DEVELOPMENT PLANS/ENVIRONMENTAL IMPACT STATEMENTS:

Environmental Impact Statement to accompany Draft Amendment No 3 to the Storm Bay off Trumpeter Bay North Bruny Island, Marine Farming Development Plan, July 1998 (Huon Aquaculture)

Environmental Impact Statement to accompany Draft Amendment No 5 to the Tasman Peninsula and Norfolk Bay, Marine Farming Development Plan, November 2008 (Tassal)

Environmental Impact Statement for draft Storm Bay North Marine Farming Development Plan (Petuna)

17 January 2018

The Derwent Estuary Program (DEP) considers Storm Bay to be a single system, and thus addresses the potential cumulative impacts of all three proposals (HAC, Tassal and Petuna) in this combined submission, with a particular focus on the Derwent estuary.

The DPIPWE overview notes an aspirational target for salmon production in Storm Bay of 80,000 tpa, but that in light of robust scientific information, a combined limit of 40,000 tpa for the three proposals is currently under assessment. Further, that a staged 30,000 tpa limit will apply while monitoring and modelling systems are being established.

In addition to the comments provided below, the DEP requests a hearing to discuss these in more detail with the Marine Farming Planning Review Panel.

ABOUT THE DEP AND THE DERWENT ESTUARY

The DEP is a partnership between government, business, scientists and the community to restore and protect our waterway. Established in 1999, the partnership has been nationally recognised for excellence in reducing water pollution, protecting nature, monitoring river health and promoting greater use and enjoyment of the Derwent. In 2010, the DEP was awarded Australia's most valuable prize – the National River*Prize*.

Our major sponsors include: Brighton, Clarence, Derwent Valley, Glenorchy, Hobart and Kingborough councils, the Tasmanian Government, Nyrstar Hobart, Norske Skog Boyer, TasWater, TasPorts and Hydro Tasmania. Since March 2017, the DEP has been operating as a registered company, with an independent board.

The Derwent estuary lies at the heart of the Hobart metropolitan area and is home to 40% of Tasmania's population, as well as a major centre for commercial, industrial and tourism activities. The estuary has a long-standing history of heavy metal pollution – with some of the highest reported levels of zinc, mercury and lead in the world. In recent years, there has been significant investment to reduce metal inputs by both the zinc smelter and the state government, with considerable success. However, the legacy pollution in the estuary sediments will require careful management for many years to come.

More recently, the estuary has shown increasing signs of nutrient stress, including nuisance algal blooms, seagrass loss and persistent low oxygen levels in some areas. Previous research has shown a strong link between nutrient loading, low oxygen and release of heavy metals from sediments. Therefore, a key element of our long-term management strategy for the estuary is to manage and reduce nutrient loads, particularly during summer months, when the risks are highest. The marine waters of Storm Bay and the D'Entrecasteaux Channel drive the overall circulation of the estuary, and set the background nutrient levels for the system as a whole. Therefore, a significant change in nutrient inputs from Storm Bay could have far-reaching impacts on the Derwent estuary.

GENERAL COMMENTS

1. **Need for a combined assessment**

   Given the size and scale of the proposed expansion, and the connectivity of Storm Bay, it is essential that these three proposals be planned, assessed and managed together, as a cumulative impact assessment. Development of an 'Area Management Agreement' is also recommended by the Aquaculture Stewardship Council as an important aspect for certification.

   It is very difficult to understand the scale and timing of the three proposed developments when they are presented as separate proposals. Without this information, it is difficult to evaluate potential impacts. Therefore, the DEP has attempted to extract information on proposed biomass and nutrient loads from the three documents, as presented in the table below. Feedback on the accuracy of this combined table would be welcome, as comparative information was difficult to find.

   Other information that should be compiled and assessed as part of a combined regional assessment includes the location of sensitive or threatened communities/species including seagrass meadows, giant kelp, spotted and red handfish, and other relevant communities and species.

2. **Large scale, rapid development and the precautionary principle**

   The proposals indicate that an initial combined maximum biomass of 40,000 tpa is being considered for Storm Bay, with a staged approach (starting with 30,000 t as first stage). However, information is not presented in a consistent manner between the proposals. In particular, the HAC proposal presents a case for the 40,000 tpa scenario, while the Tassal and Petuna proposals provide information for the 30,000 tpa scenario.

   In either case, this is a very large biomass in comparison with current salmon production across Tasmania as a whole (50,000 tpa), and as compared to production in individual systems (e.g. 12,000 to 14,000 tpa in Macquarie Harbour, >24,000 tpa in the Channel/Huon (based on 2010 figures; current data was not available); or by individual producers (HAC: 20,000 tpa; Tassal 25,000 tpa; Petuna: not available).

   Estimated nutrient loads associated with these production levels are very large, as set out in the table figure below. An estimate of nutrient loads associated with the longer-term aspiration of 80,000 tpa is also presented.

Current and proposed production and Dissolved Nitrogen Outputs (DNO) to Storm Bay under different production scenarios (in tonnes/year):

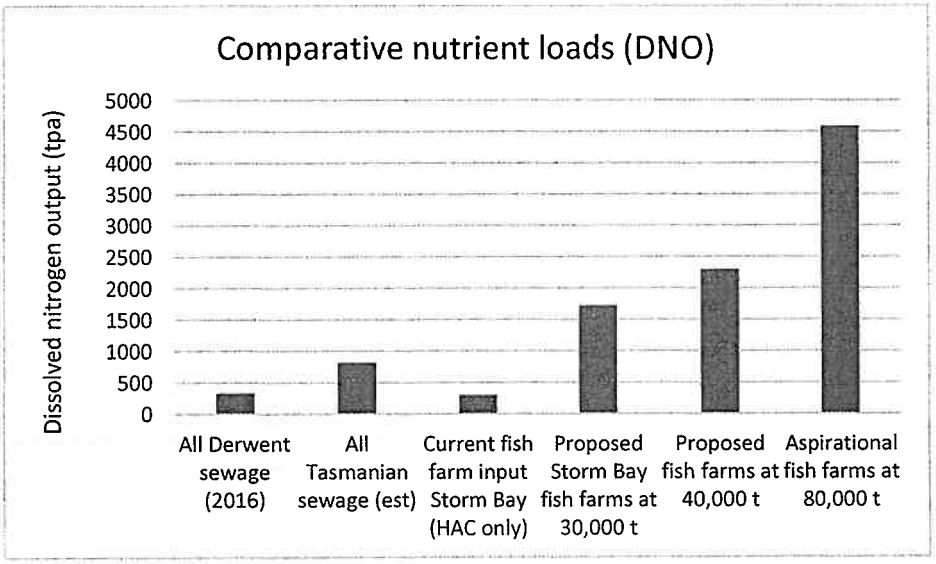
Source	Current production & load	Interim production - 30,000t **1722t TPDNO**	Proposed production - 40,000t **2296t TPDNO**	Aspirational production - 80,000 tpa **4592t TPDNO**
Storm Bay off Trumpeter lease (HAC)[1]	6000t 300 – 400 t (based on Fig 4)	*15,000 t biomass* *861 t DNO* *by ???*	20,000 t biomass 1148 t DNO by May 2019	
West of Wedge lease (Tassal)	??[2]	9000 t biomass 514 t DNO (Staged over 3 years) • Yr 1: 150 • Yr 2: 300 • Yr 3: 400	12,000 t biomass 689 t DNO	
Storm Bay North lease (Petuna) 35-39 m	0	6000t (@75%) 344t DNO (@75%) No info on staged approach	8000 t biomass 459 t DNO	

(1) HAC EIS proposes 20,000 t biomass, and notes the 30,000 t interim limit for Storm Bay as a whole, but does not provide DNO values at this level in the EIS. Values in italics are pro rata estimates based on 75% production. Of concern is the plan to stock

the Yellow Bluff site with smolts by April 2018, as this would lead to a very rapid increase in biomass and nutrient loads before monitoring & modelling systems are fully operational. See Fig 4, p17.

(2) Could not find Tassal current production at Nubeena in EIS

To provide some context, the DNO from all sewage discharged to the Derwent estuary is estimated at 327 tpa, and the sewage-derived DNO for the entire state would be under 1000 tpa (pro rata, assuming similar treatment levels). By comparison, the estimated DNO as set out in the three proposals at 40,000 t production is 1892 tpa (ie nearly six times the Derwent sewage load), and would be more than 14 times the Derwent sewage load at the 80,000 tpa production level.



The proposed rate of development is also very rapid, particularly for the Trumpeter Bay lease, which proposes to reach a DNO of 1147t by mid 2019 (Figure 4a, p 17).

'Offshore' is a relative term, and while the Storm Bay environment is relatively exposed, it is still considered to be a bay with variable degrees of exposure to prevailing winds and storms.. Given the scale and pace of the proposed expansion, and the proximity of several potentially sensitive receptors to nutrient loading – specifically the Derwent estuary and Frederick Henry Bay – it is recommended that a staged, precautionary approach be taken, based on good science, monitoring and reporting.

3. Need for good system understanding, including monitoring, modelling and process studies

Storm Bay is a unique system, with processes and patterns that are unlike other areas of Tasmania. This is an area of high variability, both within and between years, and has been identified as a climate change hotspot. Previous studies of Storm Bay have shown that nutrient processes and algal blooms are strongly influenced by wind and storm events (Harris et al, 1991). Assumptions based on steady state conditions are therefore risky, as are comparisons with other systems, and monitoring and modelling designs need to take this into account.

The nutrient assimilation capacity of Storm Bay is unknown, but likely is likely to vary seasonally, and from year to year. Furthermore, major southerly storm events could stir up nutrient-enriched bottom water and sediments with unanticipated consequences. Finally, the benthic system may not respond as anticipated as this system may not be adapted to high levels of nutrient and organic loading.

While there has been some baseline monitoring done for Storm Bay and some early stage modelling, these results are indicative and should be interpreted with caution. Furthermore, while there are a number of scientific investigations currently underway (e.g. FRDC), these have not yet been completed.

The intention to develop and implement a regional BEMP monitoring program, together with development of a BGC model (and associated process studies), would provide a good scientific basis for science-based management of aquaculture in Storm Bay. However, it is anticipated that this work will take a minimum of 2 to 3 years. We believe this work should commence, before significant expansion, and that future stages should be linked to completion of specific milestones.

4. **Regular public reporting and access to data**

Publications of annual environmental reports on the state of Storm Bay should be an integral part of this plan to ensure timely and transparent reporting on conditions and trends. It is essential that this include robust interpretation, and that funds be allocated to complete this (non-trivial) task. Monitoring data should also be made available via an on-line portal, as well as on request.

DETAILED COMMENTS

Issues of particular concern for the Derwent estuary

The Derwent has shown increasing signs of nutrient stress, including nuisance algal blooms, seagrass loss and persistent low oxygen levels in some areas. Previous research has shown a strong link between nutrient loading, low oxygen and release of heavy metals from sediments. Therefore, a key element of our long-term management strategy for the estuary is to manage and reduce nutrient loads, particularly during summer months, when the risks are highest. The marine waters of Storm Bay and the D'Entrecasteaux Channel drive the overall circulation of the estuary, and set the background nutrient levels for the system as a whole. Therefore, a significant change in nutrient inputs from Storm Bay could have far-reaching impacts on the Derwent estuary.

Of particular concern is the potential for increased nutrient levels in bottom water, which drives the overall circulation of the Derwent estuary and subsequent ecological response. This is not fully represented in the model, nor is the potential for large-scale resuspension following storm events. Ecological responses to eutrophication could present as changes in phytoplankton production (algal blooms and/or changes in community structure) and/or increased macroalgae production (attached or drift). Sensitive receptors could include:

- Ralphs Bay (shallow, poorly flushed, may be susceptible to drift algae growth and accumulation)
- Spotted handfish in lower Derwent/Ralphs Bay (spawning substrate susceptible to algal fouling)
- Derwent temperate reef communities (including EPBC-listed giant kelp communities), particularly those along the Kingborough shoreline
- Seagrass and macrophyte communities (susceptible to algal overgrowth, shading and loss)
- Heavy metal contaminated sediments – low oxygen levels can remobilize toxic metals (including mercury) with potential impacts on humans, fish, birds and other biota.

Comments on Nutrient Dispersion Modelling (Hadley et al, 2017) and proposed biogeochemical model

This report provides an interesting representation of predicted nutrient dispersion from the proposed developments at a combined biomass of 40,000 tpa, however, as stated on page 14 'this is early stage modelling is only indicative of the system conditions, and as such the results should be interpreted with the relevant degree of caution.' The DEP has a number of questions about the model, and would be concerned if it was used as a basis for decision-making without further validation, and indeed without the development of the full biogeochemical model. In particular:

- What hydrodynamic model underpins the dispersion model? If Herzfeld 2008, this is a relatively early-stage model (Stage 1 –INFORMD), and requires further development, particularly with respect to boundary conditions.
- The assumptions used in the model require further testing and validation, particularly the 4-day decay rate.
- Decay is not the same as removal – both ammonium and nitrate will stimulate phytoplankton and other algal growth, and the nutrients removed will return to the system when the algae breaks down (along with

oxygen depletion). This is what we are really interested in understanding, and a full biogeochemical model is needed to evaluate nutrient impacts more broadly.

- The assumptions used for dispersion at depth are hard to follow, and the dispersion model does not seem to include nitrogen release from sediments (e.g. breakdown of faecal matter and feed)
- It is unclear what period of data were used to generate the background percentiles – was this a single year or multiple years?
- The model seems to reflect steady-state conditions, but how would the system respond to a major storm event?

The biogeochemical model is an important tool to assess ecological responses to nutrient loading. The model should identify sensitive receptors and the conditions/times when these are most likely to be impacted – e.g. during summer months, following major storm events, during EAC dominated periods. Scenarios to be tested should include 'worst case scenarios'. Growth and accumulation of drift algae may be an important symptom of eutrophication in shallow bays such as Ralphs Bay and Frederick Henry Bay, and should be also be included in model development. Given the time required to develop and test the model – including process studies – the BGC model should be funded and well underway before significant expansion

Comments on Indicative Storm Bay Environmental Monitoring Program (DPIPWE, 2017)

This report provides an overview of an indicative BEMP monitoring program for Storm Bay, to be implemented as part of an adaptive management regime. The Storm Bay BEMP would include a range of water quality, benthic and reef monitoring sites. The DEP is very supportive of broadscale monitoring and reporting, and would strongly encourage coordinated and integrated monitoring between the Derwent and Storm Bay systems. Our recommendations include the following:

- Deployment of sensors at key sites to better inform model development, and to assess storm-related effects (it will not be practical or safe to collect water samples during major southerlies!).
- Include resources needed for the preparation/publication of annual reports. While the Huon/Channel BEMP is cited as a model for Storm Bay, lack of timely and regular public reporting has been a real concern. To date, only one BEMP report has been publicly released (for the period from 2009 to 2013), and it is therefore not possible to assess the merits of this monitoring program, or the current state of the Huon/Channel system.

Other comments

- Frederick Henry Bay / Norfolk Bay: these are shallow, clear and biodiverse systems, which are highly valued by the recreational fishing community. These bays are poorly flushed, and could be seriously impacted if nutrients were to be entrained. Some areas also provide critical habitat for the endangered red handfish (sensitive to biofouling), and there may also be important seagrass meadows and giant kelp communities. Thus, this area should be assessed with particular care, including potential impacts of storm events.
- Implications for Harmful Algal Blooms (HABs) – the increasing prevalence of the EAC suggests that this development may essentially be adding nutrients to a warm water, nutrient poor system that has seen severe increase in HABs over the past few years. Could further addition of nutrients exacerbate this?
- Marine pests: could nutrient and organic enrichment of previously coarse, sandy sediments encourage settlement and migration of marine pests? For example, the invasive Japanese seaweed *Undaria pinnitafolia* has been shown to grow more prolifically in nutrient enriched conditions.
- Handfish – where are current handfish populations (spotted and red), and could nutrient enrichment/biofouling pose a risk to their breeding success?
- Seagrass: as noted, seagrass is adversely impacted by nutrient enrichment. Existing seagrass beds should be mapped, baseline surveys (condition & extent) carried out and regular monitoring be implemented as part of this development.
- The estimated nutrient loads for Storm Bay are based on Food Conversion Ratios and associated nutrient yields that were derived from studies that are now over 15 years old; these also assumed zero loss of feed

(Wild-Allen, 2005). Given recent advances in feeds, feeding technologies and new cage designs, a review of these conversion rates is recommended to ensure the models are based on correct load estimates.

RECOMMENDATIONS

1. **Science-based management**
   Storm Bay should be managed as a single system, including integrated assessment and management of salmon production. It is important that potential impacts on adjacent nutrient-sensitive systems (Derwent and Frederick Henry Bay) also be fully assessed, and included in modelling and monitoring programs.

2. **Staged and precautionary growth**
   Given the scale of the proposed expansion, a staged and precautionary approach is recommended based on good system understanding. This should include determination of the Bay's carrying capacity under a range of conditions, as well as an understanding of how the system responds to major storms.

   A series of milestones and deliverables should be established that are clearly linked to each stage, and stocking levels should allow for the completion of each stage before the next production level is approved. It is particularly important that environmental triggers be established early on, and that there is clarity about the required management response, should the monitoring program demonstrate that these have been exceeded. A possible growth scenario could progress as follow:

   Pre-expansion
   - Commence BEMP and BGC model development; map location of / conduct baseline surveys of sensitive receptors (e.g. seagrass meadows, giant kelp, handfish populations)

   Stage 1 (e.g. 10,000 tpa)
   - Complete first BEMP report and stage 1 modelling

   Stage 2 (e.g. 20,000 tpa)
   - Complete second BEMP report and BGC modelling, including scenario-testing under worst case conditions

   Stage 3 (e.g. 30,000 tpa)
   - Consider further expansion based on successful completion/assessment of above.

3. **Regular public reporting and access to data**
   Publications of annual environmental reports on the state of Storm Bay is requested to ensure timely and transparent reporting on conditions and trends. Monitoring data should also be made available both via an on-line portal, as well as on request.

4. **DEP actively engaged**
   Given the potential sensitivity of the Derwent estuary to eutrophication, the size of the regional population, and the importance of the Derwent to tourism, we request that the DEP be actively engaged in the development and coordination of Storm Bay monitoring, modelling and process studies. We have over 20 years of water quality and other environmental data that could inform and value-add to these activities, and are widely respected by the regional and scientific community for our scientific understanding and expertise.

   In particular, the DEP would welcome regular meetings and workshops with colleagues at EPA, DPIPWE, IMAS, CSIRO and the marine farming companies to facilitate exchange of information, coordination of scientific investigations and constructive review and feedback on reports.

OPEN LETTER – TO WHOM IT MAY CONCERN

14 September 2019

Re. Impacts of salmon pens at Port Arthur/Long Bay

As a scientist and resident of the Tasman Peninsula, I am writing to express my concerns about the condition of Long Bay/Port Arthur following the introduction of multiple salmon pens into this system in 2017. I have heard similar concerns raised by the local community, and have raised some of these concerns with both EPA and Tassal representatives in person and in writing. While this letter primarily focusses on the Port Arthur lease, many of these concerns are also relevant to the leases at Nubeena.

Having spent considerable time reviewing available documents, including the 2017/18 Tasman BEMP, the current Environmental License, as well as previous baseline reports commissioned by Tassal, I am setting out a number of specific concerns and recommendations which I hope you will respond to in order to ensure sustainable use of this system.

Long Bay/Port Arthur is a narrow, N-S oriented embayment extending approximately 10 km into the middle of the Tasman Peninsula. Given the limited development and low density population in this area, water quality should be good, and previous surveys (Barrett et al, 2001) have documented healthy/diverse ecosystems, including temperate reef communities and seagrass beds. These provide valuable habitat for fish and invertebrates, and the bay is highly valued/used by the recreational fishing community. There are few waterways discharging to the bay, and their flow tends to be ephemeral; in particular, the northern end of the bay is not well-flushed.

As you are aware, a series of 14 large fish pens were installed at the Pt Arthur lease in about August 2017 with a maximum estimated biomass of 3200 tonnes, from which 2682 tonnes of salmon were harvested in late 2018 (Tassal, pers comm). This biomass of fish would have released at least 150t of DIN and considerably more organic matter to the bay. This nutrient load is equivalent to that of the Macquarie Point and Blackmans Bay sewage treatment plants combined, and represents an extremely high nutrient and organic load into the head of a poorly flushed and nutrient sensitive embayment.

Impacts associated with large-scale salmon aquaculture in this bay include:

- Altered hydrology and reduced circulation due to physical effects of pens, nets, feed barges, etc (baffle effect). This would result in longer residence times, increased sediment deposition and a change in nature of the sediments (finer, organic rich) and associated benthos
- Deposition of organic matter in vicinity of pens derived from uneaten feed, fish faeces and net-washing debris, leading to change in sediment character and benthos
- Release of bioavailable nutrients leading to increased phytoplankton, nuisance/drift algae and epiphytes. This is particular a concern for both nearby temperate reef communities and seagrass beds
- Potential effects of hypersaline emissions derived from desalination plant on land and/or well-boat (particularly in deeper channels). This could affect both flora and fauna
- Capture/mortalities of native fish and fish larvae during freshwater bathing and desalination operations
- Other (e.g. use of antibiotics, fish escapes, attraction of seals and sharks)

While kayaking in Long Bay/Port Arthur on multiple occasions in 2018 and 2019, I have observed extensive growth of filamentous algae in subtidal areas around lease (particularly *Chaetomorpha billiardii*), as well as fouling/epiphytic growth and some die-off of seagrass beds in Stingaree Bay and further north in Long Bay. This has persisted in some areas even after the harvesting of fish in late 2018, suggesting that nutrient enriched sediments may be an on-going source. I have kayaked extensively in the Tasman region and have never seen this level of persistent nuisance algal fouling, with exception of areas around the large salmon leases off Nubeena.

Science-based management and regulation

I am concerned that the initial stocking of Long Bay/Port Arthur has been far too intensive for this system, and that no efforts have been made to establish the carrying capacity or to set limits on the allowable maximum biomass or TPDNO. Indeed, the only compliance requirements I can find in the current Environmental License are:

- G1.1 That benthic sediment conditions meet specific criteria within the lease area and at the 35m boundary. This does not address impacts associated with dissolved pollutants which are likely to affect areas well beyond 35m.
- G2 That copper and zinc levels thresholds within the lease area are not exceeded, and
- G3 That indicator values set for the 'compliance site' off Nubeena (NUB-4) not exceed specified limits. How can this possibly be relevant for the Port Arthur lease, which is over 25 km away?

Monitoring and reporting

While the EL requires a significant level of monitoring it does not include key areas and communities, and it is unclear how the results will be used to inform production limits. The baseline survey and on-going monitoring were not designed to address impacts on broader ecosystem health, particularly with respect to rocky reef and seagrass communities, and the BEMP does not include water quality monitoring sites most likely to be impacted.

While there is a fairly extensive set of reporting requirements, much of this information is not made available to the public. In particular, I believe it is in the public interest to be advised of nutrient loads, compliance at the 35m boundary, release of chemicals and antibiotics, fish escapes and other matters that may impact on the use and enjoyment of this shared waterway. A further concern is that Tassal has recently withdrawn this site from ASC certification (due to shift to smolt grow-out), reducing the incentive for stakeholder consultation about operations in this bay.

In my professional opinion, the following steps are needed to improve the health of Long Bay and ensure salmon aquaculture can be undertaken sustainably:

- Major reduction in allowable biomass and set clear TPDNO limits, until the carrying capacity and robust monitoring systems have been established
- Undertake investigations and modelling to determine carrying capacity
- Extend monitoring to include additional BEMP sites to the north of the lease, as well as monitoring of reef and seagrass communities (including nuisance algal growth)
- Provide more comprehensive reporting to confirm that aquaculture operations are not impacting the wider system, including compliance results at the 35m limit, use of antibiotics, fish escapes, and other aspects of concern to the community. Much of this information may be included in the Annual Environmental Report, which should be made available to the public.
- Consult with stakeholders and the wider community in good faith about this site. I would suggest that an annual briefing from the EPA and Tassal to review regulatory compliance, present monitoring results, advise on production plans and address community concerns would be a good starting point.

I look forward to your response to these recommendations, and am available to meet in person to discuss my concerns and recommendations in further detail. I have also attached some more specific feedback and recommendations specific to the 2017/18 BEMP report (which can hopefully be incorporated into future monitoring and reports) as well as additional monitoring activities that are needed to protect this valuable asset.

Yours sincerely,

Christine Coughanowr

Attachments:

- Comments on 2017/18 BEMP for Tasman Peninsula and Norfolk Bay
- Additional monitoring recommendations for Port Arthur/Long Bay

ATTACHMENT 1: COMMENTS ON 2017/18 TASMAN PENINSULA & NORFOLK BAY BEMP.
Annual Broadscale Monitoring Report for the Tasman Peninsula and Norfolk Bay Marine Farm Development Plan Area (June 2017 to May 2018). Prepared by Aquenal, 2018

This publicly-available report covers the regulatory period from June 2017 to May 2018, but also includes water quality data back to 2013. Monitoring results for water quality, sediments and biota are provided at nine sites: 4 at Port Arthur and 5 at Nubeena, including the compliance site NUB-5.

Water quality monitoring is monthly at 9 sites, 3 depths for phys/chem parameters, nutrients and phytoplankton (chl a and cell counts). Water quality at Port Arthur sites has been monitored from Aug 2013 to present. Nubeena sites have been monitored from Feb 2014 to present.

Sediment samples were collected at each BEMP site (triplicate cores) in March 2018, which was 6+ months after fish were introduced to the Port Arthur system. Basic analyses (visual appearance, redox & sulphide) are done annually; benthic infauna, stable isotopes and grain size are four-yearly 1st round provided here (samples to be archived in between).

The report includes considerable information and numerous graphs, and clearly represents significant investment in effort and resources. However, the material as presented is difficult to review and interpret, and does not clearly evaluate if there have been impacts associated with the leases at Port Arthur or Nubeena.

In particular, several additional BEMP sites are needed in the less well-flushed ends of the Nubeena and Port Arthur systems, as this is where impacts are most likely to occur. Without this information, the BEMP cannot rule out significant impacts. Information on water clarity is also needed (e.g. Secchi Depth) to better evaluate potential impacts on benthic vegetation.

The figures are very difficult to review and interpret. Some provide data for all of the Nubeena and Port Arthur BEMP sites on single graph (lines run together and overlap), others combine data across the entire region. It is essential that the data for Port Arthur and Nubeena be presented separately, as these are spatially and ecologically separate systems, and have different operational activities. Also, the text size on many graphs is too small to read. While there is some interpretation of water quality results in Section 4, potential impacts resulting from aquaculture activities are not clearly assessed. To my eye, there are a number of trends which may well be related to increasing aquaculture in Nubeena and Port Arthur, as noted below:

- Fig 17: Lower DO at Nubeena than at Port Arthur. Bottom DO levels at NUB1 are particularly low, and have declined over several years.
- Fig 21: increasing bottom water ammonia levels at Nubeena, particularly at NUB1 during 2017/18.
- Fig 27: phosphate levels at Nubeena increasing over past few years, particularly at NUB1 and at depth
- Fig 33: chla levels at both Nubeena and Port A have increased in 2017/18, with progressively higher values towards the more intensively farmed areas of the bays. In Pt A, several high chla spikes (>5 mg/L) have been measured since smolt were introduced, that were not previously observed.

Furthermore, no information about operations/biomass is provided during this period. This information is needed to interpret results, and particularly whether changes may be attributable to marine farming activities. I am aware that smolts went in @Pt A in Aug 2017, so this report would cover the first 8-10 mos of production, when biomass was building up. Presumably Nubeena would have had higher levels of production.

The use of the 'compliance site' at NUB-5 does not make any sense to me as it is too far away from the Port Arthur lease, and may also be influenced by nutrients from the nearby Creeses Mistake lease at Nubeena. Instead, I would suggest that a reference site be established for Port Arthur (e.g. PA-4 or PA-3) and that seasonal water quality criteria are set using this, against which the Port Arthur BEMP results can be compared. Same goes for Nubeena.

I am actually quite confused about the rationale behind the 'compliance site' based on the EL and Section 4.5 of the BEMP report. It seems that as long as the rolling annual medians at NUB-5 are below the specified trigger levels, then the operations at both Nubeena and Port Arthur are considered to be in compliance. Is this correct? There does not seem to be any requirement to compare water quality results at the other BEMP sites with these trigger levels. If I have misunderstood this, I would appreciate some clarification. As noted above, it would be more appropriate to select a unimpacted reference site for Nubeena and Port Arthur, set seasonal water quality criteria, and then compare the BEMP data to these trigger values.

Finally, the report does not provide an executive summary, discussion, conclusions or recommendations. Have there been any observable effects associated with the fish farms in these two systems?

The sediment/benthic invertebrate data is also difficult to interpret, as it is based on samples collected in March 2018. This is some 6+ mos after fish were introduced to Pt A, and as such it is difficult to evaluate/attribute change. Was prior baseline sediment work done at the BEMP sites to provide a comparison? Or are there baseline or 35m compliance results that can provide better information on change. Where is the information on impacts at 35m published and have the compliance standards in the EL been achieved?

ATTACHMENT 2: PORT ARTHUR/LONG BAY MONTORING REVIEW AND RECOMMENDATIONS
(prepared by C. A. Coughanowr – Sept 2019)

The following additional monitoring and investigations are needed at Port Arthur/Long Bay to evaluate impacts on environmental condition, including sensitive receptors.

- Additional water quality sites (inner bay and meaningful compliance site) and parameters (Secchi depth)
- Additional sediment quality sites (inner bay)
- Seagrass monitoring (inner bays plus reference sites)
- Rocky reef monitoring (areas adjacent to lease plus previous baseline & reference sites)
- Intertidal monitoring (areas adjacent to lease plus previous baseline & reference sites)
- DEPOMOD and carrying capacity modelling and assessment

It is particularly concerning that baseline surveys and subsequent monitoring at Pt A were not designed to assess/track impacts on reef or seagrass communities, and furthermore that the BEMP design did not include likely areas of impacts to the north of the lease. Specific recommendations include the following:

Water quality (monthly)

- Extend BEMP to include at least 3 additional sites in sheltered areas to the north of the lease (e.g. 1 in channel, 2 on either side)
- Collect nutrient samples at surface and at depth where water column is stratified (e.g. channel)
- Include a reference site (PA-4, near the mouth of Pt A may be suitable; NUB-5 is not)
- Include Secchi depth (or another water clarity indicator) at all sites

Sediment/benthic monitoring (annual) Monitor changes in sediment quality (grain size, % organic carbon, redox, sulphide) and associated invertebrates at the above sites

Seagrass monitoring (seasonal/annual)

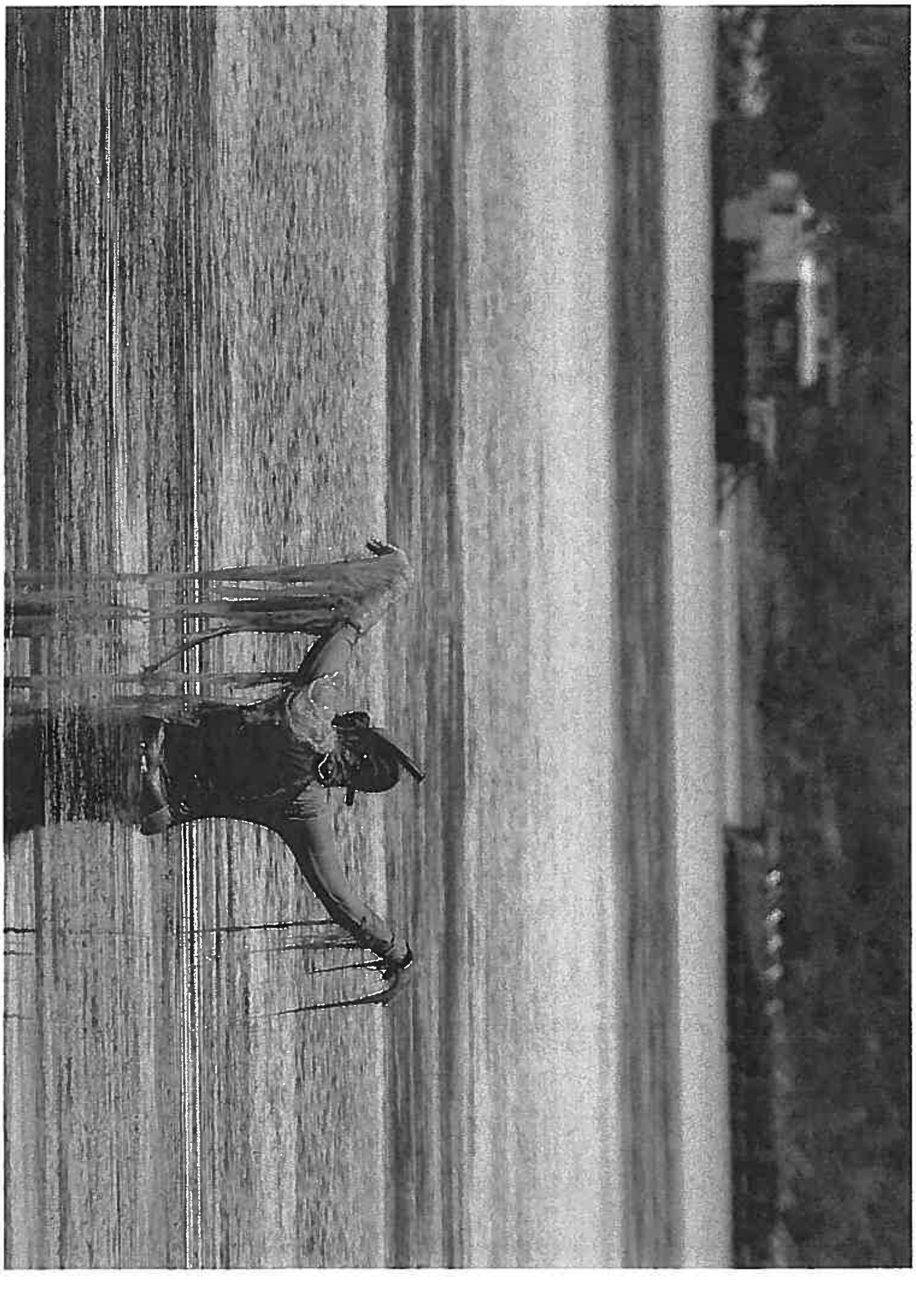
- Start with aerial photographic analysis/history to provide baseline and interannual variability
- Delineate major seagrass banks and channels – map distribution and maximum depth of seagrass
- Conduct seasonal monitoring (e.g. quarterly, possibly more during summer/high fish biomass periods)
- Set up fixed transects/quadrants or set points within specific areas
- Take photos of quadrants and record key attributes (e.g. sediment composition, % cover, species composition, canopy height, epiphyte abundance, algal % cover, macrofauna)
- Measure temperature, salinity and DO, particularly if stratified - including at depth in the central channel

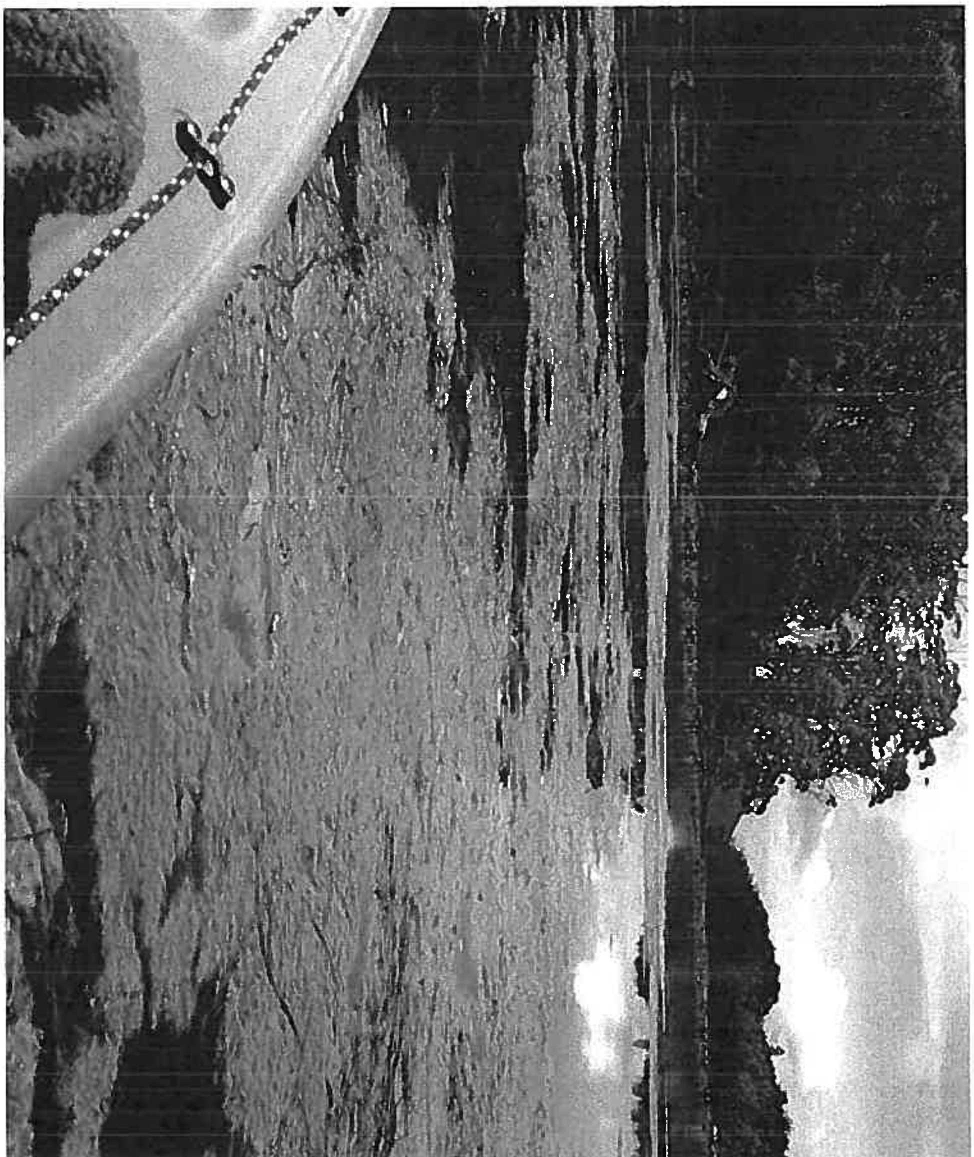
Reef monitoring (seasonal/annual)

- Baseline mapping of reef type and distribution is needed
- Set up reef monitoring at @ 4 to 6 representative sites plus reference site(s); include/re-visit sites previously monitored by Tassal in 2013
- Monitor reef health/biodiversity using Edgar/Barrett method
- Monitor nuisance algae using IMAS RVA method (quarterly) – 12 fixed quadrants/site, or another well documented method

Intertidal monitoring (seasonal/annual)

- Set up series of fixed quadrants (mid & lower intertidal) and/or photo points. May need multiple transects/quadrants at each site, as variability is high. Also need reference site(s).
- These could be just on-shore from reef monitoring sites above; should also include/re-visit sites previously monitored by Tassal in 2013





OPEN LETTER – TO WHOM IT MAY CONCERN

14 September 2019

Re. Impacts of salmon pens at Port Arthur/Long Bay

As a scientist and resident of the Tasman Peninsula, I am writing to express my concerns about the condition of Long Bay/Port Arthur following the introduction of multiple salmon pens into this system in 2017. I have heard similar concerns raised by the local community, and have raised some of these concerns with both EPA and Tassal representatives in person and in writing. While this letter primarily focusses on the Port Arthur lease, many of these concerns are also relevant to the leases at Nubeena.

Having spent considerable time reviewing available documents, including the 2017/18 Tasman BEMP, the current Environmental License, as well as previous baseline reports commissioned by Tassal, I am setting out a number of specific concerns and recommendations which I hope you will respond to in order to ensure sustainable use of this system.

Long Bay/Port Arthur is a narrow, N-S oriented embayment extending approximately 10 km into the middle of the Tasman Peninsula. Given the limited development and low density population in this area, water quality should be good, and previous surveys (Barrett et al, 2001) have documented healthy/diverse ecosystems, including temperate reef communities and seagrass beds. These provide valuable habitat for fish and invertebrates, and the bay is highly valued/used by the recreational fishing community. There are few waterways discharging to the bay, and their flow tends to be ephemeral; in particular, the northern end of the bay is not well-flushed.

As you are aware, a series of 14 large fish pens were installed at the Pt Arthur lease in about August 2017 with a maximum estimated biomass of 3200 tonnes, from which 2682 tonnes of salmon were harvested in late 2018 (Tassal, pers comm). This biomass of fish would have released at least 150t of DIN and considerably more organic matter to the bay. This nutrient load is equivalent to that of the Macquarie Point and Blackmans Bay sewage treatment plants combined, and represents an extremely high nutrient and organic load into the head of a poorly flushed and nutrient sensitive embayment.

Impacts associated with large-scale salmon aquaculture in this bay include:

- Altered hydrology and reduced circulation due to physical effects of pens, nets, feed barges, etc (baffle effect). This would result in longer residence times, increased sediment deposition and a change in nature of the sediments (finer, organic rich) and associated benthos
- Deposition of organic matter in vicinity of pens derived from uneaten feed, fish faeces and net-washing debris, leading to change in sediment character and benthos
- Release of bioavailable nutrients leading to increased phytoplankton, nuisance/drift algae and epiphytes. This is particular a concern for both nearby temperate reef communities and seagrass beds
- Potential effects of hypersaline emissions derived from desalination plant on land and/or well-boat (particularly in deeper channels). This could affect both flora and fauna
- Capture/mortalities of native fish and fish larvae during freshwater bathing and desalination operations
- Other (e.g. use of antibiotics, fish escapes, attraction of seals and sharks)

While kayaking in Long Bay/Port Arthur on multiple occasions in 2018 and 2019, I have observed extensive growth of filamentous algae in subtidal areas around lease (particularly *Chaetomorpha billiardii*), as well as fouling/epiphytic growth and some die-off of seagrass beds in Stingaree Bay and further north in Long Bay. This has persisted in some areas even after the harvesting of fish in late 2018, suggesting that nutrient enriched sediments may be an on-going source. I have kayaked extensively in the Tasman region and have never seen this level of persistent nuisance algal fouling, with exception of areas around the large salmon leases off Nubeena.

Science-based management and regulation

I am concerned that the initial stocking of Long Bay/Port Arthur has been far too intensive for this system, and that no efforts have been made to establish the carrying capacity or to set limits on the allowable maximum biomass or TPDNO. Indeed, the only compliance requirements I can find in the current Environmental License are:

- G1.1 That benthic sediment conditions meet specific criteria within the lease area and at the 35m boundary. This does not address impacts associated with dissolved pollutants which are likely to affect areas well beyond 35m.
- G2 That copper and zinc levels thresholds within the lease area are not exceeded, and
- G3 That indicator values set for the 'compliance site' off Nubeena (NUB-4) not exceed specified limits. How can this possibly be relevant for the Port Arthur lease, which is over 25 km away?

Monitoring and reporting

While the EL requires a significant level of monitoring it does not include key areas and communities, and it is unclear how the results will be used to inform production limits. The baseline survey and on-going monitoring were not designed to address impacts on broader ecosystem health, particularly with respect to rocky reef and seagrass communities, and the BEMP does not include water quality monitoring sites most likely to be impacted.

While there is a fairly extensive set of reporting requirements, much of this information is not made available to the public. In particular, I believe it is in the public interest to be advised of nutrient loads, compliance at the 35m boundary, release of chemicals and antibiotics, fish escapes and other matters that may impact on the use and enjoyment of this shared waterway. A further concern is that Tassal has recently withdrawn this site from ASC certification (due to shift to smolt grow-out), reducing the incentive for stakeholder consultation about operations in this bay.

In my professional opinion, the following steps are needed to improve the health of Long Bay and ensure salmon aquaculture can be undertaken sustainably:

- Major reduction in allowable biomass and set clear TPDNO limits, until the carrying capacity and robust monitoring systems have been established
- Undertake investigations and modelling to determine carrying capacity
- Extend monitoring to include additional BEMP sites to the north of the lease, as well as monitoring of reef and seagrass communities (including nuisance algal growth)
- Provide more comprehensive reporting to confirm that aquaculture operations are not impacting the wider system, including compliance results at the 35m limit, use of antibiotics, fish escapes, and other aspects of concern to the community. Much of this information may be included in the Annual Environmental Report, which should be made available to the public.
- Consult with stakeholders and the wider community in good faith about this site. I would suggest that an annual briefing from the EPA and Tassal to review regulatory compliance, present monitoring results, advise on production plans and address community concerns would be a good starting point.

I look forward to your response to these recommendations, and am available to meet in person to discuss my concerns and recommendations in further detail. I have also attached some more specific feedback and recommendations specific to the 2017/18 BEMP report (which can hopefully be incorporated into future monitoring and reports) as well as additional monitoring activities that are needed to protect this valuable asset.

Yours sincerely,

Christine Coughanowr

Attachments:

- Comments on 2017/18 BEMP for Tasman Peninsula and Norfolk Bay
- Additional monitoring recommendations for Port Arthur/Long Bay

ATTACHMENT 1: COMMENTS ON 2017/18 TASMAN PENINSULA & NORFOLK BAY BEMP.
Annual Broadscale Monitoring Report for the Tasman Peninsula and Norfolk Bay Marine Farm Development Plan Area (June 2017 to May 2018). Prepared by Aquenal, 2018

This publicly-available report covers the regulatory period from June 2017 to May 2018, but also includes water quality data back to 2013. Monitoring results for water quality, sediments and biota are provided at nine sites: 4 at Port Arthur and 5 at Nubeena, including the compliance site NUB-5.

Water quality monitoring is monthly at 9 sites, 3 depths for phys/chem parameters, nutrients and phytoplankton (chl a and cell counts). Water quality at Port Arthur sites has been monitored from Aug 2013 to present. Nubeena sites have been monitored from Feb 2014 to present.

Sediment samples were collected at each BEMP site (triplicate cores) in March 2018, which was 6+ months after fish were introduced to the Port Arthur system. Basic analyses (visual appearance, redox & sulphide) are done annually; benthic infauna, stable isotopes and grain size are four-yearly 1st round provided here (samples to be archived in between).

The report includes considerable information and numerous graphs, and clearly represents significant investment in effort and resources. However, the material as presented is difficult to review and interpret, and does not clearly evaluate if there have been impacts associated with the leases at Port Arthur or Nubeena.

In particular, several additional BEMP sites are needed in the less well-flushed ends of the Nubeena and Port Arthur systems, as this is where impacts are most likely to occur. Without this information, the BEMP cannot rule out significant impacts. Information on water clarity is also needed (e.g. Secchi Depth) to better evaluate potential impacts on benthic vegetation.

The figures are very difficult to review and interpret. Some provide data for all of the Nubeena and Port Arthur BEMP sites on single graph (lines run together and overlap), others combine data across the entire region. It is essential that the data for Port Arthur and Nubeena be presented separately, as these are spatially and ecologically separate systems, and have different operational activities. Also, the text size on many graphs is too small to read. While there is some interpretation of water quality results in Section 4, potential impacts resulting from aquaculture activities are not clearly assessed. To my eye, there are a number of trends which may well be related to increasing aquaculture in Nubeena and Port Arthur, as noted below:

- Fig 17: Lower DO at Nubeena than at Port Arthur. Bottom DO levels at NUB1 are particularly low, and have declined over several years.
- Fig 21: increasing bottom water ammonia levels at Nubeena, particularly at NUB1 during 2017/18.
- Fig 27: phosphate levels at Nubeena increasing over past few years, particularly at NUB1 and at depth
- Fig 33: chla levels at both Nubeena and Port A have increased in 2017/18, with progressively higher values towards the more intensively farmed areas of the bays. In Pt A, several high chla spikes (>5 mg/L) have been measured since smolt were introduced, that were not previously observed.

Furthermore, no information about operations/biomass is provided during this period. This information is needed to interpret results, and particularly whether changes may be attributable to marine farming activities. I am aware that smolts went in @Pt A in Aug 2017, so this report would cover the first 8-10 mos of production, when biomass was building up. Presumably Nubeena would have had higher levels of production.

The use of the 'compliance site' at NUB-5 does not make any sense to me as it is too far away from the Port Arthur lease, and may also be influenced by nutrients from the nearby Creeses Mistake lease at Nubeena. Instead, I would suggest that a reference site be established for Port Arthur (e.g. PA-4 or PA-3) and that seasonal water quality criteria are set using this, against which the Port Arthur BEMP results can be compared. Same goes for Nubeena.

I am actually quite confused about the rationale behind the 'compliance site' based on the EL and Section 4.5 of the BEMP report. It seems that as long as the rolling annual medians at NUB-5 are below the specified trigger levels, then the operations at both Nubeena and Port Arthur are considered to be in compliance. Is this correct? There does not seem to be any requirement to compare water quality results at the other BEMP sites with these trigger levels. If I have misunderstood this, I would appreciate some clarification. As noted above, it would be more appropriate to select a unimpacted reference site for Nubeena and Port Arthur, set seasonal water quality criteria, and then compare the BEMP data to these trigger values.

Finally, the report does not provide an executive summary, discussion, conclusions or recommendations. Have there been any observable effects associated with the fish farms in these two systems?

The sediment/benthic invertebrate data is also difficult to interpret, as it is based on samples collected in March 2018. This is some 6+ mos after fish were introduced to Pt A, and as such it is difficult to evaluate/attribute change. Was prior baseline sediment work done at the BEMP sites to provide a comparison? Or are there baseline or 35m compliance results that can provide better information on change. Where is the information on impacts at 35m published and have the compliance standards in the EL been achieved?

ATTACHMENT 2: PORT ARTHUR/LONG BAY MONTORING REVIEW AND RECOMMENDATIONS
(prepared by C. A. Coughanowr – Sept 2019)

The following additional monitoring and investigations are needed at Port Arthur/Long Bay to evaluate impacts on environmental condition, including sensitive receptors.

- Additional water quality sites (inner bay and meaningful compliance site) and parameters (Secchi depth)
- Additional sediment quality sites (inner bay)
- Seagrass monitoring (inner bays plus reference sites)
- Rocky reef monitoring (areas adjacent to lease plus previous baseline & reference sites)
- Intertidal monitoring (areas adjacent to lease plus previous baseline & reference sites)
- DEPOMOD and carrying capacity modelling and assessment

It is particularly concerning that baseline surveys and subsequent monitoring at Pt A were not designed to assess/track impacts on reef or seagrass communities, and furthermore that the BEMP design did not include likely areas of impacts to the north of the lease. Specific recommendations include the following:

Water quality (monthly)

- Extend BEMP to include at least 3 additional sites in sheltered areas to the north of the lease (e.g. 1 in channel, 2 on either side)
- Collect nutrient samples at surface and at depth where water column is stratified (e.g. channel)
- Include a reference site (PA-4, near the mouth of Pt A may be suitable; NUB-5 is not)
- Include Secchi depth (or another water clarity indicator) at all sites

Sediment/benthic monitoring (annual) Monitor changes in sediment quality (grain size, % organic carbon, redox, sulphide) and associated invertebrates at the above sites

Seagrass monitoring (seasonal/annual)

- Start with aerial photographic analysis/history to provide baseline and interannual variability
- Delineate major seagrass banks and channels – map distribution and maximum depth of seagrass
- Conduct seasonal monitoring (e.g. quarterly, possibly more during summer/high fish biomass periods)
- Set up fixed transects/quadrants or set points within specific areas
- Take photos of quadrants and record key attributes (e.g. sediment composition, % cover, species composition, canopy height, epiphyte abundance, algal % cover, macrofauna)
- Measure temperature, salinity and DO, particularly if stratified - including at depth in the central channel

Reef monitoring (seasonal/annual)

- Baseline mapping of reef type and distribution is needed
- Set up reef monitoring at @ 4 to 6 representative sites plus reference site(s); include/re-visit sites previously monitored by Tassal in 2013
- Monitor reef health/biodiversity using Edgar/Barrett method
- Monitor nuisance algae using IMAS RVA method (quarterly) – 12 fixed quadrants/site, or another well documented method

Intertidal monitoring (seasonal/annual)

- Set up series of fixed quadrants (mid & lower intertidal) and/or photo points. May need multiple transects/quadrants at each site, as variability is high. Also need reference site(s).
- These could be just on-shore from reef monitoring sites above; should also include/re-visit sites previously monitored by Tassal in 2013

ABC NEWS

Salmon industry panel 'inherently compromised', experts told minister in leaked resignation letter

By state political reporter Alexandra Humphries

Posted Mon 25 Feb 2019, 7:11am

A damning letter sent to Tasmania's Primary Industries Minister reveals two experts on a panel which approved the salmon industry's expansion into Storm Bay believed it was "inherently compromised".

The two experts, who resigned in protest from Tasmania's eight-person Marine Farming Planning Review Panel after the Storm Bay decision, believed the panel did not serve the best interests of the state, the leaked letter revealed.

They also believed the panel was geared toward approving "operationally convenient" proposals for the industry.

Last November, the two experts — Barbara Nowak and Louise Cherrie — wrote to Primary Industries Minister Guy Barnett, explaining their reasons for quitting.

That letter was heavily redacted in a subsequent Right to Information release last week, but a leaked copy obtained by the ABC showed the pair outlined a series of concerns in relation to salmon farming approvals for Storm Bay.

Professor Nowak and Ms Cherrie are experts in aquaculture and environmental management respectively.

In the letter, Ms Cherrie and Professor Nowak wrote that:

- "The panel was not serving the best interests of the state"
- "Our resignations were due to frustration with the process"
- "The panel is, as currently structured and within the confines of the legislation, inherently compromised"

The panel approved proposals by Tassal (360 hectares) and Huon Aquaculture (330 hectares) to farm new waters in Storm Bay in August.

The two experts wrote that their ability to apply best practice lessons learned from the industry's expansion into Macquarie Harbour was hindered by legislation, an absence of base information and the functioning of the panel, which "shows an undue propensity to support what is operationally convenient for the aquaculture industry".

Experts tried to resolve issues

They said their resignations were tendered only after unsuccessful attempts to resolve the issues.

PHOTO: The move into Storm Bay was approved in August. (Supplied: Tassal)

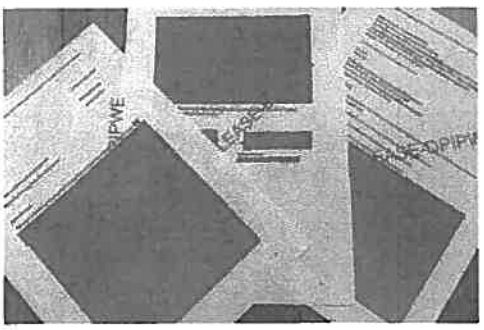
RELATED STORY: Two experts quit over salmon farming expansion concerns, but you're not allowed to know why

RELATED STORY: Salmon industry wins approval for further fish farming expansion in Storm Bay

RELATED STORY: 'Sorry, it was private': Minister refuses to reveal letter explaining why experts quit fish farm panel

Key points:

- The two experts quit the salmon farming approvals panel last November
- Their resignation letter said the panel was "inherently compromised" and "not serving the best interests of the state"
- The Primary Industries Minister said the Government had full confidence in the panel



"We entered an assessment process that was well advanced and our questions and discussions in relation to the deficiencies were inconvenient and unwelcome," they wrote.

They wrote to Mr Barnett in November after resigning in August because they had not received a response to their initial resignation letter from his department.

The pair said they were supportive of a sustainable salmon industry, and had no affiliations with or biases against any operators, political parties or government departments.

"Our appointment to the panel was, we were led to believe, intended to ensure rigour in the review of proposed developments and to provide the Minister with sound, objective and scientifically based advice," they said.

PHOTO: The resignation letter obtained under an RTI request was heavily redacted.
(ABC News: Alexandra Humphries)

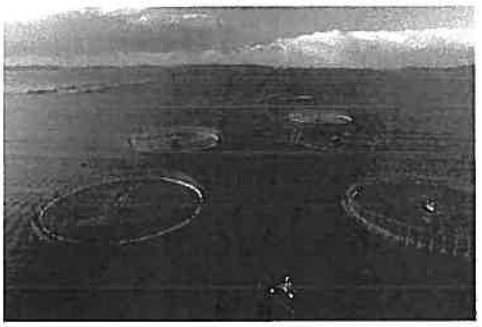


PHOTO: Salmon farming is one of Tasmania's fastest growing industries. (ABC News: Sophie Zoellner)

"A number of factors prevented this."

The letter also includes a list of concerns specifically related to the Storm Bay approval, including:

- There was no detailed biogeochemical model upon which to determine carrying capacity and nutrient transfer with the lower Derwent Estuary
- There was no government-endorsed biosecurity plan
- There was no regulatory guideline to define the standards to which operators should be held
- The proposed adaptive management strategy did not provide required assurances and the gathering of additional information proved difficult
- The natural values of Storm Bay were not mapped and considered, including the amenity owed to communities

Minister backs panel's judgement

In a statement, Mr Barnett said the movement of salmon farming into Storm Bay was being managed responsibly and the Government had full confidence in the panel.

Mr Barnett said he and the Department Secretary had consulted the two former members about improvements which could be made on future processes.

"The panel's recommendations were made after consideration of comprehensive environmental impact statements, public submissions, representations and public hearings," the statement said.

"Importantly, the panel found environmental effects associated with marine farming operations can be effectively managed under the development plans and conditions of an environmental licence granted by the Environment Protection Authority."

There are currently four vacant positions on the eight-member Marine Farming Planning Review Panel.

PHOTO: Guy Barnett said the Government has confidence in the panel. (ABC News)

Topics: fishing-aquaculture, state-parliament, hobart-7000, launceston-7250, tas

Contact Alexandra Humphries

The Australia Institute
Research that matters.

Making mountains out of minnows

Salmon in the Tasmanian economy

The economic benefit of the salmon industry to Tasmania is weighted strongly against its environmental and social impacts. Yet it accounts for just 1% of jobs in the state. Over 5 years $3.8 billion worth of fish were sold, but just $64 million tax paid, while $9.3 million in subsidies were received in 2 years. Changing generous leasing arrangements to the Norwegian model could raise $2 billion for community development.

Discussion paper

Leanne Minshull
Bill Browne
July 2019

ABOUT THE AUSTRALIA INSTITUTE

The Australia Institute is an independent public policy think tank based in Canberra. It is funded by donations from philanthropic trusts and individuals and commissioned research. We barrack for ideas, not political parties or candidates. Since its launch in 1994, the Institute has carried out highly influential research on a broad range of economic, social and environmental issues.

OUR PHILOSOPHY

As we begin the 21st century, new dilemmas confront our society and our planet. Unprecedented levels of consumption co-exist with extreme poverty. Through new technology we are more connected than we have ever been, yet civic engagement is declining. Environmental neglect continues despite heightened ecological awareness. A better balance is urgently needed.

The Australia Institute's directors, staff and supporters represent a broad range of views and priorities. What unites us is a belief that through a combination of research and creativity we can promote new solutions and ways of thinking.

OUR PURPOSE - 'RESEARCH THAT MATTERS'

The Institute publishes research that contributes to a more just, sustainable and peaceful society. Our goal is to gather, interpret and communicate evidence in order to both diagnose the problems we face and propose new solutions to tackle them.

The Institute is wholly independent and not affiliated with any other organisation. Donations to its Research Fund are tax deductible for the donor. Anyone wishing to donate can do so via the website at https://www.tai.org.au or by calling the Institute on 02 6130 0530. Our secure and user-friendly website allows donors to make either one-off or regular monthly donations and we encourage everyone who can to donate in this way as it assists our research in the most significant manner.

Level 1, Endeavour House, 1 Franklin St
Canberra, ACT 2601
Tel: (02) 61300530
Email: mail@tai.org.au
Website: www.tai.org.au
ISSN: 1836-9014

Summary

Political leaders routinely exaggerate the salmon industry's economic role in Tasmania. The Tasmanian Government describes it as "critically important" and trade unions have called it Tasmania's "brightest economic prospect". With views like this, the relative cost to the environment imposed by the industry can be skewed. This is concerning, because economic data does not support the claims of the industry's importance.

Employment: The salmon industry is the 40th largest sector by employment in Tasmania, employing fewer than car repairs or child care. It employs about 1,500 people, or 0.6% of total employment in the state.

Employment in Tasmania, selected industries

Source: ABS (2016) *Census* and salmon industry calculations above.

Gross state product: Industry figures put salmon aquaculture's contribution to Gross State Product at somewhere between 0.6% and 2.3% of total Gross State Product. Tasmania, like other Australian states, is largely a services economy.

Production, income and taxes

Over the five years from 2013 to 2018 the Tasmanian salmon industry sold 255,000 tonnes of fish, worth $3.8 billion. This revenue produced $416 million in taxable income, an approximation of profit. $64 million in tax was paid, equal to 2% of production value and 15% of taxable income.

Subsidies: The industry has benefited from significant state and federal subsidies, with at least $9.3 million paid in the last two years.

State and local payments: The salmon industry does not pay council rates on its marine leases, putting it at an advantage compared to land-based industries. When councils considered charging rates on marine leases, the Tasmanian parliament legislated to remove that power from them.

Annual lease and licence fees are paid to the State Government, of approximately $923,000 for the entire industry. This represents 0.1% (one-thousandth) of the total farmgate production of the salmon industry in Tasmania, and 0.02% of total state revenue. Changing the current licensing regime to one similar to the Norwegian system could return between $707 million and $2 billion at government auction.

Introduction

The Tasmanian Government describes the state's salmon industry as "critically important" and "important to the economic future of the state". If industry plans to almost double in size are met, it will be "one of the largest industries in the Tasmanian economy".[1]

Then Opposition Leader Bill Shorten said in 2017 that the industry accounted for "literally thousands of local jobs" and was "an important part of the Tasmanian economy".[2] Shorten's union, the Australian Workers Union, describes salmon as Tasmania's "brightest economic prospect" and a "critical growth industry".[3] Even Tasmanian chef and SBS personality Matthew Evans, who has since been critical of the salmon industry, said that in Tasmania "everyone knows someone who works in the salmon industry."[4]

Everyone seems to know that salmon is big business and critical to Tasmania. Some believe this perception has resulted in the environmental impacts of the industry being brushed aside.[5] This report puts Tasmania's salmon industry into its wider economic context.

---

[1] Tasmanian Liberals (2019) *Labor's deal to devastate the Salmon industry*, https://www.facebook.com/watch/?v=821201188242813; Tasmanian Government (2018) *Tasmania Delivers ... The perfect environment for an innovative and successful aquaculture industry*, https://web.archive.org/web/20190306111042/https://www.cg.tas.gov.au/__data/assets/pdf_file/0003/123447/Tasmania_Delivers_-_Aquaculture.pdf

[2] O'Connor (2017) *The Australian Workers Union enlists @billshortenmp to drum up support for Tasmania's salmon industry.*, https://twitter.com/TedOConnor4/status/821972594081415169

[3] AWU (n.d.) *Tassie Salmon*, https://www.tassiesalmon.com.au/

[4] Dubecki (2017) *Are we eating too much salmon?*, https://www.goodfood.com.au/recipes/news/are-we-eating-too-much-salmon-20170921-gylrqu

[5] Konkes (2017) *Bender's choice*, https://www.themonthly.com.au/issue/2017/october/1506780000/claire-konkes/bender-s-choice

Employment

The salmon industry is a small employer in Tasmania. While there are various estimates, the entire industry represents around one percent of the 216,547 Tasmanians in work at the last census. According to a 2015 report commissioned by the Tasmanian Salmonid Growers Association, written by KPMG:

> The total contribution of the combined aquaculture firms to the Tasmania economy is 2.3% of State GSP and 1.2 % of State employment.

In other words, 99% of Tasmanians do not work in the salmon industry, according to the industry itself.

In fact, this represents a substantial overestimate of the size of employment in the salmon industry. The 1.2% estimate refers not just to people employed in the salmon industry, but also includes jobs 'supported' in other industries:

> [The salmon industry provides] support for approximately 2,786 FTE jobs (full time positions employed in, or supported by the industry).[6]

By reporting jobs 'supported' rather than direct numbers of employees, the industry exaggerates its economic impact. If all industries added up the number of jobs they support in other industries this would double or triple count many jobs, giving a total far greater than the number of employees in the economy. While the impact of the salmon industry on other industries may be debated, the total numbers estimated by KMPG are of limited use as they estimate the impact of the entire industry, as if the entire industry's presence or absence could be a subject of policy debate.

In reality, it is marginal expansions or contractions of the industry that are affected by policy decisions. With supply and marketing chains already established, marginal expansions are likely to have a minimal impact on 'supported' employment.

Because of its tendency to overstate employment impacts, the class of economic model used by KPMG has been described by the Productivity Commission as widely "abused", "biased" by the Australian Bureau of Statistics and "deficient" by the NSW Land and Environment Court.[7]

---

[6] KPMG (2015) *Economic Impact Assessment: Tasmanian Aquaculture Industry*, p. ii, https://www.tsga.com.au/wp-content/uploads/2014/11/TSGA15-Economic-Impact-Report.pdf

[7] Gretton (2013) *On Input-output Tables: uses and abuses*, https://www.pc.gov.au/research/supporting/input-output-tables; ABS (2010) Input output multipliers,

While the modelled figure including 'supported' jobs is used in KPMG's percentages, in its headline figures and executive summary, the report does include a figure of direct industry employees in Tasmania – 1,365. This represents 0.6% of Tasmanian jobs.

KPMG's report is based on 2014 data. While the value of salmon production has increased by 20% since then, employment is unlikely to have had a similar boost. A 2018 report by the International Salmon Farmers Association, that Tasmania's industry contributed to, says only vaguely:

> The salmon and trout farming industry currently create over 1,500 direct jobs [in Tasmania]. [8]

While there has been growth in the salmon industry's output since 2014, the trend towards automation in the industry is likely to have kept jobs numbers down.[9] Tassal is investing in automated feeders and camera-based monitoring, and has a "completely integrated automation solution" for its new smolt tanks.[10] Huon feeds its fish "from a central feeding room in Hobart", with software adjusting feeding rates automatically based on on-site video feeds, and it is moving to "fully automated and unmanned feed barges".[11]

How this will affect salmon industry employment in the future is not clear. In 2017, Senator Peter Whish-Wilson revealed leaked documents from Tassal that showed that an automated feed method would allow them to employ one third as many feed staff

---

https://www.abs.gov.au/AUSSTATS/abs@.nsf/Previousproducts/5209.0.55.001Main%20Features4Final%20release%20200607%20tables?opendocument&tabname=Summary&prodno=5209.0.55.001&issue=Final%20release%202006-07%20tables&num=&view=; Preston (2013) *Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Limited*, NSW Land and Environment Court

[8] International Salmon Farmers Association (2018) *Salmon farming: Sustaining communities and feeding the world*, pp. 14, 23, https://www.tsga.com.au/wp-content/uploads/2018/06/ISFA-Socio-Economic-report-2018.pdf

[9] Fantin (2017) *Tassal trading halted while $100m in capital raised*, https://www.abc.net.au/news/2017-03-02/tassal-trading-halted-while-$100m-in-capital-raised/8317942; Mereghetti (2017) *Chile's Blumar invests $7m in upgrading salmon feeding systems, automation*, https://www.undercurrentnews.com/2017/09/04/chiles-blumar-invests-7m-in-upgrading-salmon-feeding-systems-automation/; Sinefa (2018) *Case Study - Huon aquaculture*, https://web.archive.org/web/20180528141024/https://www.sinefa.com/case-study-huon-aquaculture

[10] NHP Electrical Engineering (n.d.) *Nothing mainstream about Tassal salmon*, https://www.nhp.com.au/files/editor_upload/File/Case%20Studies/Tassal%20Salmon.pdf; SBS News (2017) *Bigger fish means bigger profit for Tassal*, https://www.sbs.com.au/news/bigger-fish-means-bigger-profit-for-tassal

[11] Huon Aquaculture (2018) *Annual Report 2018*, p. 8, http://investors.huonaqua.com.au/investors/?page=Annual-Reports

as would be employed for their current method. Instead of feed staff numbers increasing from 65 to 105 by 2025, they would fall to 35.[12]

Assuming current industry employment of 1,500 people, as stated by the International Salmon Farmers Association, the industry represents 0.7% of Tasmanian employment. Comparing this figure to ABS data on other industries, the salmon industry is the 40th largest employing sector in Tasmania. Figure 1 below shows a selection of Tasmanian industries:

Figure 1: Employment in Tasmania, selected industries

Source: ABS (2016) *Census* and salmon industry calculations above.

Figure 1 above shows that education and health services are the highest employing sectors in Tasmania, as they are in most of Australia. Service industries dominate employment in most developed economies. Tasmania's tourism focus is shown in the large employment shares of accommodation, retail and hospitality sectors.

The salmon industry by contrast employs fewer people than child care, car repairs, or hardware stores. It employs slightly more people than baking (not to be confused with

[12] Whish-Wilson (2017) *ADJOURNMENT - Tasmania: Aquaculture Industry*, https://www.aph.gov.au/Parliamentary_Business/Hansard/Hansard_Display?bid=chamber/hansards/38a7c160-c946-4e90-b0c4-7c50493e1073/&sid=0221

retail bakeries, likely to employ more) or metal ore mining – most mining other than quarries in Tasmania.

Another estimate of salmon industry employment can be made from company annual reports and public statements. Tasmania's salmon industry is dominated by just three companies – Tassal, Huon and Petuna. There are only a handful of small businesses outside of these three. Tassal reports 1,261 employees and Huon reports 659. Petuna reportedly employs 264.[13] This sums to a total of 2,184 employees. This includes employees in other states and territories. Huon has employees in "most" states, including sales in Perth, Brisbane and Melbourne.[14] Their Sydney operations have both sales and processing facilities.[15] Tassal has operations in Sydney and prawn farms in Queensland.[16] Petuna is not listed and is privately owned by the Rockliff family and New Zealand-Japanese firm Sealord group. It does not publish detailed annual reports.

[13] Bingham (2018) *Shock as Petuna axes 22 senior jobs*, https://www.theadvocate.com.au/story/5230450/shock-as-petuna-axes-22-senior-jobs/; Huon Aquaculture (2019) *Sustainability Dashboard*, http://sustainability.huonaqua.com.au; Tassal (2018) *Employees*, http://dashboard.tassalgroup.com.au/our-people/employees/

[14] Wiley & Co (2015) *$12 million salmon processing facility opens in Tasmania*, http://foodprocessing.com.au/content/the-food-plant/article/-12-million-salmon-processing-facility-opens-in-tasmania-605318147

[15] Huon (2019) *Our locations*, https://www.huonaqua.com.au/working-at-huon-2/our-locations/

[16] Tassal (2019) *Join our team*, http://tassalgroup.com.au/our-people/join-our-team/

Gross state product

Tasmania's Gross State Product ("GSP") in financial year 2018 was $30,266 million.[17]

Estimates of the salmon industry's contribution vary significantly, even between industry groups, at between 0.6% and 2.3% of Tasmania's GSP.

The most recent estimate of the salmon industry's contribution to Gross State Product is from the International Salmon Farmers Association, of which the Tasmanian Salmonid Growers' Association is a member. The International Salmon Farmers Association said in 2018 that the salmon and trout farming industry in Tasmania "currently" contributes $190 million to Tasmanian GSP.[18] This would represent about 0.6% of Tasmanian Gross State Product, or about 7% of agriculture, forestry and fishing's GSP contribution ($2.7 billion).

By contrast, the KPMG report commissioned by the Tasmanian Salmonid Growers Association found the industry in 2015 had a "value added or net additions to GSP" of $626 million, or 2.3% of GSP. The GSP contribution consists of $264 million for "final demand", $79 million for "industry effects" and $283 million for "consumption effects".[19] These latter effects are those "supported" in other industries, which suffer from the same problems discussed above. Even so, $626 million would represent about 23% of agriculture, forestry and fishing's GSP contribution in 2018.

For context, Deloitte Access Economics calculated for Tourism Tasmania that tourism directly contributes $1.4 billion to Gross State Product, which would represent about 5% of GSP.[20] As Deloitte itself acknowledges, calculating tourism's economic contribution is difficult,[21] but the satellite accounts allow for the general comparison: which shows that tourism's GSP contribution is twice or more larger than that of the salmon industry.

---

[17] ABS (2018) *5220.0 - Australian National Accounts: State Accounts, 2017-18*, http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/5220.0Main+Features12017-18?OpenDocument

[18] International Salmon Farmers Association (2018) *Salmon farming: Sustaining communities and feeding the world*, p. 23

[19] KPMG (2015) *Economic Impact Assessment: Tasmanian Aquaculture Industry*, pp. 7–13

[20] Tourism Tasmania (2019) *Tourism Fast Facts*, https://www.tourismtasmania.com.au/industry/facts

[21] For methodology and details about Deloitte's use of Tourism Research Australia's satellite accounts, see for example Deloitte Access Economics (2017) *Tasmanian Regional Tourism Satellite Accounts 2015-16*, https://www.tourismtasmania.com.au/__data/assets/pdf_file/0016/60622/Tasmanian-RTSA-2015-16-Report_FINAL.pdf

Overall, primary and secondary industries like mining, agriculture and manufacturing contribute 26% to Tasmanian GSP, compared to 54% from service industries.[22]

[22] The reminder consists of the "mixed" industry of electricity, gas, water and waste services; taxes less subsidies; and ownership of dwellings. ABS (2012) *Main Features - Service industries*, https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/1301.0Main+Features332012; (2018) *5220.0 - Australian National Accounts: State Accounts, 2017-18*

Subsidies

The salmon industry receives several subsidies.

Tassal records $2.3 million in government grants in 2017 and $3.2 million in 2018.[23] In 2014, it received a $3.85 million federal government grant for its Triabunna Processing Facility; this represents about three-quarters of the expected cost of the facility.[24]

Huon Aquaculture records $724,000 in government grants in 2017 and $807,000 in 2018.[25] In each of 2017 and 2018, $463,000 of the grant reflects the amortising of $5 million of grants for its Parramatta Creek Smokehouse and Innovation Centre, which Huon received in 2015.[26] The grants, consisting of a $3.5 million federal government contribution and $1.5 million state government contribution, reflect about two-fifths of the $12 million cost of the smokehouse.[27]

The government also co-funds the Aquatic Animal Health and Vaccines Centre of Excellence[28] and in 2017 contributed $2.3 million to BioMar's $56 million fish feed production facility,[29] due to open in late 2019. BioMar is an international fish feed manufacturer, and already supplies the Tasmanian market from its Chile and Scotland factories.[30]

Between the Tassal and Huon grants and the BioMar facility, this represents about $9.3 million in state and federal government subsidies to the salmon industry in the two years 2017 and 2018.

---

[23] Tassal Group (2018) *Annual Report 2018*, p. 44, http://tassalgroup.com.au/investors/reports/annual-reports/

[24] Clark (2014) *Fishy future for former forestry town*, https://www.news.com.au/national/tasmania/tassal-reels-in-38m-in-federal-funds-for-fish-protein-and-oil-facility-at-triabunna/news-story/51c70990ae36a60bda0b4698fc9107e8#.nr9xy

[25] Huon Aquaculture (2018) *Annual Report 2018*, p. 56

[26] Huon Aquaculture (2018) *Annual Report 2018*, p. 93

[27] Slessor (2015) *$12m factory creates jobs*, https://www.theadvocate.com.au/story/3189375/12m-factory-creates-jobs/

[28] DPIPWE (n.d.) *Sustainable industry growth plan for the salmon industry*, p. 21, https://dpipwe.tas.gov.au/Documents/salmonplan.pdf

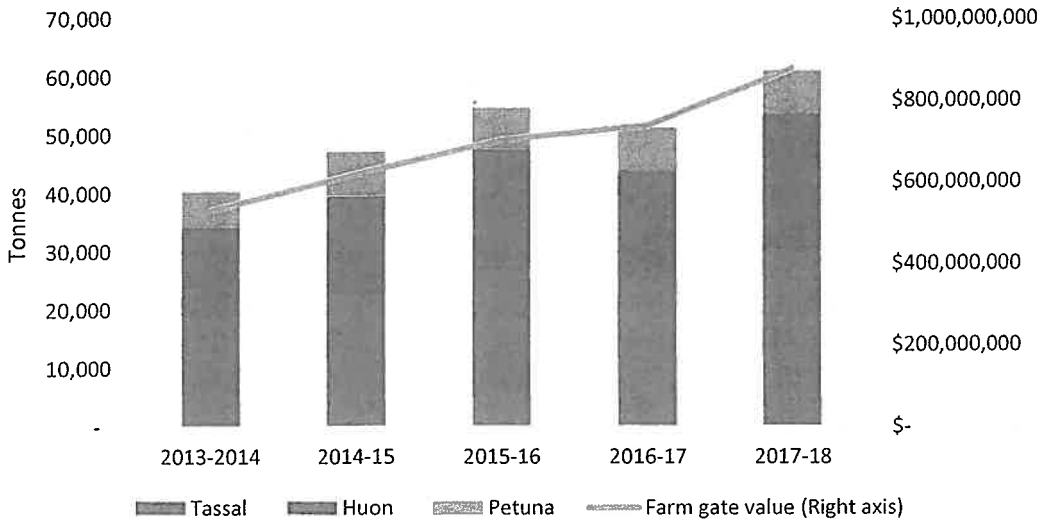
[29] BioMar (2017) *New Factory in Tasmania*, https://www.biomar.com/en/australia/articles/biomar-to-establish-new-factory-in-tasmania/

[30] Grain Central (2018) *BioMar eyes late 2019 opening for Tasmanian aquafeed plant*, https://www.graincentral.com/trade/biomar-eyes-late-2019-opening-for-tasmanian-aquafeed-plant/; The Advocate (2019) *Wesley Vale's $56m aqua feed plant to start recruiting workers soon*, https://www.theadvocate.com.au/story/6185647/fish-food-factory-open-day/

Production, income and taxes

Production of salmon has increased by more than 50% in the last five years, both in terms of tonnes produced and total value. Figure 2 below shows this increase and the production shares of the three main companies:

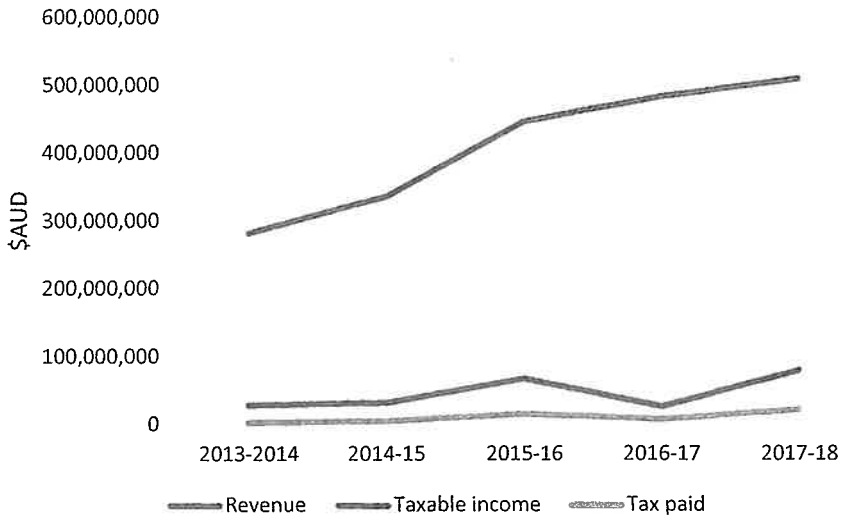
Figure 2: Tasmanian salmon production by company 2013-14 to 2017-18



Sources: Company annual reports; ABARES (2017, 2018) *Fisheries and aquaculture statistics*; author calculations. Note: Petuna do not report volumes, here calculated as ABARES total production estimate less reported totals for Tassal and Huon.

Figure 2 shows that in 2013–14, the industry produced 40,405 tonnes of salmon. By 2017–18, this had grown to 61,033 tonnes. Reflecting their growth in production, the industry has grown substantially and has made large profits. Figure below shows total income, taxable income and tax paid by Tassal over the last five years:

Figure 3: Tassal income and tax 2013-14 to 2017-18

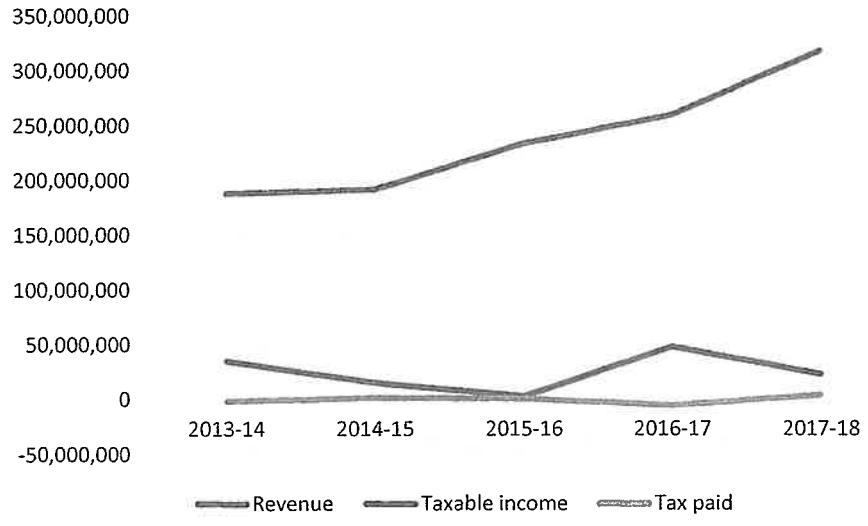


Sources: ATO corporate tax transparency, Tassal (2018) Annual report

Figure 3 shows that over the last five years, Tassal had income of just over $2 billion, including taxable income of $236 million. On that taxable income, Tassal paid $54 million, or an effective tax rate of about 23%.

Over the same five-year period, Huon had income of $1.2 billion, including taxable income of $124 million – as shown in Figure . Huon received a net $1 million tax refund over the period.

Figure 4: Huon income and tax 2013-14 to 2017-18



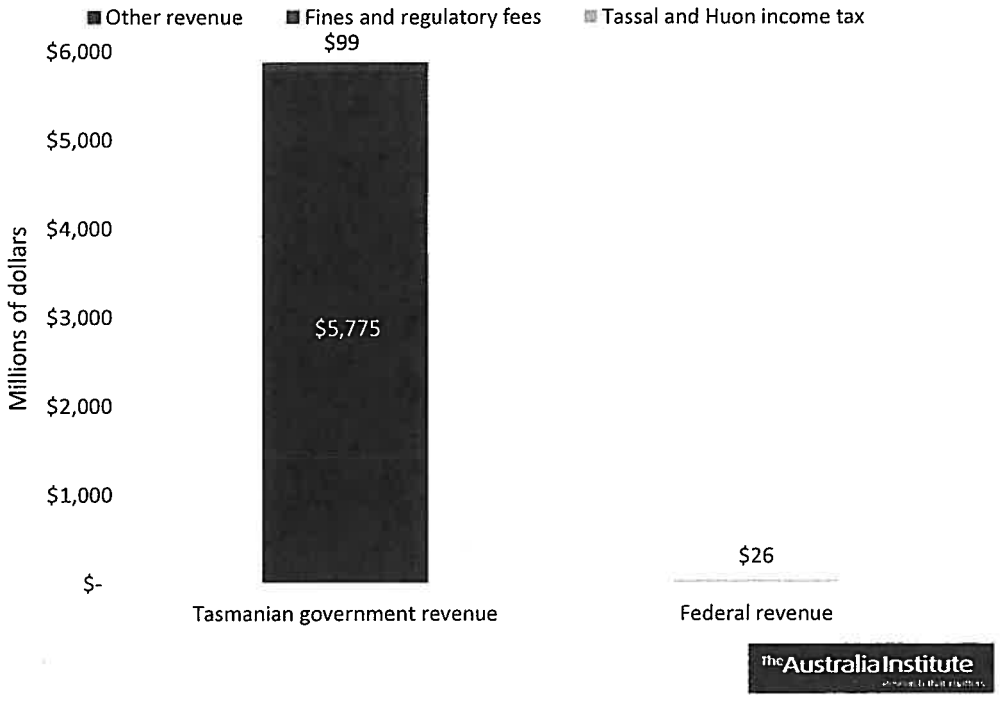
Sources: Huon annual reports, author calculations

We estimate that Petuna's revenue over the same period was $512 million. This is Petuna's production estimate in Figure 2 over the five years multiplied by the average revenue per tonne for Tassal and Huon. Based on Huon and Tassal's taxable income and tax paid per tonne we estimate the company would have made $56.8 million in taxable income and paid $8.4 million in corporate tax.

In total, we estimate over this five-year period the Tasmanian salmon industry sold 255,000 tonnes of fish, worth $3.8 billion. This revenue produced $416 million in taxable income, an approximation of profit. $64 million in tax was paid, equal to 2% of production value and 15% of taxable income.

While income taxes are paid to the federal government rather than the state government, for the purposes of illustration the $26 million in income tax paid by Huon and Tassal in 2018 represents 0.4% of Tasmanian government revenue. The Tasmanian government makes about four times as much from fines and regulatory fees as the Federal Government makes in income tax from the two largest salmon farmers in Tasmania.[31]

Figure 1: Comparison of revenue sources



Sources: Tasmanian Budget Papers, company annual reports

[31] Tasmanian Government (2018) *2017-18 Tasmanian Budget - Budget Paper Number 1*, pp. 6, 10, https://www.treasury.tas.gov.au/budget-and-financial-management/2018-19-tasmanian-budget/budget-papers-archive/2017-18-tasmanian-budget

OWNERSHIP

From their annual reports, it appears that Tassal's largest shareholders are institutional investors, while Huon is majority owned by its (Tasmania-based) founders.[32]

According to the Tassal Group share registry as of February 2017, 366 shareholders (4.3% of all shareholders) had Tasmanian postcodes, and together these Tasmanians owned 1.1% of all Tassal shares.

In 2010, global seafood enterprise Sealord Group bought 50% of privately-owned Petuna from Devonport-based founders Peter and Una Rockliff. The Rockliff family are still joint owners,[33] although it is unclear if they still own a 50% share.

[32] Huon Aquaculture (2017) *Annual report 2017*, p. 103; Tassal (2017) *Annual report 2017*, p. 81

[33] Petuna Seafood (n.d.) *Our Story - Peter and Una Rockliff*, http://www.petuna.com.au/our-story/

State and local payments

More publicly-available information on the salmon industry's payments to government would allow for a clearer picture of the industry. However, information that is public allows us to estimate that the salmon industry pays the state government about $920,000 in annual lease and licence fees on its fish farm leases.

We estimate that industry levies amount to $1.1 million, as well as $500,000–$730,000 for the EPA Tasmania levy.

Public information about payments from the salmon industry to the government is scattered, and in some cases incomplete. The number of leases, and the hectares that they cover, is known, and in some cases can be compared to lease, licence and levy fees. However, it is difficult to tell if these represent the total payment because it is not always clear if some leases have been grandfathered, whether all leases are currently licensed, and so on.

LEASES AND LICENCES

In Tasmania, lessees of finfish farms (including salmonids) must pay annual lease fees, which currently consist of an annual fee of $2,673 plus $302.94 per hectare.[34] Since Tasmania has 44 leases occupying a total of 2,257 hectares,[35] this would result in an annual lease fee of $801,348 for the entire industry.

Marine farming licence fees are $2,765 per lease for one species of finfish (e.g. *Salmo salar,* the Atlantic salmon).[36] Not all of Tasmania's 44 leases necessarily have current licences. However, if assuming they did, licence fees would amount to $121,660 per year for the industry.

[34] ABLIS (2019) *Marine Farming Lease - Tasmania*, https://ablis.business.gov.au/; Tasmanian Government (2019) *Gazette No. 21,870*, p. 143, http://www.gazette.tas.gov.au/?a=449648

[35] EPA Tasmania (n.d.) *Environmental management*, https://epa.tas.gov.au/regulation/salmon-aquaculture/environmental-management

[36] Trout is also farmed in some cases, but adding an additional finfish species to a lease only costs $158. DPIPWE (2018) *Application for the grant of a Marine Farming Licence in respect to a lease over an area in state waters*, https://dpipwe.tas.gov.au/Documents/Licence-WB%20GRANT%20MF%20Application.pdf

The estimated total lease and licence fees of $923,008 represents about 0.1% (one-thousandth) of the total farmgate production of the salmon industry in Tasmania, and 0.02% of total state revenue.

Other jurisdictions with large salmon farming operations use different licensing and leasing structures. For example, Norway's licensing system consists of perpetual licences that are limited by biomass. Each salmon farming licence allows the holder to farm up to 780 tonnes of salmon at one time (the "maximum allowed biomass" or MAB). New licences are made available infrequently. Since 2017, production capacity will rise or fall on a biennial basis depending on sea lice levels in the area.[37]

An auction of licences last year raised NOK 2.9 billion ($468 million) for licences covering 14,945 tonnes of MAB.[38] Since 2016 in Norway, 80% of the revenue from the growth in the salmon industry is allocated to municipalities with aquaculture operations.[39]

In Tasmania, salmon stocking densities of between 10 and 28 tonnes per hectare have been reported.[40] If the 2,257 hectares of salmon leases in Tasmania leases were valued the same way as the Norwegian biomass licences, they would be worth between $707 million and $2 billion at government auction.

Another advantage of the Norwegian system is its transparency, with public disclosure of areas, winning bidders, volume purchased and price per tonne – as shown in Figure 2, below. Transparent and readily-available details about payments by industry should be available for all jurisdictions.

---

[37] Marine Harvest (2017) *Salmon Farming Industry Handbook 2017*, p. 70, https://web.archive.org/web/20180219002701/http://marineharvest.com/globalassets/investors/handbook/salmon-industry-handbook-2017.pdf

[38] FishFarmingExpert.com (2018) *Norwegian salmon licence auctions raise NOK2.9bn*, https://www.fishfarmingexpert.com/article/norwegian-salmon-licence-auctions-raise-nok29bn/

[39] Olsen (2018) *The salmon license auction completed*, https://salmonbusiness.com/the-salmon-license-auction-completed/

[40] Meldrum-Hanna & Balendra (2017) *Salmon farmer accuses government of failing to protect World Heritage area*, https://www.abc.net.au/news/2017-02-06/huon-aquaculture-lawsuit-tasmania-government-macquarie-harbour/8244330; Ryan & Creswell (2017) *Tassal Group Limited: FY2017 Roadshow*, p. 7, http://www.tassal.com.au/wp-content/uploads/2017/09/1711197-FY2017-investor-relations-roadshow.pdf

Figure 2: Example of public disclosures of winning bids, Norway

FINAL LIST:

Area of production	Bidder	Volume tonnage	Price per tonn in euros
1: Swedish border to Jæren	EIDE FJORDBRUK AS	100	13,941
	MARINE HARVEST NORWAY AS	493	13,941
	EMILSEN FISK AS	400	23,868
	NORSK HAVBRUKSSENTER OPPDRETT AS	265	23,868
7: Nord-Trøndelag with Bindal	MIDT NORSK HAVBRUK AS	600	22,292
	MIDT NORSK HAVBRUK AS	180	22,079
	SALMAR FARMING AS	183	22,292
	SALMAR FARMING AS	260	22,079
8: Helgeland to Bodø	LOVUNDLAKS AS	1,850	26,623
	EDELFARM AS	604	22,219
	BALLANGEN SJØFARM AS	200	24,510
	BALLANGEN SJØFARM AS	50	24,096
	CERMAQ NORWAY AS	2,000	24,510
9: Vestfjorden and Vesterålen	CERMAQ NORWAY AS	30	24,096
	EIDSFJORD SJØFARM AS	200	24,510
	LOFOTEN SJØPRODUKTER AS	53	24,510
	LOFOTEN SJØPRODUKTER AS	20	24,096
	LOFOTEN SJØPRODUKTER AS	32	24,510

Source: Olsen (2018) *The salmon license auction completed*, https://salmonbusiness.com/the-salmon-license-auction-completed/

LEVIES

Three levies apply to salmon farms in Tasmania. The Tasmanian Seafood Industry Council levy is $442.40 per lease. The Salmon Industry Planning Levy is $474 per hectare and the EPA levy is $322.32 per hectare. This would represent annual levies of $19,465 for the Seafood Industry Council, $1,069,818 for the Salmon Industry Planning Levy and $727,476 for the EPA levy – provided that all leases have current licences. The latest EPA Tasmania annual report (financial year 2017–18) gives the levy's size as $500,000 for that year, or 3.8% of EPA Tasmania's operating budget.[41]

The Seafood Industry Council and Salmon Industry Planning levies are primarily for the direct benefit of the industry. The planning levy is intended to help fund "the

[41] EPA Tasmania (2018) *Annual report 2017-18*, p. 41, https://epa.tas.gov.au/Documents/EPA%20Annual%20Report%202017-18.pdf

assessment of industry proposals, tactical research and scientific projects specifically focused on expanding industry production".[42]

COUNCIL RATES

Councils do not charge rates on marine farming leases. After West Coast Council considered charging rates on salmon aquaculture leases in Macquarie Harbour, the Tasmanian Parliament legislated in 2017 to prohibit councils from charging rates on marine farms. Land-based salmon farms are still charged rates.[43]

In June 2019, the West Coast Council significantly increasing council rates for the salmon industry's on-land assets, especially Strahan's "aquaculture hub". The rates will go from "several thousand dollars" to about $70,000 per year.[44] In response, the Tasmanian Salmonid Growers Association called on the state government to "intervene in this immediately", and may consider legal appeals.[45]

Australia Institute polling shows that 70% of Tasmanians think that intensive fish farms should pay rates to local governments.[46]

[42] Rockliff (2016) *Supporting the growth of salmon farming*, http://www.premier.tas.gov.au/releases/supporting_the_growth_of_salmon_farming

[43] Department of Premier and Cabinet (n.d.) *Local Government Amendment (Rates) Act 2017*, http://www.dpac.tas.gov.au/divisions/local_government/legislation/draft_local_government_amendment_rates_bill_2017; Whiting (2017) *Push to exempt marine farms from council rates*, https://www.abc.net.au/news/2017-04-05/legal-move-to-free-salmon-companies-from-paying-council-rates/8416860; Woodruff (2017) *Mates' rates just smell fishy*, https://www.themercury.com.au/news/opinion/talking-point-mates-rates-just-smell-fishy/news-story/e693b3b16f5b509e162dbd5818d4d6bd

[44] Ford (2019) *West Coast Council draft budget targets salmon farmers*, https://www.theadvocate.com.au/story/6239544/west-coast-council-draft-budget-targets-salmon-farmers/

[45] Ford (2019) *West Coast salmon farming rates hike might end up in court*, https://www.theadvocate.com.au/story/6242285/west-coast-salmon-farming-rates-hike-might-end-up-in-court/

[46] The Australia Institute (2016) *Intensive salmon farming in Tasmania*, p. 6, http://www.tai.org.au/content/intensive-salmon-farming-tasmania

ROYALTIES

Some fish harvests in Tasmania, particularly abalone fishing, require royalty payments. The abalone royalty rate varies depending on the deed, but new deeds have a royalty of 7% of average beach price.[47]

Royalty payments are intended to compensate the community for the harvesting of a public resource.[48] As such, aquaculture operations such as salmon farming, are not expected to pay them as they provide their own fish. However, if the public resource were conceived of as a community's waterways, rather than a community's fish, then the intellectual case for a royalty on aquaculture operations could be made.

[47] Ogier et al. (2018) *Economic and Social Assessment of Tasmanian Fisheries 2016/17*, pp. 20–21, http://www.imas.utas.edu.au/__data/assets/pdf_file/0007/1144582/EconSocial-Assessment-Tasmanian-Fisheries-2016-17.pdf

[48] Ogier et al. (2018) *Economic and Social Assessment of Tasmanian Fisheries 2016/17*, pp. 20–21, http://www.imas.utas.edu.au/__data/assets/pdf_file/0007/1144582/EconSocial-Assessment-Tasmanian-Fisheries-2016-17.pdf

Conclusion

Political leaders have overstated the importance of the salmon industry for the state's economy. Salmon farms should be considered on their own economic, environmental and social merits, instead of the industry being treated as essential or as a major part of the Tasmanian economy. The industry is accounts for around 1% of the state's employment and just 1 to 2% of Gross State Product.

Tasmanian salmon companies have gone through a period of growth. This growth has not led to a commensurate growth in returns to the state government, or the communities that bare the environmental costs of the industry.

The Advocate

News

News

- Local News
- Court and Crime
- Property
- History
- Health
- Politics
- Business
- Education
- Investigations
- Rural
- National
- World

Sport

- Local Sport
- Scores and Draws
- Local Footy
- Soccer
- Netball
  Basketball
- Hockey
- Bowls
- Racing
- National Sport

What's On

- Things to do
- Food and Drink
- Family and Kids
- Theatre and Arts
- Music and Gigs
- TV Guide

Today's Paper

Community

- Babies, Weddings & Obituaries
- Newsletters
- Send Us Your News
- Competitions
- Photo Sales
- Sponsorships

Comment

- Your Say
- Our Say
- Opinion

Recommended

- Advertising Features
- Features
- Special Publications
- Sponsored Content

Classifieds

- Tributes
- Celebrations
- Jobs
- Cars
- Place a Classifieds Ad
- Real Estate
- Ag and Rural

Life & Style

- Life
- Money
- Travel
- Horoscopes
- Puzzles
- Celebrity
- Shopping

Search Site Search the site

- Home
-
- News
- Sport
- What's On
- Today's Paper
- Community
- Comment
- Recommended
- Classifieds
- Life & Style
- All

NewsLocal News

- Local News
- Court and Crime
- Property
- History
- Health
- Politics
- Business
- Education
- Investigations
- Rural
- National
- World

1. Home
2. News
3. Local News

February 15 2018 - 6:00PM

Shock job losses at Petuna

- **Libby Bingham**

Local News

- SHARE
- TWEET
-
-

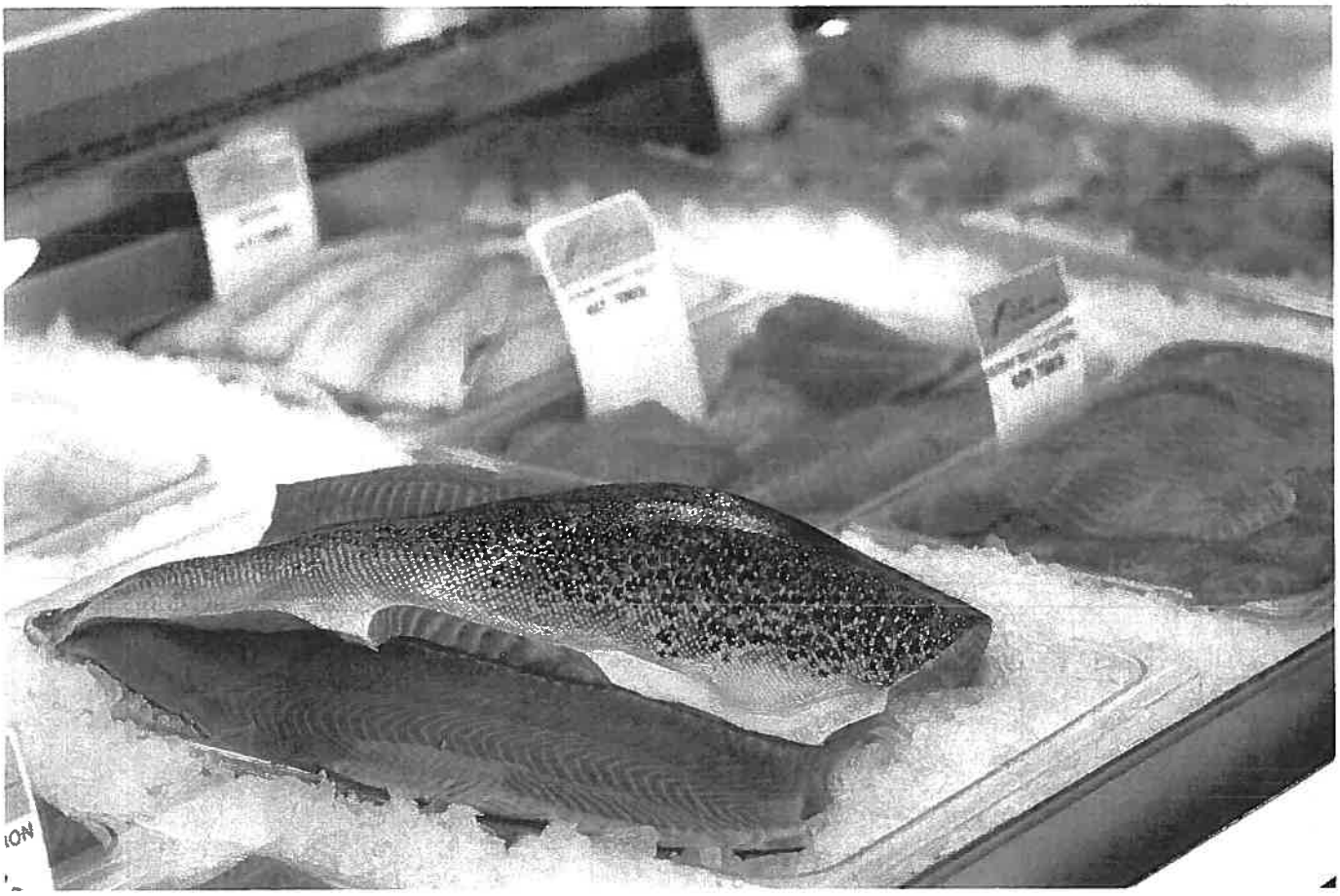
East Devonport-based seafood company, Petuna Aquaculture, has axed 22 senior jobs, following a recent review of operations.

Petuna said it had "been forced to make redundant a number of supervisor and management roles within the company".

Speaking from Strahan on Thursday about the job cuts, Petuna chief finance and development officer, David Wood, said the decision was a regrettable but necessary step to ensure the business remained competitive.

Gutted Petuna staff were advised of the shock job losses earlier this week.

It's also understood some full-time roles were made part-time.



Jobs going: East Devonport-based seafood company Petuna Aquaculture has confirmed the loss of 22 supervisory and management jobs after a recent review of operations.

"The decision is mainly due to expected lower production from Macquarie Harbour, which is a result of one-off losses from POMV (Pilchard Orthomyxovirus) and lower stocking levels – in line with recent biomass determinations from the EPA and our own views on sustainable lease management," Mr Wood said.

"Notwithstanding the difficult decisions required, and the regrettable impact on employment, Petuna continues to support the importance of effective regulation by the EPA.

"We will continue to apply adaptive management principles to ensure our business is sustainable and that we continue to responsibly manage the environments in which we operate."

It's understood some of the people losing their jobs had worked at Petuna for 15 years and 20 years.

Mr Wood said the operational review was undertaken at management and supervisor level right across the Petuna business.

However, it's believed several of the workers being made redundant were based at Petuna's East Devonport headquarters.

When asked if Petuna could rule out any more job losses, the response was "all redundant roles identified have been advised".

After this week's 22 job cuts, Petuna said it employed 264 people across the group.

Petuna said of those, 145 people were employed at East Devonport including those through Petuna's labour hire firm arrangements.

Late last year, The Advocate reported Petuna culled about 100,000 fish at its Macquarie Harbour fish farms in response to an outbreak of POMV, a type of fish herpes.

The report said POMV is a reoccurring issue for Tasmania's salmon industry and has led to hundreds of thousands of fish deaths in recent years.

The naturally-occurring disease is spread by wild fish and doesn't pose a health risk to people who eat salmon.

Petuna told The Advocate at the time, the fish cull was undertaken to prevent the spread of POMV which was detected in the company's juvenile stock.

- SHARE
- TWEET
-
-

RECOMMENDED

First Ocean fish farm raising 1.5 million salmon three miles off Norway

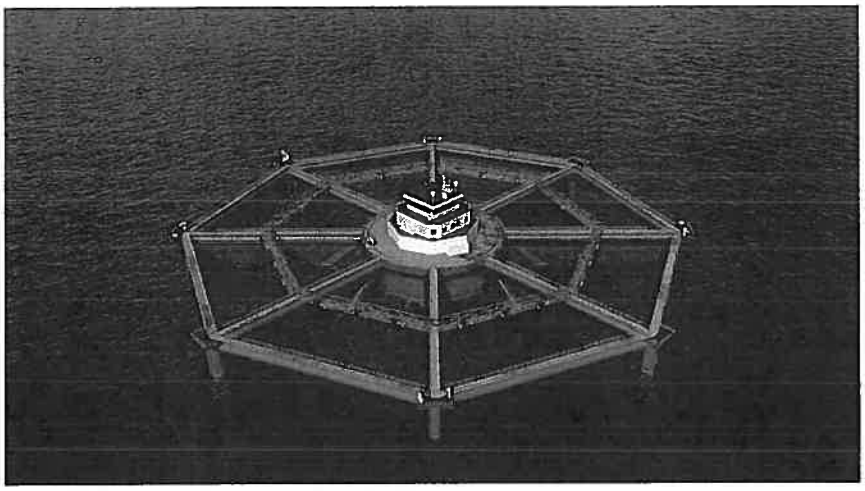
Brian Wang | August 7, 2018

114

Ocean Farm 1 is the world's first deep-sea aquaculture farm. It is designed by leading salmon farmer SalMar ASA (of Norway). They paid China Shipbuilding Industry $300 million for six facilities.

The first pilot system is 67 meters (220 feet high) and a diameter of 110 meters (football field length). It has the volume of c hundred Olympic swimming pools. The pilot system car foot (15 meter) waves.

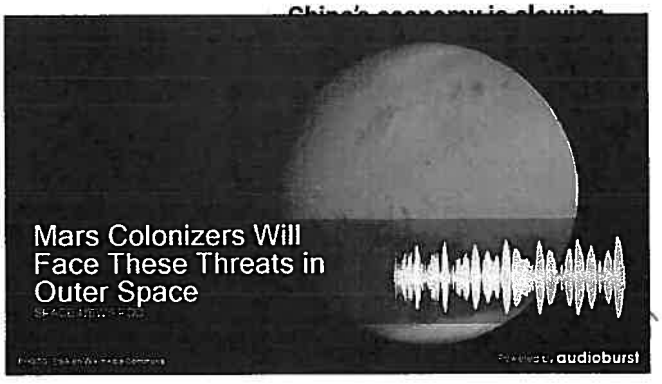
Movable, submerged valves disperse food to allow fish depths instead of clustering near the surface for feedin current helps clear out the waste to keep low mortality a fish.



The production unit will be around 70 meters high and will have a diameter of around 160 meters. the production unit will be able to produce 12,000 tons of fish each year. The production system can withstand 100 foot (31 meter) waves. The systems can be put anywhere in the open sea.

The new system will be able to grow 3 million salmon each year. The production ocean fish farm will cost 157 million euros.

World's first semi-submersible automated offshore fish ...



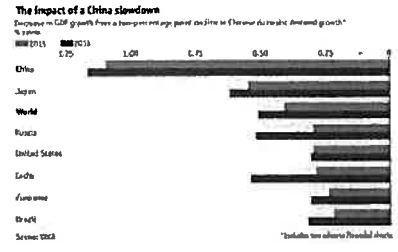
USEFUL SITES AND LINKS

Next Big Coins
Oil Price
Nextbigfuture Space Facebook Page
Nextbigfuture Blockchain Facebook Page
Nextbigfuture Military Facebook Page
Nextbigfuture Anti-Aging Facebook Page
Nextbigfuture Energy Page

ARCHIVES

Archives Select Month

AUTHOR POSTS



Back in 2006, I had a prediction that there would be a cubic mile of deep ocean fish farms by the end of 2025. It would take about 2,500 of the production sized ocean fish farms to reach that volume. The number of fish farms and reaching the overall volume now seems likely. It is a matter of when. It could be in the 2030-2050 timeframe.

China is also deploying these large fish farms in the Yellow Sea.

A 35-meter-high cage will be deployed in the Yellow Sea about 130 nautical miles east of Rizhao where the cold water is believed to be a suitable habitat for the fish. Wang Yu, head of the Hubei Marine Engineering Equipment Research Institute, said the cage had a volume of 50,000 cubic meters and could generate a harvest of about 1,500 tonnes of salmon per season.

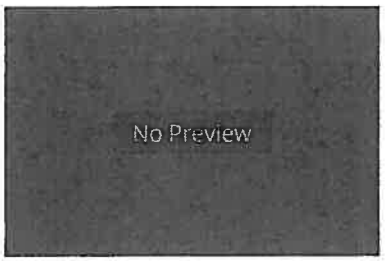
More open sea farms in China and other locations could follow. China estimates the Yellow Sea could support an industry of more than 100 billion yuan (US$15.7 billion). This would be about 1000 of the large Salmar production sized systems.

The value of the global fish trade was about $150 billion in 2017. This was an increase of about 7% compared with 2016. Global aquaculture production is anticipated to exceed the 100 million tonne mark for the first time in 2025 and to reach 102 million tonnes by 2026.

Salmon is growing in popularity in China, with the count
about 70,000 tonnes of the fish each year.

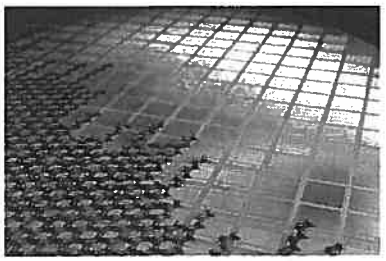
There are over 1000 ocean oil platforms. Ocean oil platf
larger than the ocean fish farm.

Sponsored Content



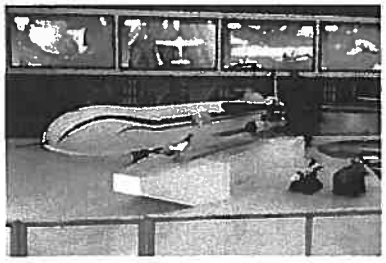
Ecomotors OPOC Engines Could Make a ...

August 29, 2010 0



Seeing The Invisible With A Graphene-CMOS ...

June 11, 2017 0



25 different Chinese models of the ...

November 19, 2010

Brian Wang

Brian Wang is a prolific business-oriented writer of emerging and disruptive technologies. He is known for insightful articles that combine business and technical analysis that catches the attention of the general public and is also useful for those in the industries. He is the sole author and writer of nextbigfuture.com, the top online science blog. He is also involved in angel investing and raising funds for breakthrough technology startup companies.

He gave the recent keynote presentation at Monte Jade event with a talk entitled the Future for You. He gave an annual update on molecular nanotechnology at Singularity University on nanotechnology, gave a TEDX talk on energy, and advises USC ASTE 527 (advanced space projects program). He has been interviewed for radio, professional organizations. podcasts and corporate events. He was recently interviewed by the radio program Steel on Steel on satellites and high altitude balloons that will track all movement in many parts of the USA.

He fundraises for various high impact technology companies and has worked in computer technology, insurance, healthcare and with corporate finance.

He has substantial familiarity with a broad range of breakthrough technologies like age reversal and antiaging, quantum computers, artificial int
ocean tech, agtech, nuclear fission, advanced nuclear fission, sp
propulsion, satellites, imaging, molecular nanotechnology, biotec
medicine, blockchain, crypto and many other areas.

Popular in the Community

Our Community

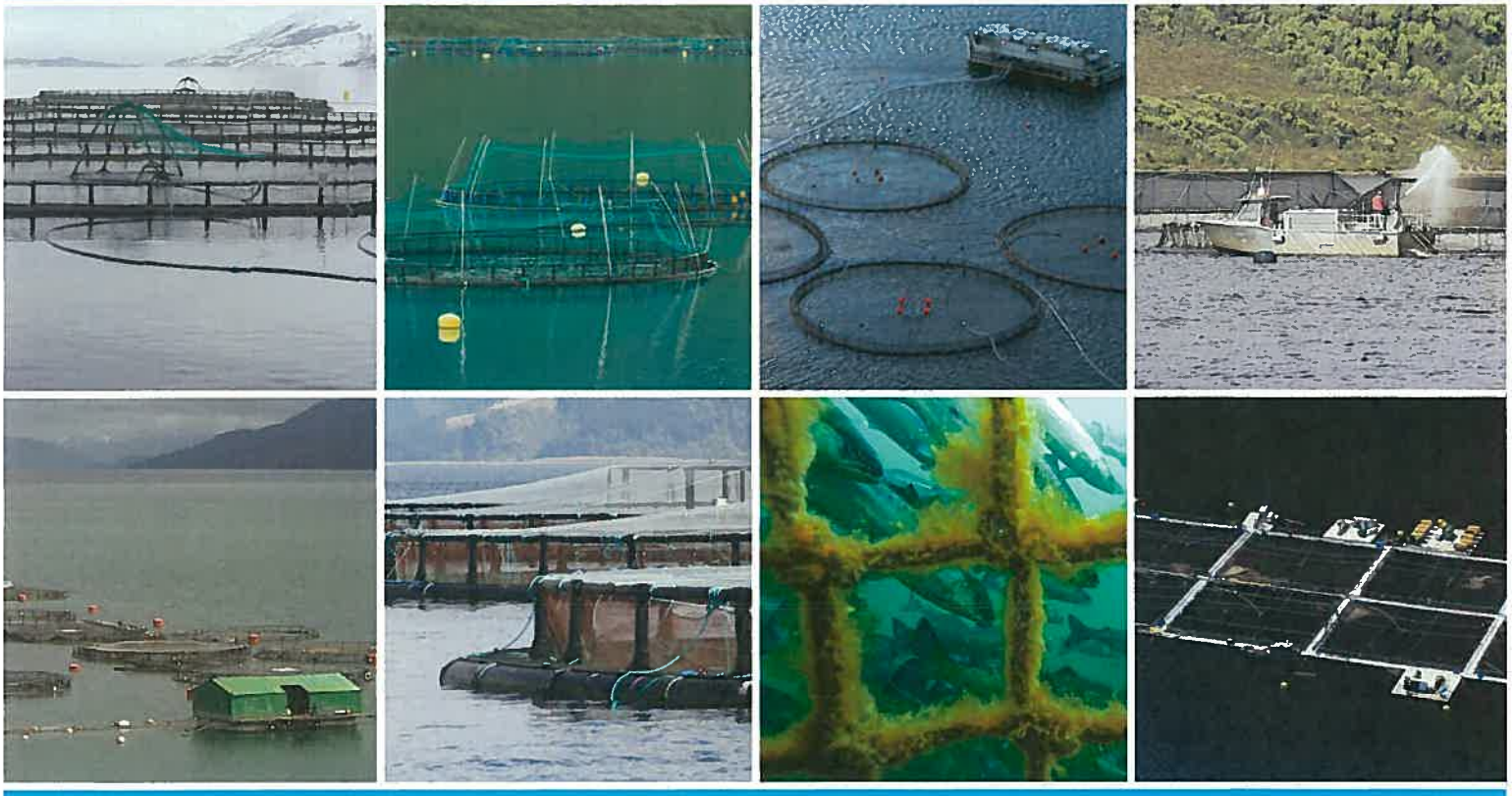
Read next: Johan Rockström predicts climate doom again but is not advocating nuclear or ocean solutions »
« China is spending millions on engineering and geological work for the 84 mile rail tunnel to Taiwan

Tags: agriculture, farming, fish, food, future, ocean

About Us Contact

SeaChoice.org
for healthy oceans

Global Review of the Aquaculture Stewardship Council's Salmon Standard



TECHNICAL REPORT

Authors: Kelly Roebuck & Karen Wristen

DAVID SUZUKI FOUNDATION

Ecology Action Centre

LIVING OCEANS

ISBN: 978-1-988424-26-2

Table of Contents

Citation: Roebuck, K. & Wristen, K. Global Review of the Aquaculture Stewardship Council's Salmon Standard. Technical Report. SeaChoice, September 2018.

Cover photos by: Tavish Campbell, Kristina D.C. Hoeppner, Kelly Roebuck and Mike Peel.

Acknowledgements
Audit data entry: Claude Tremblay
Thank you to the ASC for their review and response to this report.

List of Acronyms

ABM	Area-Based Management
AMA	Area Management Agreement
AMAs	Aquaculture Management Areas
ASC	Aquaculture Stewardship Council
ASI	Accreditation Standards International
AZE	Allowable Zone of Effect
BAP	Best Aquaculture Practices
B.C.	British Columbia
BCSFA	British Columbia Salmon Farmers Association
CAB	Certification Assessment Body
CAR	Certification and Accreditation Requirements
CLAMS	Coordinate Local Aquaculture Management System
CMS	Cardio Myopathy Syndrome
CoGP	Codes of Good Practice
CoL	Conditions of Licence
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
DPIPWE	Department of Primary Industries, Parks, Water and Environment
EG	Entry Gate
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organisation
FFDRm	Fishmeal Forage Dependency Ratio
FFDRo	Fish Oil Forage Dependency Ratio
FMA	Farm Management Area
FMAg	Farm Management Agreements
GT	Global Target
GSI	Global Salmon Initiative
HSMI	Heart Skeleton Muscle Inflammation
IMAP	Integrated Management of Aquaculture Plan
IMAS	Institute of Marine and Antarctic Studies
ISA	Infectious Salmon Anemia
ISEAL	International Social and Environmental Accreditation and Labeling
MH	Macquarie Harbour
MSC	Marine Stewardship Council
NC	Non-conformity (not meeting a specific ASC Standard requirement)
OIE	World Organisation for Animal Health
PAR	Pacific Aquaculture Regulations
POMV	Pilchard Orthomyxovirus
PTI	Parasiticide Treatment Index
QA	Quality Assurance
SAG	Stakeholder Advisory Group
SBM	Single Bay Mangement
TAG	Technical Advisory Group
TWG	Technical Working Group
TWWHA	Tasmania Wilderness World Heritage Area
U.K.	United Kingdom
VR	Variance Request
VHS	Viral Hemorrhagic Septicaemia
WNMT	Weighted Number of Medicinal Treatments
WHO	World Health Organisation

Executive Summary

The Aquaculture Stewardship Council's (ASC) "responsibly farmed" eco-label is considered the gold standard of farmed seafood eco-certifications. The organisation's theory of change relies on consumer confidence in the label driving increased demand and premium pricing for ASC-certified products; and that demand, in turn, drives aquaculture improvements toward certification. Confidence in the label is inspired by ASC's assurance that its standards are designed to reward only the top-performing producers; by the integrity of its transparent and inclusive processes and the assurance of farm-specific and third-party auditing, as well as the commitment to continuous improvement.

The ASC species standards are said to define global best practices for managing environmental and social impacts. Salmon has become the ASC's top commodity in terms of the number of farms certified, by production volume and presumably by value. At the time of the Salmon Standard's launch, best practices were defined by the top-performing 15 per cent of all salmon farms globally. Today, with 27 per cent of the industry by volume and about 11 per cent of the total number of salmon farms certified, the ASC has reached the point where the top performers are likely among the certified. Meanwhile, industry has indicated its intention to increase the number of certified farms substantially and quickly. Members of the Global Salmon Initiative,[1] for example, are focused on 100 per cent enrolment by 2020. In response to the pressure to admit more farms into the program, it is crucial for the ASC to hold the bar at best practices as defined in their theory of change, which underpins the label's credibility.

This SeaChoice review looks at every audit filed for each of the 257 certified salmon farms from the first farm certified in 2014 through March 15, 2018. It examines both the conformance of farms with the Salmon Standard and aspects of farm performance based in part on data external to the audits. Finally, it examines changes being made to the Salmon Standard and assesses the impact of those changes.

The review finds that most ASC-certified salmon farms successfully meet several key environmental indicators of the Salmon Standard. For example, 95 per cent of farms meet the required forage fish dependency ratios for fishmeal and fish oil. In fact, ASC farms have improved their fishmeal inclusion rates over time. The parasiticide use limit is also met by 96 per cent of farms. Most farms are successful in meeting limits on escapes, lethal incidents involving marine mammals, antibiotic use and viral disease mortality. In addition, public reporting by certified farms on key Standard metrics is found to be relatively effective. In many cases, the posting of this data goes beyond what local regulatory agencies require of the industry.

The review also finds, however, that farms are far less consistent in meeting several critical Standard requirements – including participating in an area-based management (ABM) scheme, on-farm sea lice counts and sea lice monitoring on wild salmon. For example, no farms comply with all the ABM requirements as written in the Standard's appendix. Some farms recorded on-farm sea lice levels up to 21 times the ASC threshold. For Atlantic regions, farms are treated as exempt from needing to demonstrate that some sort of robust and publicly available monitoring of sea lice levels on wild out-migrating salmonid juveniles is occurring (whether it be conducted via industry, regulatory bodies or independent researchers). Such requirements are intended to help safeguard wild salmon from potential farm-derived impacts.

Furthermore, the Salmon Standard asserts that farms "must meet 100 per cent of the [Standard] requirements" in order to be certified but, in reality, this is not the case. This is a really impressive statement that instils trust in consumers interested in making environmentally responsible food

[1] The Global Salmon Initiative, representing around 55 per cent of the salmon aquaculture industry, have pledged to be 100 per cent ASC certified by 2020. As of April 2018, over 40 per cent of GSI members are certified.

choices. However, auditing processes - including non-conformities, variances and interpretations - mean that few certified farms follow the Standard as written. Additionally, the Standard itself is at risk from being weakened by operational reviews. All together these realities are undermining the organisation's theory of change by eroding the best practices codified in the Standard.

Non-conformities, where a farm fails to conform with a Standard requirement, are regularly raised and farms can be certified with 'open' minor non-conformities. At time of writing, auditors have raised a total of 3,726 non-conformities across 456 audits (representing 257 farms). The average initial farm audit detected 2.33 major and 9.30 minor non-conformities. **Post-certification, most farms failed to conform fully to the Standard**; non-conformities were regularly detected during surveillance and recertification audits (an average of 0.98 major, 2.82 minor and 1.31 major, 4.68 minor non-conformities respectively). Additionally, a number of audits failed to raise a non-conformity where evidence or metrics indicate a non-conformity ought to have been raised but wasn't. Others failed to resolve, or 'close', non-conformities within the stipulated timeframe outlined by the ASC. It was also found that **certified farms in major non-conformance with the Standard can sell their product with the ASC logo**.

Variances, which are alterations to the Standard requested by auditors and approved by the ASC Variance Request (VR) Committee, can represent significant lowering of the Standard criteria and enable farms that would otherwise be non-compliant to be certified. Over half of the ASC's variances to all eight of its species Standards related to the Salmon Standard. **Only 21 per cent of certified farms followed the Standard as written** (i.e. without varied criteria), and the average salmon farm audit cited 2.4 variances (range = 0 to 9). Variances that deferred to government regulations were found to be weakening the intent of the requirement—to hold ASC farms to a higher Standard than that imposed by local regulators. The process for granting a variance is not transparent and the degree of scientific or technical consultation undertaken by the VR Committee is discretionary. Stakeholders are not engaged. Decisions are published after they have taken effect and have occasionally become precedent-setting, *defacto* regional changes to the Standard.

Some interpretations of the Standards or the auditors' guidance document, known as the Certification and Accreditation Requirements (CAR), sought by auditors through ASC's Interpretation Platform are arguably better suited to an operational review. For example, the definition of the 'unit of certification' subject to audit was interpreted to exclude intermediary farms (early grow-out farming stages) from the scope of the audit. This confounds the application of numerous Standard indicators that require evidence from a full production cycle to demonstrate conformance. Consequently, **up to a year of a farmed salmon's production cycle can be omitted from conformance assessments**, with unknown consequences for the amount of parasiticide or other chemicals and therapeutants that might be associated with the certified fish during intermediary stage production.

Farms that are in major non-conformance with the Standard are required to 'close out' the non-conformity before certification is granted or within three months if already certified. However, another ASC interpretation contravenes this by allowing major non-conformities to indefinitely remain open (with an action plan and assessed progress, but no specified deadlines). This interpretation violates the CAR stipulated deadlines for closing out non-conformities and for initiating suspensions. **The result is that ASC labelled product can enter the marketplace despite not meeting all criteria for certification, clearly breaching the Standard's stated 100 per cent conformance requirement.**

The operational review process is intended to fine-tune the Standard and the CAR to ensure relevance and efficacy in attaining the ASC's goals and is the most inclusive and transparent of the vehicles available for amending the Standard. However, it can be difficult for stakeholders to understand why a review is being undertaken or how solutions are being developed. For example, the current operational

review of the Parasiticide Treatment Index (PTI) was apparently undertaken to remove a perceived barrier to certification: in that too few chemical treatments to control parasites were being allowed by the Standard. Yet our review found 96 per cent conformance with the indicator among certified farms, representing 27 per cent of global production and 11 per cent of farms. This strongly suggests that the PTI is set at just the right level to reflect best practices, whereas the proposal developed for **amending the PTI represents a very substantial weakening of this indicator, allowing up to a 450 per cent increase in the amount of parasiticide allowed** to be used by certified farms. The proposal also shifts the Standard from best practice certification to one more aligned with an 'aquaculture improvement project' approach, with some regions allowed up to 15 years to reach the proposed parasiticide global metric.

It is critical that eco-certifications are leading to genuine changes on the water and not simply rewarding business as usual. Otherwise, eco-certifications are at risk of losing credibility and consumer trust. SeaChoice calls on the ASC to immediately correct such amendments that weaken the Standard's stated goal of best practice certification.

The following recommendations are offered to outline steps the ASC should take to reverse the erosion of the Salmon Standard and to improve confidence in its application.

Key Recommendations

Auditing Processes

1. **Strengthen the Quality Assurance (QA) framework:** Continue to monitor and ensure that Certification Assessment Bodies (CABs) are providing the required metrics within audit reports to demonstrate conformance; are assessing Standard indicators correctly; raising and closing non-conformance appropriately; applying variances suitably and posting audit reports on time.
2. **Clarify the application and consequence of non-conformities:** Validate the Standard's stated 100 per cent conformance requirement by reinforcing that farms are either 'conforming' (i.e. meets the Standard) or 'non-conforming' (i.e. does not meet the Standard). Minor non-conformities should only be non-critical in nature (e.g. administrative). Farms in major non-conformance to the Standard should not be certified. If a major non-conformance is raised after the initial certification, the farm should not be able to use the label. Provide further rules in regard to suspension, re-instatement and withdrawal of certificates.

Standard Conformance and Performance

3. **Revise the PTI proposal to reflect actual global best practice:** The Standard should continue to define what is the top global performance and not allow regional variations that substantially weaken the Standard. Do not remove the potential lobster impacts from the criteria. Establish an acceptable ABM parasiticide load and number of allowed treatments within the ABM.
4. **Consider further reductions to the Fishmeal and Fish Oil Forage Fish Dependency Ratios:** 1.0 FFDRm and 2.30 FFDRo which reflect current best practices.
5. **Require further performance indicators be publicly reported:** These should include, but not limited to: escapes, parasiticide and antibiotic use.
6. **Develop an ABM approach to all Standards:** Establish requirements for potential cumulative impacts in relation to Standards' environmental indicators.

Variance Requests and Interpretations

7. **Improve the variance request process and its application:** Incorporate expert and stakeholder input into the variance request approval process. At approval, the scope (e.g. applicable farm, area and dates) should be defined to avoid incorrect application by CABs. Eliminate variances that permanently change a Standard requirement (metric, indicator, procedure) unless specifically envisioned in the Standard.

8. **Ensure the Interpretations Platform is used for clarifications only:** The platform should be used strictly for providing clarification to auditors and not for interpretations that amend the intent of the Standard or CAR. Rescind the interpretation that states intermediary sites are "out of scope" and align the CAR and Salmon Standard definitions of Unit of Certification to ensure that audits assess the complete production cycle impacts. Correct the interpretation that states the closure of a major non-conformity may be extended without an ASC defined deadline to correctly reflect the CAR's stipulated timelines for closing a major non-conformance—the one-time three-month extension and suspension after six months.

Monitoring and Evaluation

9. **Demonstrate that ASC certification is leading to sustainability improvements:** Conduct a data driven analysis to determine if certified farms are improving their practices.

Introduction

As one of the world's fastest growing food sectors, aquaculture now contributes half of the seafood we consume. In 2016, a total of 80 million tonnes of farmed seafood entered the global supply chain.[1] The sector's exponential growth has experienced environmental and social challenges. In response to these challenges, eco-labels for farmed seafood have proliferated in the last decade. In 2015, the global retail value of eco-certified farmed seafood was estimated to be $3.6 billion U.S.[2]

Private aquaculture eco-certifications aim to identify responsibly farmed seafood, promote it to consumers and improve their ability to easily purchase it. This increased ease of identification and selection is, in turn, meant to increase demand, or price, or volume of sale of certified product, thus creating market incentives to reward the certified practices and for industry to further improve practices. Seafood eco-certifications generally rely on one of two approaches to a theory of change: the promotion of gold Standard best performers *or* the exclusion of the worst performers.[3] [4] Gold Standard eco-certifications are associated with true best practices, stringent environmental sustainability principles and independent third-party audits (i.e. a higher bar). The 'excluding the worst' approach enables easier certification for a larger section of the industry and therefore has less stringent sustainability principles in comparison (i.e. a lower bar). The former requires substantial improvements on the part of the majority of the industry in order to be certified and therefore, industry up-take can be slow and/or confined. The latter requires only nominal improvements to the industry and will generally result in quicker and broader up-take by industry. The degree to which environmental improvements can be made by either theory of change remains largely debatable and untested,[5] although studies suggest that once producers achieve certification, there is virtually no impetus for further improving practices. [6] [7] [8]

Established in 2010 following a series of multi-stakeholder dialogues, the global ASC has grown to become one of most prominent eco-label schemes for farmed seafood.[9] Often touted as the gold Standard for certification,[10] [11] [12] the ASC eco-label is intended to promote farms with best environmental and social practices. It was anticipated only the best practice farms, defined as the top 15 per cent of all farms globally, would successfully meet the ASC's Standards.[13] As of May 2018, over 1.4 million tonnes of farmed seafood have featured the ASC eco-label, consisting of over 11,900 products available in 68 countries.[14] Last year, the number of ASC farms grew by 45 per cent.[15]

Farmed salmon is the ASC's leading certified product by volume (and presumably by value), representing half of all certified production. This is despite the fact that in 2014, farmed Atlantic salmon represented a mere four per cent of all aquaculture production worldwide.[16] The Salmon Standard, one of eight ASC Standards, was launched in 2012[17] and the first farm was certified in 2014.[18] Today 27 per cent of the global salmon farming industry's production volume features the ASC eco-label. ASC has not yet demonstrated whether their certification of industry has led to measurable improvements in farm sustainability practices or environmental or social negative impacts.

This SeaChoice[ii] technical report is the first global review of all ASC salmon certifications that examines farm conformance and performance with the Salmon Standard.[iii] The report also reviews to what extent the Standard's criteria are varied at the request of auditors for farms that cannot meet the criteria as written, and what impact such variances have on the stringency of the Standard. This review builds on SeaChoice's previous report, *ASC Certification in Canada: Technical Report.*[19]

[ii] SeaChoice member groups have been active stakeholders in the ASC and Salmon Aquaculture Dialogue for more than a decade. This has included steering committee representation during the original Aquaculture Dialogues, core participation in numerous ASC advisory and working groups, and active stakeholder engagement on ASC audits and projects. For more information: http://www.seachoice.org/our-work/eco-labels/

[iii] The technical report content is current as of August 6, 2018, the date it was shared with the ASC for review and comment. Their response can be found as an appendix to this report.

Globally, salmon farming continues to be the subject of serious environmental and social concerns.[20] [21] [22] [23] It is therefore critical for seafood eco-certification Standards and processes to be credible, and to lead to genuine sustainability improvement on the water. Our report provides recommendations that have the potential to strengthen the ASC certification in the long-term, which in turn, could help drive sustainability gains in the industry.

How the ASC and the Salmon Standard Works

The ASC Certification Scheme: Components and Actors

The ASC scheme is comprised of a number of components and operated by a number of actors:

The ASC Standards

Currently, the Salmon Standard is one of eight ASC species Standards that were created in a series of multi-stakeholder processes known as the Aquaculture Dialogues.[24] The ASC is in the process of developing a Core Standard. The Core Standard marks a strategic shift from the singular species Standards created during the Aquaculture Dialogues to a single harmonized Standard for numerous species.[25] The ASC is the "Standard holder" and may convene processes for amendment of, or case-by-case variance from, the Standards. The ASC may also interpret its Standards from time to time, on the request of a CAB.

The ASC Supervisory Board, Technical Advisory Group and Technical Working Groups

The ASC appoints and consults with these three multi-stakeholder groups. The Supervisory Board is tasked with the overall supervision of the ASC's general activities.[26] The Technical Advisory Group (TAG) and the Technical Working Groups (TWGs) are active in the course of special projects to review ASC Standards and processes. The TAG advises the Supervisory Board on these matters.[27] The TAG and Supervisory Board Chairs are also members of the Variance Request Committee, and so the ASC consults them on requests for variances for particular audits.[28]

The Certification and Accreditation Requirements (CAR) guidance document[29] and Conformity Assessment Bodies (CABs)

The CAR establishes definitions, requirements and Standards to be applied by the accredited CABs when they conduct independent audits of applicant farms. The CAR covers matters such as audit procedures, the quality of acceptable evidence and reporting requirements. CABs are independent certifiers contracted by the aquaculture client; they may also provide representation on the ASC Supervisory Board, TAG and TWGs.[30]

Aquaculture clients

Aquaculture operators apply for certification for individual farms or for multiple sites[31] within the same company. (They will soon be permitted to apply for certification for groups of farms).[32] They may also provide representation on the ASC Supervisory Board, TAG and TWGs.[33]

Stakeholder engagement

A critical component of the ASC certification scheme is that it confers social licence through the engagement of stakeholders.[34] The certification process calls for robust stakeholder engagement before and during certification and requires a CAB to respond to stakeholder comments.[35] In addition, where CAB response is deemed inadequate, a stakeholder may take a complaint to Accreditation Standards International (ASI) (see below). There are representatives from academia and nongovernment organisations on the ASC Supervisory Board, TAG and TWGs.[36]

Chain of Custody, the ASC logo and the Marine Stewardship Council (MSC)

Following certification, a farm is entitled to apply the ASC logo to its product and introduce it into the Chain of Custody system shared with MSC. The Chain of Custody system is operated by MSC and is intended to ensure that only product that has been properly certified enters the market bearing these stewardship logos.[37]

Accreditation and oversight by Accreditation Standards International (ASI)

CABs are trained in the ASC certification scheme by ASC and accredited as auditors by ASI.[38] ASI supervises CABs, acting as a second level of review of individual farm audits in cases where a

stakeholder requests the review and makes a case for non-conformance with the Standards or the CAR.[39]

International Social and Environmental Accreditation and Labeling (ISEAL) Alliance

The ASC is a member of this alliance, the mandate of which is to strengthen multi-stakeholder sustainability certifications.[40] ISEAL sets credibility Standards and publishes and promotes codes of practice. ISEAL employs an independent evaluation process to assess the progress made by its members toward attaining ISEAL Standards and goals.

The Audit Process

The ASC audit process begins with a full (initial) assessment audit undertaken by an independent auditor (known as the CAB) hired by the farm operator. If a certificate is awarded, it is valid for three years, during which time two surveillance audits are conducted, typically on an annual basis. A re-certification audit is conducted after the certificate expires.

Stakeholders are given 30 days' notice of the applicant farm's audit date on the ASC website[41] and can submit comments during this period. Following the audit, a draft assessment audit is made publicly available for 10 working days for stakeholder comments. Stakeholder submissions require a response from the CAB indicating whether or how the stakeholder's comments have been incorporated into the final assessment.[42] A dissatisfied stakeholder may take their complaint to ASI for further review. This usually occurs after the farm has been awarded certification. Stakeholders may contribute further comment at any point in the certification process when a case is made that the farm has ceased to be entitled to certification, or upon a surveillance or re-certification audit.

Auditing and logo licencing fees

Auditing fees are paid by the farming client directly to the CAB. One Australian farming client, which produces around 25,000 metric tonnes a year,[43] disclosed that their annual auditing fees for ASC certification cost approximately $125,000 AUD ($92,835 USD) per year plus internal costs.[44] The ASC does not receive income from the auditing process. However, the ASC does charge an annual fee and royalties to organisations who use the ASC logo under licence.[45] Logo licence holders pay an annual fee of £160 GBP to £1,600 GBP ($211 to $2,117 USD) depending on the sales value of ASC certified seafood. Royalty rates range from 0.3 to 0.5 per cent depending on the sales value of the licence holder's ASC labelled consumer facing products.

The Salmon Standard

The Salmon Standard version 1.1 is one of eight ASC species Standards and consists of seven principles, 36 criteria and a total of 119 indicators, plus an additional section for suppliers of smolt (a further seven criteria and 35 indicators).[46] Salmon farms are scored against the ASC Standard on a pass/fail basis by the CAB.

ASC SALMON STANDARD		
Principle	**No. of Criteria**	**No. of Indicators**
1: Comply with all applicable national laws and local regulations	1	4
2: Conserve natural habitat, local biodiversity and ecosystem function	5	20
3: Protect the health and genetic integrity of wild populations	4	15
4: Use resources in an environmentally efficient and responsible manner	7	21
5: Manage disease and parasites in an environmentally responsible manner	4	24
6: Develop and operate farms in a socially responsible manner	12	27
7: Be a good neighbour and conscientious citizen	3	8
8: Standards for suppliers of smolt	7	35
TOTAL	**43**	**154**

The ASC provides the following definitions for each:

Principle: "The guiding principle for addressing the impact"
Criteria: "The area to focus on to address the impact"
Indicator: "What to measure in order to determine the extent of the impact"[47]

Each indicator stipulates requirements that are defined as: "The number and/or performance level that must be reached to determine if the impact is being minimized."[48] Each requirement is calibrated as either a pass/fail or a defined metric.

The Application of the Salmon Standard

The ideal

The ASC may be considered the gold Standard of salmon certification schemes because its Salmon Standard states that farms "must meet 100 per cent of the requirements in this document to achieve certification."[49] This is an impressive claim that instils trust in consumers interested in making environmentally responsible food choices.

ASC's process is outlined below. However, it is important to note that despite their strong statement requiring that applicants meet 100 per cent of their requirements, ASC may also offer its applicants a loophole. ASC applicants may be assessed as "conforming," which indicates that they meet ASC requirements. But they can also be assessed as having major or minor "non-conformities." The applicant then has the opportunity to address the non-conformities. However, farms can be nonetheless certified with outstanding, or "open," non-conformities. For example, Arbolito salmon farm in Chile was certified with 62[iv] open minor non-conformities.[50]

Applicants can also be granted a variance,[51] which allows them to be excused from meeting certain criterion. These are submitted by the CAB to the ASC's Variance Request Committee for deliberation. An approved variance can allow an auditor to certify an applicant without flagging a non-conformity. See Part 3 for an in-depth discussion of the variance process and the associated concerns.

The process

- CABs use the ASC Audit Manual[52] and CAR guidance[53] to assess an applicant for certification.
- If an applicant meets each of the ASC requirements, it is considered "conforming" and receives ASC certification.
- Any instances in which the applicant does not meet ASC Standards are marked as non-conforming and graded as either "major" or "minor."
- According to the CAR guidance document, Version 2.1, major non-conformities should be closed within three months, with a possible extension of an additional three months (i.e. six months in total). Major non-conformities need to be closed before certification is granted.
- According to the CAR guidance document, Version 2.1, minor non-conformities should be closed within three months; however, they can be extended by an additional 12 months (i.e. 15 months in total). Farms can be certified with any number of open minor non-conformities.
- In situations not addressed by the Salmon Standard, audit manual or CAR document, or if the auditor believes the evidence indicates an appropriate case for excusing a farm from meeting any of the criterion, the CAB can submit a variance request to the ASC's Variance Request Committee.[54] These requests are supposed to be supported by evidence sufficient to enable ASC to conclude that the principles underlying the Standard indicator in question are not compromised by the variance. Variance requests allow CABs to seek an ASC interpretation or approved variance to either the Standard criterion or CAR requirements.

[iv] Applying the CAR's guidelines of one non-conformity per indicator, showed 31 specific indicators with minor non-conformities (open) and five major non-conformities (closed).

Methodology

ASC program statistics were obtained from ASC's monthly certification updates. 2017 ASC certified salmon production volume data per country was acquired directly from the ASC and compared to Food and Agriculture Organization (FAO) global salmon aquaculture production volume statistics.

Audit data from all ASC certified salmon farms globally were collated from the ASC website.[v] Missing audits were noted. Each available farm audit was categorized by type: full (initial) assessment, surveillance and re-certification audits. Within each audit, each non-conformity (major and minor) identified was recorded by Salmon Standard indicator, criterion and principle. The dates for which each non-conformity was detected and closed were also recorded. Audit evidence and data availability were assessed for key Salmon Standard indicators that rely on performance-based metrics. These in turn were categorized as reported, missing, deleted, not raised or not applicable. Where a metric was reported, it was recorded. This data was used to evaluate farm performance in relation to key indicators. Publicly reported data on salmon farming company websites were collected and compared to audit evidence and data. This information was used for Part 2 of the report.

Variances granted by ASC were identified and recorded by Salmon Standard indicator, criterion and principle. The content of variances was reviewed to determine if the Standard's requirements were simply being replaced by existing government regulations. The number of times a variance was used within audit reports was checked to determine the extent to which variances are reapplied or treated as precedents, essentially altering the Standard. This information was used for Part 3 of the report.

This report reviewed a total of 456 audits (248 initial; 189 surveillance; 19 re-certification), representing 257 salmon farms.[vi]

[v] All audit reports publicly available on the ASC website as of March 15, 2018 were used in this report. Two large escape events at ASC certified farms that occurred after March 15 (May and July 2018) were also included given their significance in illustrating a key finding of the report.

[vi] As of April 2018, there are 240 ASC certified salmon farms. This report's review of 257 farms includes farms with certificates that have expired, been suspended, cancelled or withdrawn.

Part 1. ASC Certified Salmon: The Global Landscape

The ASC defines the best practices enshrined in their certification Standards as practices that only the top 15 per cent of farms globally would be able to meet at the time the Standards were launched.[55] ASC's Theory of Change aims to incentivize non-certified farms to improve practices in order to achieve certification. This theory relies on consumers driving the demand for ASC labelled products, which in turn, requires more ASC certified farms to supply the market. The foundation of the scheme thus rests on consumer perception that it is credible – that its practices are transparent and its procedures fair. Salmon, followed by shrimp, is the most valuable global seafood commodity.[56] In 2016, approximately 2.5 million metric tonnes of farmed salmon (Atlantic; Chinook; Coho and sea trout) were produced worldwide. [57] The Global Salmon Initiative (GSI), representing around 55 per cent of the salmon aquaculture industry, have pledged to be 100 per cent ASC certified by 2020.[58] As of April 2018, over 40 per cent of GSI members are certified.[59]

Part 1 of this report reviews the number of farms and amount of production by species currently ASC certified. The number of ASC labelled products along with their market presence is examined. The amount of ASC certified production under the Salmon Standard is assessed at a global and country level.

ASC's Global Market Presence

In 2017, the number of farms within the ASC program grew more than 45 per cent. [60] As of May 2018, 621 farms are ASC certified to one of the scheme's eight Standards. [61] This equates to over 1.4 million metric tonnes (mT) of seafood certified with the eco-label in the last year. Salmon is ASC's leading species certification, with 250 certified salmon farms, and representing 40 per cent of all farms certified in the ASC program (See figure 1). Likewise, farmed salmon is ASC's top certification by volume with 749,581 metric tonnes (or 53 per cent) of all ASC certified production (See figure 2). In comparison, ASC's leading competitor — the Global Aquaculture Alliance's Best Aquaculture Practices (BAP) scheme — has been used to certify over 2.35 million metric tonnes of seafood as of May 2018.[62] Although BAP's certified volume for all seafood is significantly higher than ASC's, the volume of BAP certified salmon is only somewhat more than ASC certified salmon – at 914,089 tonnes (or 38 per cent) of all BAP production.

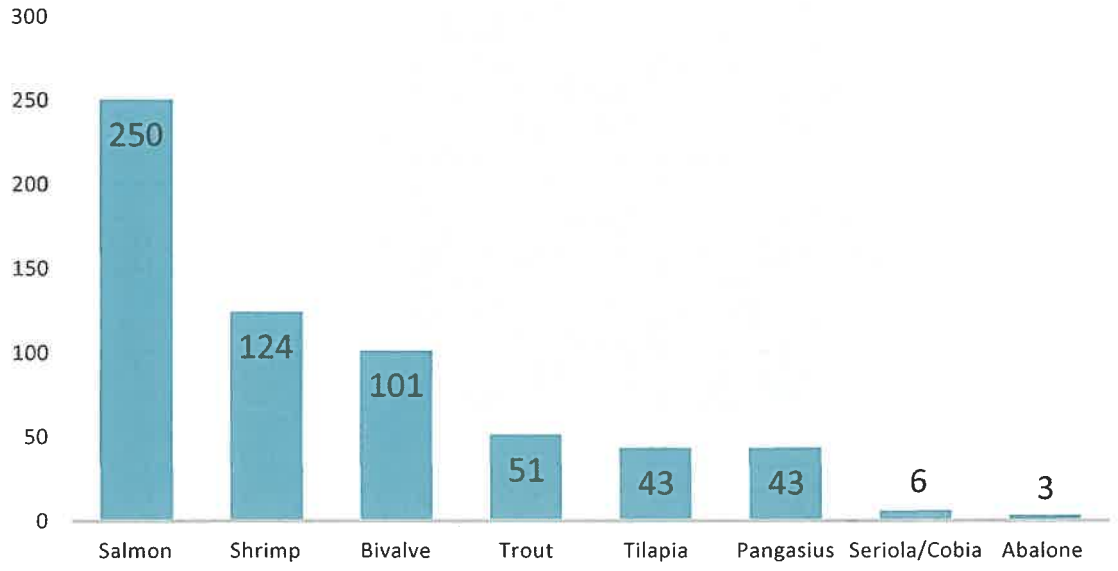


Figure 1. Number of ASC certified farms by species.

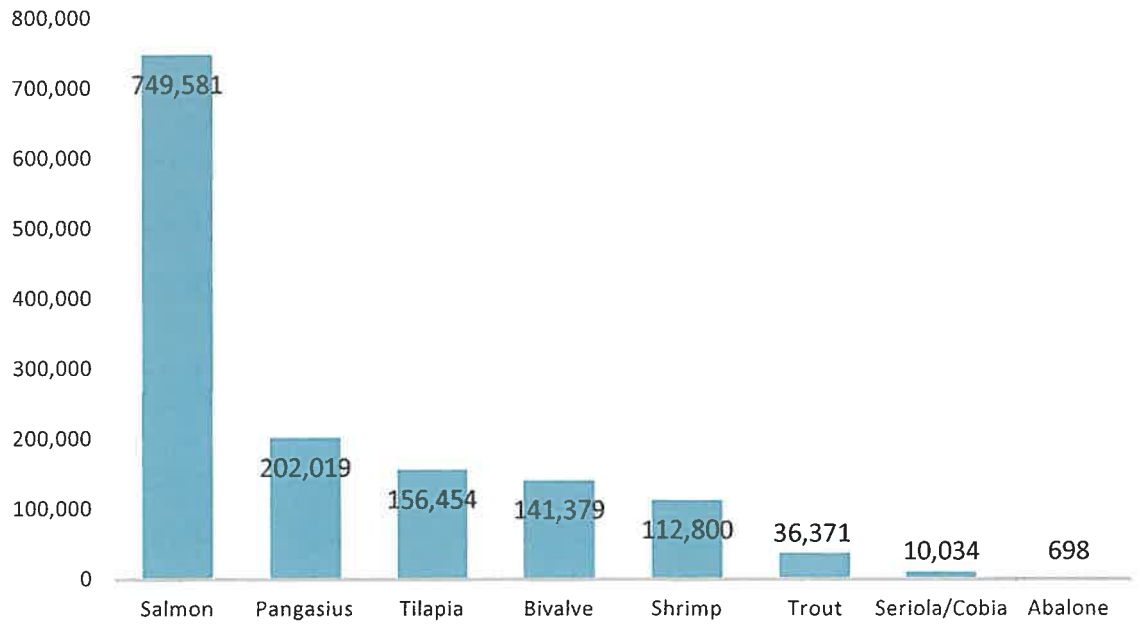


Figure 2. Volume (mT) of ASC certified product by species.

The number of ASC certified salmon farms increased by 31 per cent and production volume increased by 27 per cent from May 2017 to May 2018.in [63] [64]

Nearly 12,000 approved seafood products feature the ASC label. Shrimp and salmon products dominate these, at 39 and 33 per cent of all ASC labelled products, respectively (See figure 3.) [65]

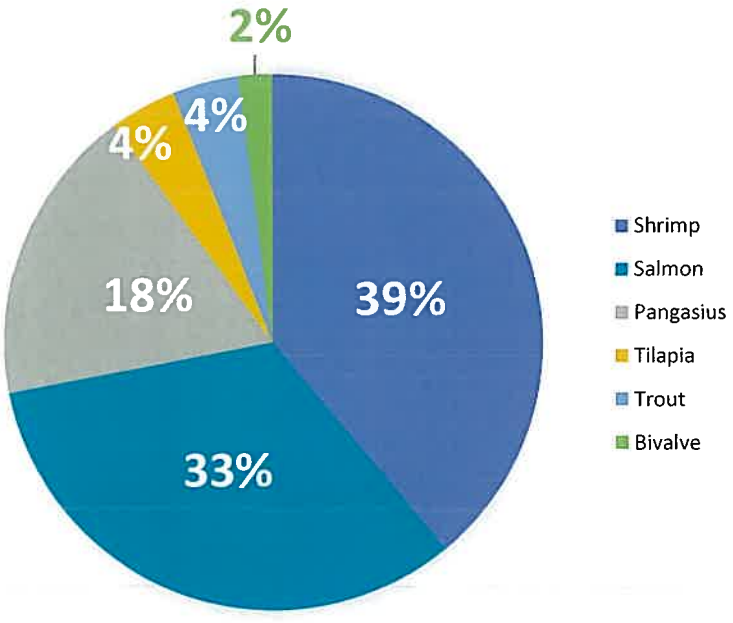


Figure 3. ASC-labelled products by species.

ASC labelled products are found in 68 countries.[66] European countries are the ASC's predominant market. North America ranks 10th (Canada) and 16th (United States). Four Asian countries/jurisdictions — Japan, China, Hong Kong SAR and Singapore — also make the top 20 sellers of ASC certified seafood.

Table 1. Top 20 countries/jurisdictions selling ASC labelled products

	Country/Jurisdictions	Number of products
1	Netherlands	1,770
2	Germany	1,664
3	Belgium	1,231
4	Switzerland	1,100
5	France	736
6	Sweden	701
7	Denmark	603
8	Norway	416
9	Austria	403
10	Canada	363
11	United Kingdom	294
12	Japan	289
13	China	258
14	Spain	218
15	Italy	185
16	United States	158
17	Poland	156
18	Finland	155
19	Hong Kong SAR	132
20	Singapore	111

The Salmon Standard

Data obtained directly from ASC shows 708,436 metric tonnes of ASC certified salmon entered the global seafood supply chain in 2017.[67] The vast majority of the ASC certified salmon is Atlantic salmon (*Salmo salar*), with limited amounts of Coho (*Oncorhynchus kisutch*) and marine-reared trout (*O. mykiss*). Currently no Chinook salmon (*O. tshawytscha*) farms are certified. Based on FAO's latest available aquaculture production figures,[vii] just over a quarter (27 per cent) of the farmed salmon produced globally is ASC certified. As of May 2018, 250 ASC certified salmon farms from 23 companies represent around 11 per cent of all salmon farming sites globally.[viii]

Two countries account for 82 per cent of ASC certified salmon by volume. Approximately half of all ASC certified salmon originates from Norwegian farms (359,083 mT), representing about 27 per cent of the Norwegian industry. This demonstrates the relatively large size of the Norwegian industry in comparison to other salmon farming jurisdictions. Chilean farms contribute just under a third of all ASC salmon (218,188 mT), and a similar percentage of the country's total production is certified. Denmark (including the Faroes Islands), Australia and Canada each account for five to six per cent of ASC certified

[vii] FAO 2016 global salmon aquaculture figures: Atlantic salmon 2,237,719mt; Chinook 11,451; Coho 124,012mt; marine-reared trout 194,100mt

[viii] There are approximately 2,220 salmon farming sites globally for Atlantic, Chinook, Coho and marine-reared rainbow trout (Australia 48; Canada 317; Chile 363; Denmark 19; Faroe Islands 25; Iceland 8; Ireland 49; Japan <5; New Zealand 9; Norway 1099; Poland 1; Russia <5; U.K. 253; U.S.A 25)

production. However, these countries have a significant amount of their production ASC certified relative to their industry's size: 42 per cent for Denmark (largely Faroes Island farms); 66 per cent for Australia and 29 per cent for Canada. Canada's ASC certified farms are all located in British Columbia (B.C.) where just under half of the Pacific Ocean-based industry (49 per cent) is certified. The remaining countries (Iceland, Ireland, Poland and the United Kingdom) represent less than two per cent of ASC certified salmon volume collectively. No farms in the U.S.A., New Zealand, Russia or Japan are currently certified.

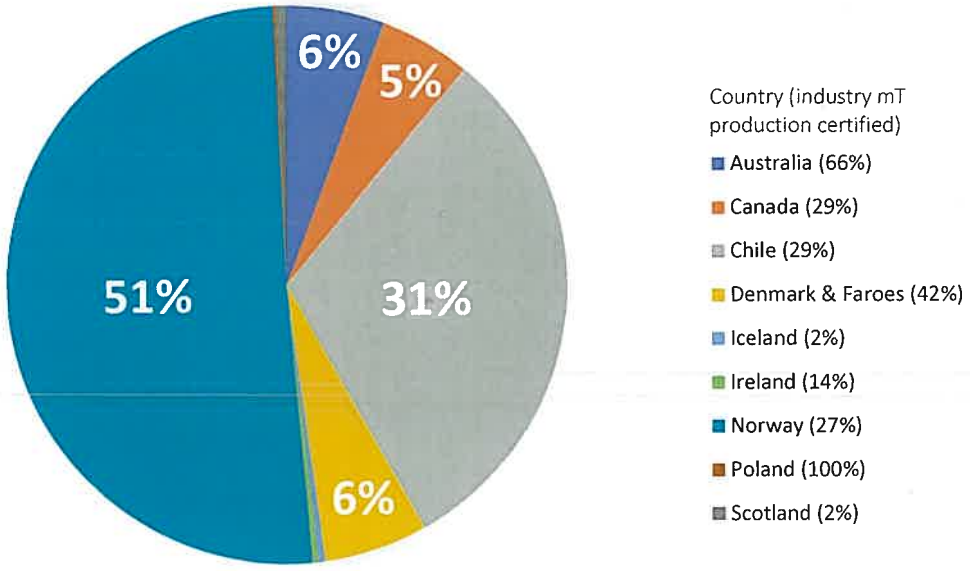


Figure 4. ASC certified salmon volume (mT) by country.

Findings

- Salmon is ASC's top commodity both by the number of farms and production volume certified. One in three ASC labelled products is salmon.
- 27 per cent of the global industry's production volume and 11 per cent of salmon farms are certified.
- Norwegian farms contribute half of the volume of ASC certified salmon, while Chilean farms contribute nearly a third. Australia has the largest amount of production certified, relative to their industry size, at 66 per cent.[ix]

[ix] Excluding Poland (100 per cent certified) which represents one closed containment farm.

Part 2. The (Written) Standard: Assessing Conformance and Performance

The Salmon Standard was created through a multi-stakeholder process known as the Salmon Aquaculture Dialogue (SAD). Following extensive research and a series of roundtables, the SAD established agreements (i.e. the Standard criteria) on key environmental and social issues associated with salmon aquaculture. The intent of the SAD was to create a Standard that fostered transparency and performance-based metrics that are measurable at the farm level. Although ASC has allowed variances (see Part 3), the Standard text actually specifies a requirement of 100 per cent conformance.[68]

Part 2 of this report reviews the transparency of the scheme based on audit availability, as well as auditor and farm reporting of metrics. Farm conformance with the Standard is reviewed by examining the number of non-conformities issued in the audit reports. Farm performance is analysed using key indicators for disease and sea lice, escapes, chemical use, wild fish in feed and marine mammal deaths.

Transparency

The ASC prides itself on being a "highly transparent organisation".[69] Transparency is a key element of ISEAL's Codes of Good Practice.[70] As an ISEAL full member, the ASC is required to comply with the code.

Audit Availability

ISEAL's Code of Good Practice requires scheme owners to have "basic information about the results of assessments of both clients and assurance providers" up to date and publicly available (Clause 6.3.1).[71] On review of the ASC web-based platform, a total of 55 audit reports (i.e. assessments) were missing. The issue is particularly pronounced for Chilean farms, which accounted for 40 of 55 missing reports.

Audit Farm-level Metrics

One of the attributes of the Salmon Standard is the inclusion of performance-based, farm-level metrics (i.e. not aggregated over a group of farms) among its indicators for each criterion. These metrics are farm-derived data that are used to demonstrate conformance to an indicator threshold. For example:

> Number of treatments of antibiotics over the most recent production cycle
>
> Requirement: ≤ 3

The Standard also promotes transparency of these metrics. In addition, the CAR requires CABs to document metrics within the audit report as evidence that the farm demonstrates conformance with the Standard.

Initial (full) assessments

Twenty key performance indicators[x] were reviewed to see if a metric was provided in the 248 full (initial) assessment audits. Of the key metric indicator requirements reviewed, 65 per cent of initial audits provided evidence of conformance with the Standard. Around one-third of initial audits (35 per cent) were found to be missing the metric.

[x] Indicators reviewed were: 2.1.1; 2.1.2; 2.1.3; 2.2.1; 2.2.2; 2.2.4; 2.2.5; 2.5.6; 3.1.1; 3.1.7; 3.4.1; 3.4.3; 4.2.1; 4.2.2; 5.1.5; 5.1.6; 5.2.5; 5.2.9; 5.3.1

The Standard's Principle 2: Conserve Natural Habitat, Local Biodiversity and Ecosystem Function, Indicators 2.1.1-2.1.3 (benthic monitoring) account for the majority of missing metrics. This is likely due to early auditing, before peak biomass sampling has occurred and therefore sample results are not yet available. See Box 1 below for further discussion on early auditing.

There were 21 instances where a metric was purposefully deleted or censored, as in this example: The farm result was [redacted]%. .[72] These deletions were found in 15 Norwegian, four Scottish, one Canadian and one Faroes Island audit reports. These deletions were categorized as 'missing'.

Surveillance audits

Metric availability improved within surveillance audit reports, with 80 per cent providing evidence of conformance and 20 per cent not. No metrics were found to be purposefully deleted or censored. Following concerns that CABs were not reporting metrics, the ASC established a Quality Assurance (QA) framework in 2016.[73] The ASC anticipated a new QA framework to be publicly launched in August 2017 [74] ; however, at time of writing no updates on the framework were found on the ASC website. Under the QA, the ASC has implemented or intends to implement the following corrective actions: an updated mandatory audit report template; weekly calls with ASI (and CABs as appropriate) to discuss the matter; greater emphasis on metric reporting during QA checks; and incorporating metric reporting procedures in auditor training.[75] The noted improvement in metric availability within surveillance reports could be because of the QA framework, although further progress is still needed (such as timely posting of audit reports; correct application of non-conformities and variances; etc).

Certified farms: public reporting

Certain Standard indicators require farms to make reportable metrics "easily publicly available" and usually within a certain timeframe.[76] These include: lethal incidents (birds and marine mammals); on-farm sea lice counts; sea lice monitoring on wild salmonids; and the estimated unexplained loss (EUL). The ASC Salmon Audit Manual advises posting these metrics on a public website. The majority of company websites with ASC certified salmon are posting the required metrics. Some companies chose to post additional metrics, such as escapes, chemicals (antibiotics and/or parasiticides), suspicious transmissible agent, and World Organisation for Animal Health (OIE) disease, if applicable.

Table 2. Public reporting matrix of company websites

Company	GSI Member	Indictor 2.5.4: Lethal incidents	Indicator 3.1.7: Sea lice counts	Indicator 3.1.6: Sea lice monitoring on wild salmonids*	Indicator 3.4.3: Estimate unexplained loss	Others (not required but provided for farm level)
Australia						
Huon Aquaculture	Y	Y	NA**	NA	N	Dissolved oxygen
Petuna		Y	NA	NA	Y	
Tassal	Y	Y	NA	NA	Y	Dissolved oxygen, antibiotics
Canada						
Cermaq	Y	Y	Y	Y	Y	Escapes; Alternative sea lice treatment (H20) application
Marine Harvest	Y	Y	Y	Y	Y	Parasiticide use
Chile						
Australis Mar S.A		Y	Y	NA	Y	Escapes; Chemicals (antibiotics; parasiticide); Suspicious unidentifiable transmissible agent; OIE disease
Cermaq	Y	N	Y	NA	N	
AquaChile	Y	Y	Y	NA	N	
Exportadora los Fiordos Limitada	Y	Y	Y	NA	Y	
Nova Austral		Y	Y	NA	Y	
Productos del Mar Ventisqueros		Y	Y	NA	Y	Escapes
Salmones Camanchaca	Y	Y	Y	NA	Y	Antibiotics, parasiticide use, OIE
Salmones Multiexport	Y	Y	Y	NA	N	
Denmark						
Danish Salmon		NA	NA	NA	N	
Faroe Islands						
Bakkafrost	Y	Y	Y	N	Y	Escapes; Suspicious unidentifiable transmissible agent; OIE disease
Marine Harvest	Y	Y	Y	N	Y	Escapes; Suspicious unidentifiable transmissible agent; OIE disease
Ireland						
Marine Harvest	Y	N	Y	N	Y	ABM lice load
Norway						
Cermaq	Y	Y	Y	N	Y	Escapes

Edelfarm		Y	Y	N	Y	
Grieg Seafood		Y	Barents Watch	N	Y	Escapes; Virus related mortality
Hofseth International		Y	Y	N	Y	
Leroy Seafood Group		Y	Y	N	Y	Escapes; Suspicious unidentifiable transmissible agent; OIE disease
Marine Harvest	Y	Y	Barents Watch	N	Y	Escapes; Suspicious unidentifiable transmissible agent; OIE disease
Masoval Fiskeoppdrett		Y	Barents Watch	N	Y	Escapes
Norway Royal Salmon	Y	Y	Barents Watch	N	Y	
SalMar Farming		Y	Barents Watch	N	Y	Escapes; Suspicious unidentifiable transmissible agent; OIE disease
Wenberg Fiskeoppdrett		Y	Barents Watch	N	Y	Escapes; Suspicious unidentifiable transmissible agent; OIE disease
Poland						
Jurassic Salmon		NA	NA	NA	N	
Scotland						
Marine Harvest	Y	Y	Y	N	Y	Escapes; Suspicious unidentifiable transmissible agent; OIE disease

*Indicator 3.1.6 Faroe Island audits state no wild salmonoids in area, trout may occur but no assessments are conducted; Irish, Norwegian and Scottish farms have been granted variances, as government authorities do not allow the handling of wild stock.
** NA = Indicators that are not applicable to the region (e.g. sea lice and wild salmonids are not present in Australia) or to land-based closed containment farms (i.e. Poland's Jurrassic Salmon).

The accessibility of these metrics varies between companies. Australian company websites have easily accessible 'sustainability' dashboards, however it was evident that data had been aggregated to zoned areas that may host many farms. Canadian metrics are accessible at the farm site level. In addition, Marine Harvest Canada posts monthly data on all site sea lice and parasiticide treatments for each of its farms.[77] While Chilean company websites housed most of the required information, this information was typically piece-meal, inconsistently presented and not always up to date. EUL were often missing for Chilean farms. Norwegian websites were generally found to report on all necessary requirements, with many referring to the government-run website, Barents Watch,[78] for sea lice counts. It was found historical data is often lost or removed from websites as certified farms begin new production cycle reporting.

GSI member companies also provide data for certain sustainability indicators on the GSI website.[79] This includes fish escapes, mortalities, antibiotic use, sea lice counts, parasiticide use, wildlife interactions, fish meal and oil dependency and others. Reporting is aggregated at the company level (versus individual farm) and does not necessarily follow the same reporting requirement as that for the ASC Salmon Standard (e.g. parasiticide use is reported by the amount of active pharmaceutical ingredients used per tonne of fish produced versus the Standard's Parasiticide Treatment Index score).

Findings

- Fifty-five audit reports that should be made public, particularly surveillance audit reports, are unavailable from the ASC certification platform. Missing reports is predominantly an issue for Chilean certified farms (40 out of 55).
- Evidence of conformance (i.e. metric data) is missing from one-third of initial audit reports. Surveillance audits show improvements in metric reporting, however, 20 per cent still failed to report metric data.
- Public reporting of on-farm sea lice counts, marine mammal and bird entanglements and estimated unexplained loss by certified farms was found to be relatively effective. In many cases, the posting of this data goes beyond what local regulatory agencies require of the industry. However, websites were often difficult to navigate and the reporting approach varied greatly among company websites.

Farm Conformance

The Salmon Standard states that farms "must meet 100 per cent of the requirements in this document to achieve certification".[80] This is an impressive claim that instils trust in consumers interested in making environmentally responsible food choices. However, in practice, farms in non-conformance to the Standard can be certified. ASC applicants may be assessed as "conforming," which indicates that they meet ASC requirements, or they can be assessed as having major or minor "non-conformities".[81] The applicant then has the opportunity to address the non-conformities. Major non-conformities must be closed before certification can be granted. However, farms can be certified with outstanding, or "open" minor non-conformities.

Non-conformities

On review of 456 audits (248 initial; 189 surveillance; 19 recertification), there have been a total of 3,726 non-conformities raised by the auditors. Of these, 790 were raised as major non-conformities and 2,946 as minor.[xi] Only 32 audits had zero non-conformities: two initial and 30 surveillance audits. The two farms that were certified with no non-conformities were in Chile[82] and Denmark.[83] However, it should be noted that the Chilean farm had 11 "observations". Observations appear to be auditor recommendations for farm improvements to ensure conformance Standard criteria. Observations are not defined in or required under the ASC's CAR. Despite this, 593 observations over 80 audits were found.

Nearly all farms have non-conformities raised during their initial audit. **The average initial farm audit detected 2.33 major[xii] and 9.30 minor non-conformities**. The average surveillance audit had 0.98 major and 2.82 minor non-conformities. The average recertification audit had 1.31 major and 4.68 minor non-conformities. Note: these major non-conformities should be closed before initial certification and re-certification is granted. After initial certification is granted, where major non-conformities arise (e.g. at surveillance audits), these must be closed within three months.

Figures 7 and 8 illustrate major and minor non-conformities across all Standard Principles. More than a quarter (226 out of 790) of the major non-conformities related to Principle 2 (conserve natural habitat, local biodiversity and ecosystem function) indicators. Likewise, the most commonly raised minor non-conformities were related to Principle 2 indicators. The majority of these non-conformities were raised because benthic sampling had not been done. Non-conformities, both major and minor, were also regularly raised against Principle 6 (develop and operate farms in a socially responsible manner) indicators. Non-conformities were also common for Section 8 (requirements for producers of smolt) and Principle 4 (use resources in an environmentally efficient and responsible manner) indicators.

[xi] Where audit reports grouped more than one indicator under the one non-conformity report, these were separated to reflect the true number of non-conformities. Where audit reports listed the same indicator in two or more non-conformity reports, these were merged as one non-conformity; where two or more minor non-conformities were given for the same indicator, these were elevated to one major non-conformance. This is in accordance with the CARv2.0 Annex A which requires one non-conformity report per indicator requirement and two or more minors to be raised as one major.

[xii] Note: CAR 17.10.1.2 requires all major non-conformities to be closed prior to certification being granted.

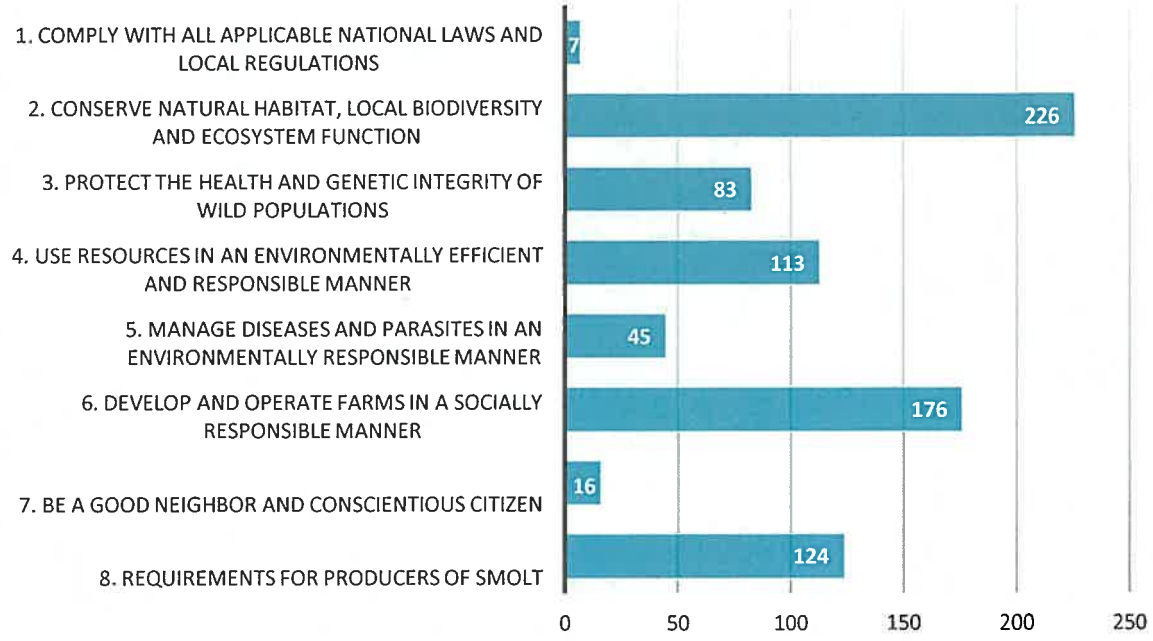


Figure 5. Major non-conformities by principle across all certifications.

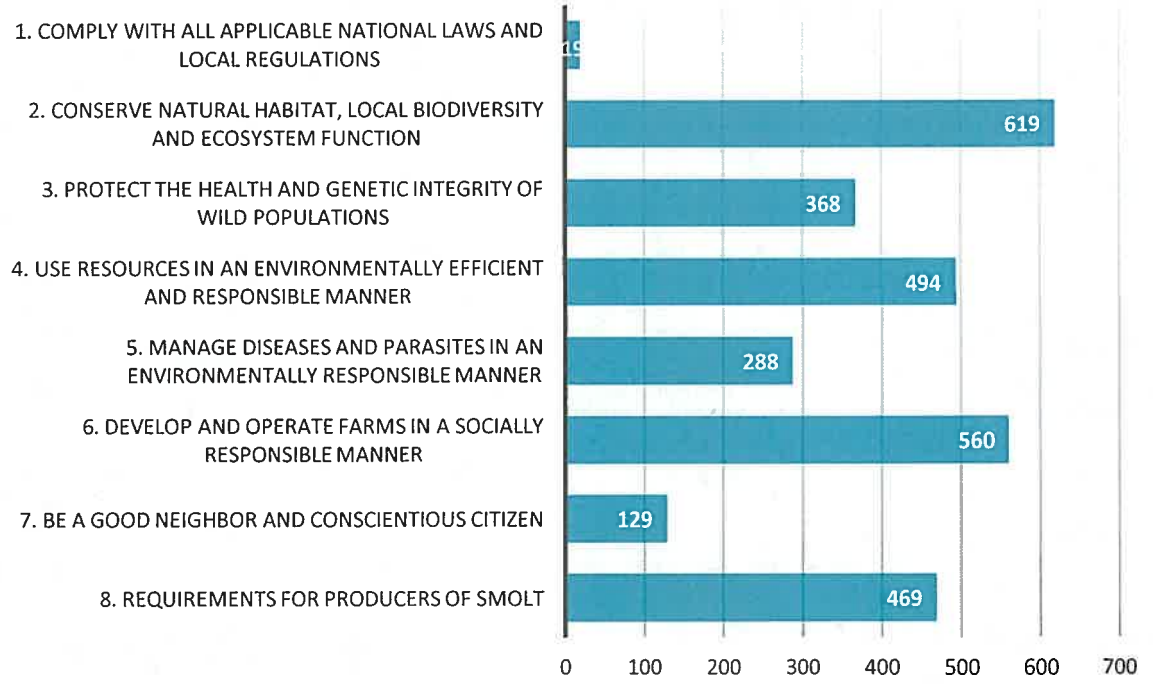


Figure 6. Minor non-conformities by principle across all certifications.

BOX 1 EARLY AUDITING AND NON-CONFORMITIES

The ASC's Certification and Accreditation Requirements (CAR) stipulate that the initial audit is to be conducted at the end of the production cycle – at harvest,[xiii] when fish have achieved peak biomass and so the full extent of the farm's impacts on the environment can presumably be assessed. This also allows the auditor to witness harvest practices and view the condition of the fish. Guidance for this audit requirement provides that the auditor may, in the alternative, provide a justification for not witnessing the harvest, so long as harvest activities are witnessed at one of the surveillance audits (i.e. within the three-year validity of the certificate).

On review, the majority of initial audits are not conducted at harvest. Auditors (CABs) commonly justify early audits by saying that the client farm wants the current cohort of fish to become ASC certified in time for market access (i.e. at harvest).[84] The CAR lacks guidance for an acceptable justification for not witnessing harvest. However, it appears that the ASC is comfortable with the market access rationale. The ASC used this same rationale in its own variance process when approving an early peak biomass sampling variance.[85] In this instance, the Variance Review Committee included amongst its reasons wanting to avoid a delay in the sales of the farm's ASC-certified salmon.

Under Salmon Standard v1.0, the benthic monitoring indicators set out in Principle 2 can only be addressed by sampling conducted at the farm's peak biomass (i.e. harvest). Consequently, early audits typically lead to non-conformities raised for these indicators. This explains why Principle 2 has the highest number of non-conformities globally.

The ASC has recognized early auditing to be problematic for the Salmon Standard's benthic monitoring indicators by identifying the following "problems": CAB application inconsistency; CABs commonly applying benthic sampling non-conformities (due to the early auditing); and audit reports typically lacking detail or evidence of conformance. Following an operational review, Salmon Standard v1.1 improved auditing guidelines, but relaxed the requirement that the auditor must witness the harvest; v1.1 requires audits to be performed after a farm has reached more than 75 per cent peak biomass.

Several other Standard indicators rely on similar end-of-cycle calculations, such as estimated unexplained loss, total disease mortality, total antibiotic and parasiticide use, amongst others. An incomplete production cycle results in incomplete evidence and records. Consequently, audit reports fail to provide a full production cycle of data for the most recent cohort of fish.

This practice appears to contravene another clear requirement set out in the CAR: "Audits shall not be conducted until sufficient records/evidence are available for all applicable Standard requirements as the minimum."[xiv] In response to SeaChoice's ASC Certification in Canada Technical Report,[86] the ASC stated CABs can raise a non-conformity against requirement 17.1.2.1 which states: "All clients seeking certification shall have available records of performance data covering the periods of time specified in the Standard(s) against which the audit(s) is to be conducted".[87] To date, no CAB has raised a non-conformity against this client requirement, despite the fact that this global review report found 35 per cent of initial audits were data-deficient.

In addition, numerous indicators focus on whether an event occurs beyond a stipulated threshold during a stated period up to and including the production cycle under audit, such as maximum number of lethal incidents, on-farm lice levels and escapes.

Instances of non-conformance have occurred after an early audit, later in the production cycle, which allowed non-conforming product to enter the market with the ASC certification. For example, an early audit at Marsh Bay farm (B.C., Canada) resulted in missing the deaths of several marine mammals that occurred post-audit, but later in the same production cycle.[88] The marine mammal deaths would have disqualified the site from certification, so the certification of Marsh Bay based on an early audit allowed for non-conforming product to enter the marketplace with ASC certification.

Current evidence suggests that early auditing creates the potential for missing non-conformities that are significant in terms of actual conformance with the Standard. When this happens, non-conforming product enters the market with the ASC label. The practice of auditing prior to peak biomass is accordingly undermining the fundamental purpose of the ASC audit process, which is to certify 100 per cent conformance with the Standard. The reason given for conducting early audits—that the client is anxious to market the current cohort of fish under the ASC label [89] [90]—offers no rational justification for overlooking the absence of evidence of conformance with so many of the Standard's important environmental indicators.

[xiii] CARv2.1 17.4.2
[xiv] CARv2.1 17.4.5

Top Themes per Region

Australia

Twenty-One Australian ASC certified farms were reviewed. It is common for Australian salmon farms to be audited as clusters which can represent two to four farm sites under the one ASC certificate. On review of 28 audits (11 initial; 13 surveillance; 4 re-certification), 36 major non-conformities and 275 minors were raised. On average, an Australia ASC audit had 1.2 major and 9.8 minor non-conformities.

Most major non-conformities occurred under Principle 2 (conserve natural habitat, local biodiversity and ecosystem function) indicators. However, unlike all other countries, major non-conformity raised against benthic monitoring indicators (2.1.1-2.1.3) was rare for Australian farms. In fact, only one major non-conformity has ever been raised (against 2.1.1). ASC approved variances override the Standard requirements, and instead defer to local regulations for benthic and water quality indicators. Tasmania's regulations do not require farmers to conduct benthic sampling, but rather use visual surveys.[91] Instead, seven out of the 11 non-conformities raised against Principle 2 indicators (2.5.5; 2.5.6) related to marine mammal and/or bird deaths.

Compared to other jurisdictions, Australian farms are commonly assessed with major non-conformities under Principle 7 (be a good neighbour and conscientious citizen) indicators 7.1.1- 7.1.3. These addressed concerns surrounding community engagement and consultation, complaint procedures and notifications.

By far, Section 8 (requirements for producers of smolts) indicators received the most minor non-conformities raised for Australian salmon farms (78 out of 275). While these non-conformities occurred over many Section 8 indicators, the top-raised include 8.4 (maximum total amount of phosphorus released into the environment), 8.33 (minimum oxygen saturation in the outflow) and 8.23 (proactive consultation with Indigenous communities). Principles 6 (develop and operate farms in a socially responsible manner) and 2 (conserve natural habitat, local biodiversity and ecosystem function) had 39 minor non-conformities each. Again, most of these are related to indicators 2.5.5 and 2.5.6 (maximum number of lethal incidents). Non-conformities in relation to Principles 5 (manage disease and parasites in a sustainable manner) and 7 (be a good neighbour and conscientious citizen) indicators were also common. Ten audits, representing seven farms, had a minor non-conformity raised for exceeding the maximum unexplained mortality allowed (≤ 40 per cent of total mortalities) under indicator 5.1.6. In notes, auditors said they believed the high numbers of unexplained mortalities could be attributed to staff failing to properly classify mortalities. For example, staff commonly reported the cause of death as 'unknown' instead of using a defined carcass classification such as disease-related, poor performers, mature, environmental, handling, etc.

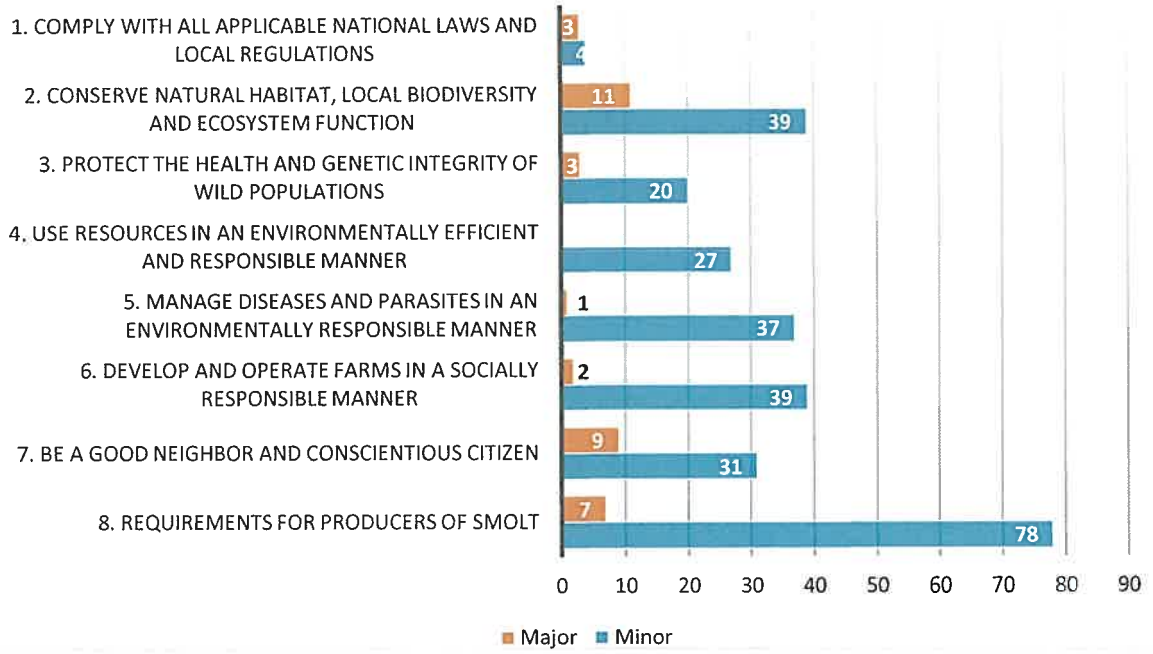


Figure 7. Australia: Major and minor non-conformities by principle

Canada (B.C.)

None of the farms on the east coast of Canada has been certified by ASC, so the following comments related solely to British Columbia (B.C.). Thirty-One B.C. ASC certified farms were reviewed. On review of 45 audits (31 initial; 14 surveillance), 82 major non-conformities and 184 minors have been raised. On average, Canadian audits had 1.8 major and four minor non-conformities.

Over half (46) of the major non-conformities found in Canadian farms related to Principle 2 (conserve natural habitat, local biodiversity and ecosystem function) indicators. For all but one, these non-conformities were raised because benthic sampling had not been completed, due to early auditing. Major non-conformities against Principle 6 (develop and operate farms in a socially responsible manner) indicators were also common for Canadian farms.

Some of the first B.C. farms to apply for ASC certification received major non-conformities raised for high on-farm sea lice counts exceeding the Standard's 3.1.7 metric requirement (0.1 female lice per farmed fish). These were closed using variances that override the Standard's metric, replacing it with the Canadian regulatory level of three motile lice per farmed fish.[92] [93] Since the sea lice variance approvals were granted, auditors have applied them to every subsequent audit and have typically failed to provide a justification for doing so. In effect, the metric requirement of the Standard is treated as if it does not apply anywhere in British Columbia, regardless of the site-specific conditions of the farm (see Part 3 for further discussion).

Other farms certified early on received major non-conformities for high copper levels (4.7.3 and 4.7.4). Variances were granted to close these non-conformities,[94] [95] however, were likely not necessary as the ASC Standard and audit manual instructs CABs to review reference site copper levels in relation to 'naturally high' background concentrations when coppers levels are above the Standard requirement.[96] Principle 2 (conserve natural habitat, local biodiversity and ecosystem function) indicators are most often raised as minor non-conformities in B.C. farms. Again, a number of these are associated with the benthic monitoring indicators and early audits. Principle 4 (use resources in an environmentally and

efficient manner) is the second most commonly raised due to various indicators. The largest number of non-conformities were raised for indicators 4.5.2 (evidence that non-biological waste from grow-out site is either disposed of properly or recycled) and 4.7.4 (copper levels). These are followed by Principle 3 (protect the health and genetic integrity of wild populations) where indicator 3.1.4 had the highest number of minors raised, due to farms failing to record or conduct on-farm sea lice counts.

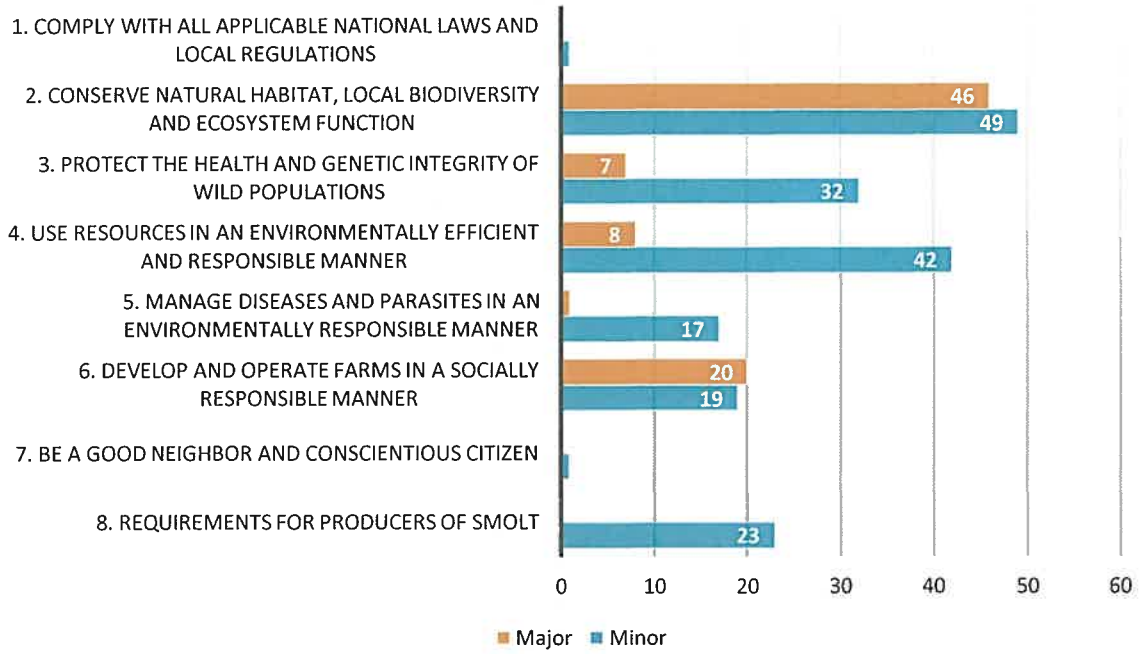


Figure 8. Canada (B.C.): Major and minor non-conformities by principle

Chile

Sixty-nine ASC certified Chilean salmon farms were reviewed. Eighty-one Chilean ASC audits were analysed (69 initial; 12 surveillance), with a total of 313 major and 756 minor non-conformities. Globally, Chilean farms had the highest average number of non-conformities per audit: 3.8 majors and 9.3 minors.

Principle 2 (conserve natural habitat, local biodiversity and ecosystem function) indicators are responsible for 90 major non-conformities, the majority of which were the benthic indicators (2.1.1; 2.1.2; 2.1.3), due to early auditing. Other Principle 2 non-conformities include water quality testing (2.2.4) where farms had failed to follow the Standard's methodology.

Both Principle 4 (use resources in an environmentally and efficient manner) and Section 8 (requirements for producers of smolt) had just over 60 major non-conformities each. Various indicators were raised for Principle 4 and Section 8. However, the top-raised indicators include 4.2.1 (fish meal dependency ratio), 4.7.4 (copper levels) and smolt requirement 8.4 (maximum total amount of phosphorus).

Nearly a quarter (182 out of 756) of minor non-conformities fell under Principle 4 (use resources in an environmentally and efficient manner) indicators. The most commonly raised indicators were associated with fish feed: 4.3.2 (fish source feed score), 4.4.3 (transgenic raw materials disclosure) and

4.2.1/4.2.2 (fishmeal and fish oil forage fish dependency ratios). Seventeen farms received minor non-conformities for indicator 4.6.1 (energy use assessment). Under Section 8 (requirements for producers of smolt) there were a high number of minor non-conformities (175) due to a range of issues across indicators, with the highest number relating to 8.9 (energy use assessment for smolt facility), 8.4 (maximum total amount of phosphorus released), 8.10 (records of greenhouse gas emissions) 8.32, (water quality monitoring matrix for open systems) and 8.18 (evidence of conformance with OIE code).

A total of 111 minor non-conformities were raised under Principle 6 (develop and operate farms in a socially responsible manner) and 103 against Principle 2 (conserve natural habitat, local biodiversity and ecosystem function) indicators. Benthic monitoring indicators 2.1.1-2.1.3 and 2.2.1 (dissolved oxygen) were the most commonly raised.

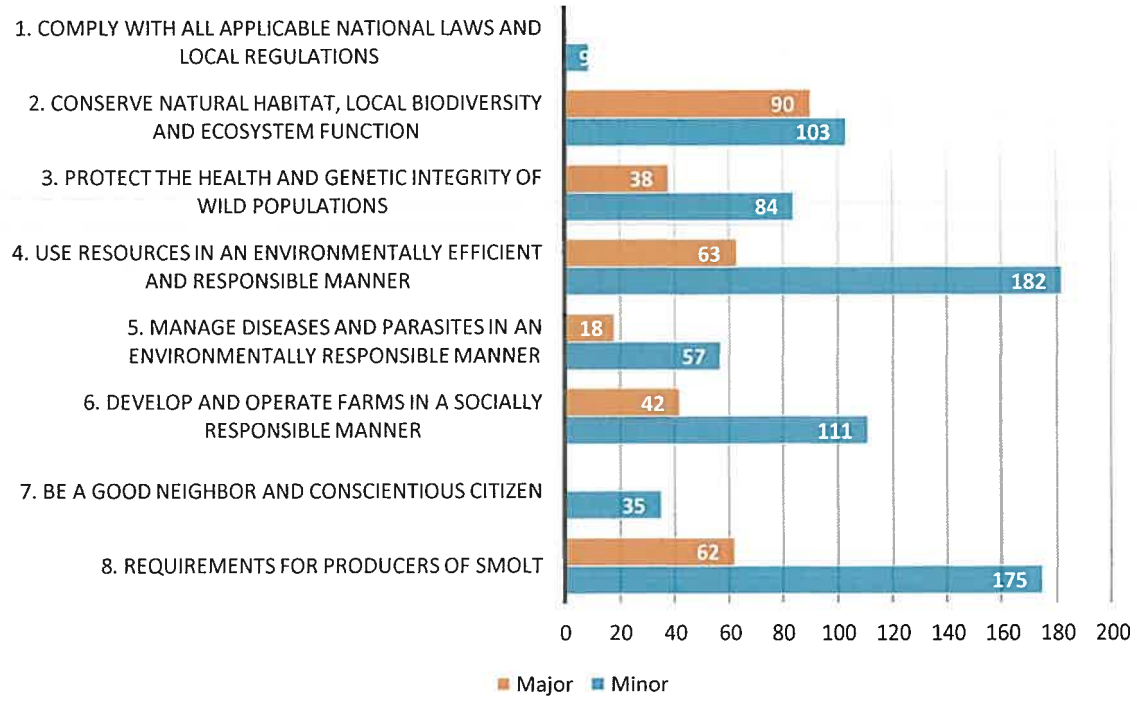


Figure 9. Chile: Major and minor non-conformities by principle

Denmark and the Faroe Islands

Seven Danish farms were reviewed, with six of these located in the Faroe Islands. On review of 12 audits (7 initial; 5 surveillance), 35 major non-conformities and 123 minors have been raised. On average, Danish audits had 2.9 major and 10 minor non-conformities per audit.

The most major and second-most minor non-conformities fell under Principle 6 (develop and operate farms in a socially responsible manner) indicators. It was also common for indicators under Principles 2 (conserve natural habitat, local biodiversity and ecosystem function), 3 (protect the health and integrity of wild populations) and 5 (manage disease and parasites in an environmentally responsible manner) to receive major non-conformities. Overall, indicators 2.1.4 (definition of site-specific Allowable Zone of Effect (AZE)) and 3.1.7 (on-farm sea lice counts) resulted in the highest number of major non-

conformities. Four Faroes farms failed to have a site-specific AZE completed because they were intending to use peak biomass sampling to define the area, but their audits were conducted prior to peak biomass. Four out of the six Faroes farms experienced sea lice levels above the ASC requirement.

Thirty minor non-conformities were raised under Principle 2 (conserve natural habitat, local biodiversity and ecosystem function) indicators - mostly related to the benthic sampling (i.e. early auditing) and Criterion 2.5 (interaction with wildlife, including predators) indicators due to lack of documentation and untimely public posting of data.

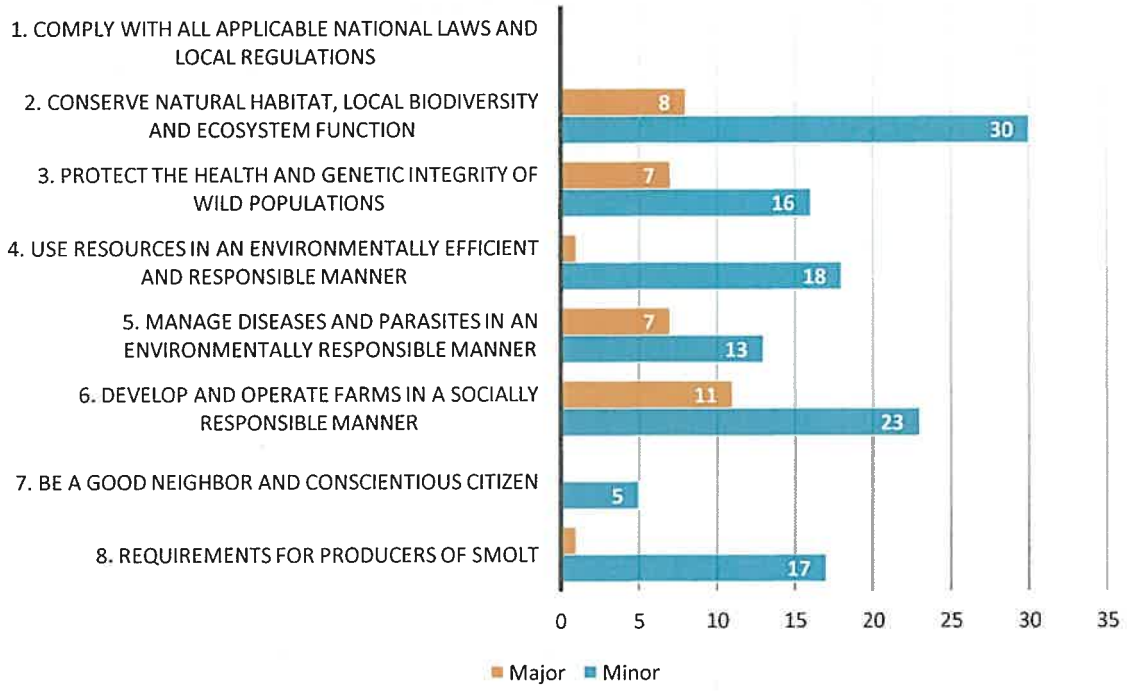


Figure 10. Denmark and the Faroe Islands: Major and minor non-conformities by principle

Ireland

Assessing trends for Irish farms is challenging given that only three farms are certified and one farm's certificate has expired. Of the six audits reviewed (4 initial; 2 surveillance), there were a total of 24 major and 48 minor non-conformities raised.

The highest major and minor non-conformities were for Principle 6 (develop and operate farms in a socially responsible manner) indicators. This is followed by non-conformities against Principle 2 (conserve natural habitat, local biodiversity and ecosystem function) due to the benthic monitoring indicators and Principle 3 (protect the health and genetic integrity of wild populations) indicators. Three farms received minor non-conformities against indicator 3.1.6 (sea lice monitoring on wild out-migrating salmonoids) due to the government prohibition of wild salmon capture and interception – this was closed with a variance exempting the farms from monitoring.[97] None of the farms had regular community consultations as required under indictor 7.1.1 (regular and meaningful consultation and engagement with community).

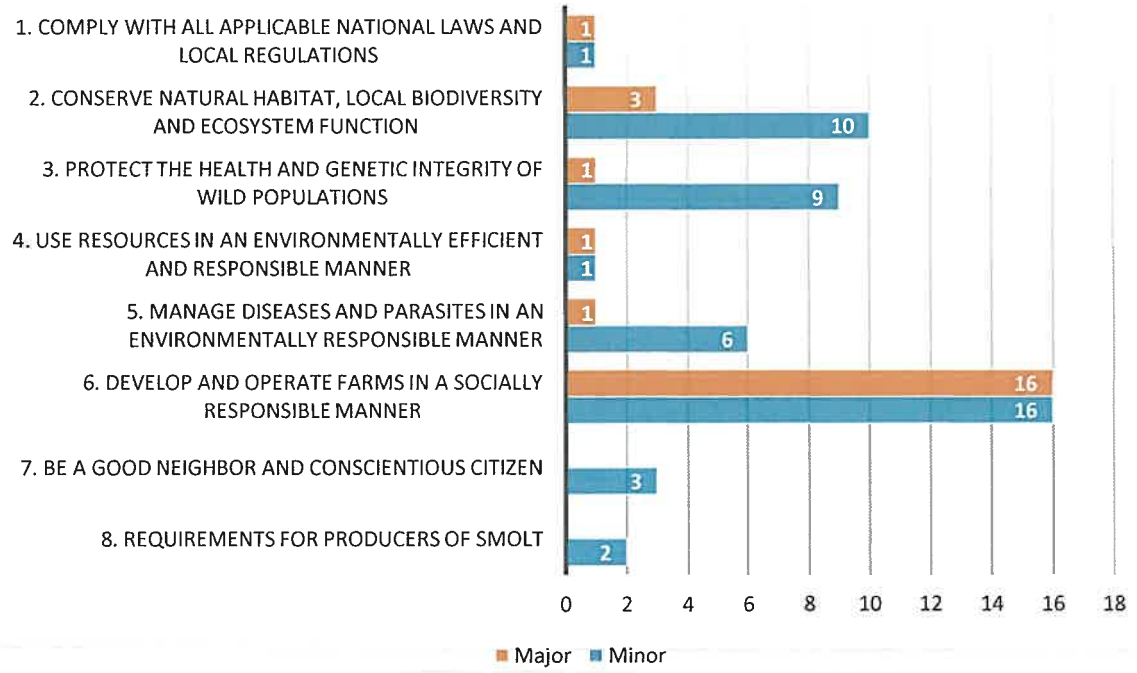


Figure 11. Ireland: Major and minor non-conformities by principle

Norway

A total of 121 Norwegian salmon farms were reviewed. Two-hundred and seventy-four ASC audits were analysed (121 initial; 138 surveillance; 15 re-certification), with a total of 273 major and 1,479 minor non-conformities. Norwegian audits had an average of 1 major and 5.3 minor non-conformities.

The most commonly raised major non-conformities occur under Principle 6 (develop and operate farms in a socially responsible manner) indicators. Early auditing is also common in Norway and this, in turn, causes many non-conformities for the benthic sampling indicators (2.1.1; 2.1.2; 2.1.3) under Principle 2 (conserve natural habitat, local biodiversity and ecosystem function) – 52 majors and 259 minors. Fifteen major and 96 minor non-conformities were associated with sea lice related indicators under Principle 3 (protect the health and integrity of wild populations). This included farms that had not established a maximum sea lice load for the area-based management and farm site (3.1.3) and/or breached the Standard's sea lice metric of 0.1 mature female per fish (3.1.7). A number of these also related to indicator 3.1.6 (sea lice monitoring on wild out-migrating salmonoids), as Norwegian authorities do not allow the sampling of wild salmon/trout.

Inadequate regular community consultation for both the grow-out (7.1.1) and smolt producers (8.20) accrued 18 major and 66 minor non-conformities. Other Section 8 (requirements for producers of smolt) non-conformities run the gamut: indicators 8.4 (maximum total amount of phosphorus released), 8.21 (community complaints policy) and 8.15 (allowance for use of therapeutic treatments that include antibiotics or chemicals that are banned).

Thirty-eight major and 209 minor non-conformities were raised for Principle 4 (use resources in an environmentally efficient and responsible manner) indicators. The majority of these were found under Criterion 4.2 (use of wild fish for feed) and Criterion 4.6 (energy consumption and greenhouse gas emissions on farms) indicators.

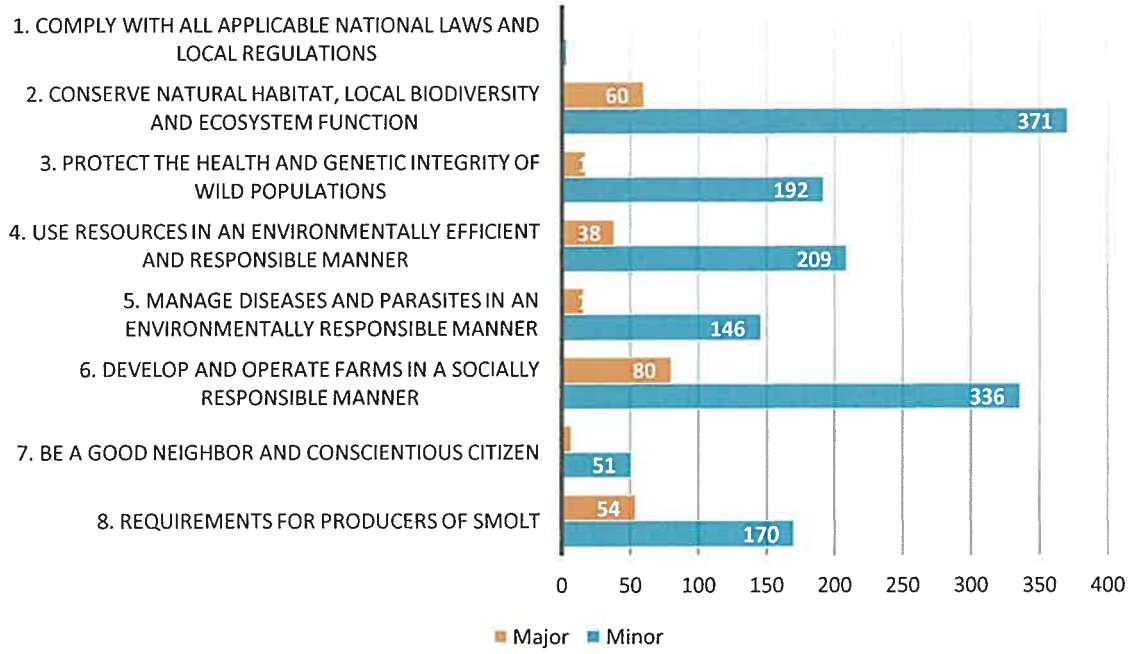


Figure 12. Norway: Major and minor non-conformities by principle

U.K. (Scotland)

Assessing trends for Scottish farms is challenging given that only one farm was certified as of April 1, 2018. In addition, one farm's certificate has expired, another has withdrawn and a few are listed as cancelled. Six audits were reviewed (3 initial; 3 surveillance), which included a total of 21 major and 51 minor non-conformities.

The audits show non-conformities for sea lice indicators (3.1.3; 3.1.4 and 3.1.7) under Principle 3 (protect the health and genetic integrity of wild populations) were regularly raised for Scottish audits. This was due to farms failing to establish a maximum sea lice load for the area-based management and farm. Non-conformity was also raised due to untimely public sea lice reporting. Major and minor non-conformities were raised for Principle 2 (conserve natural habitat, local biodiversity and ecosystem function) benthic monitoring indicators.

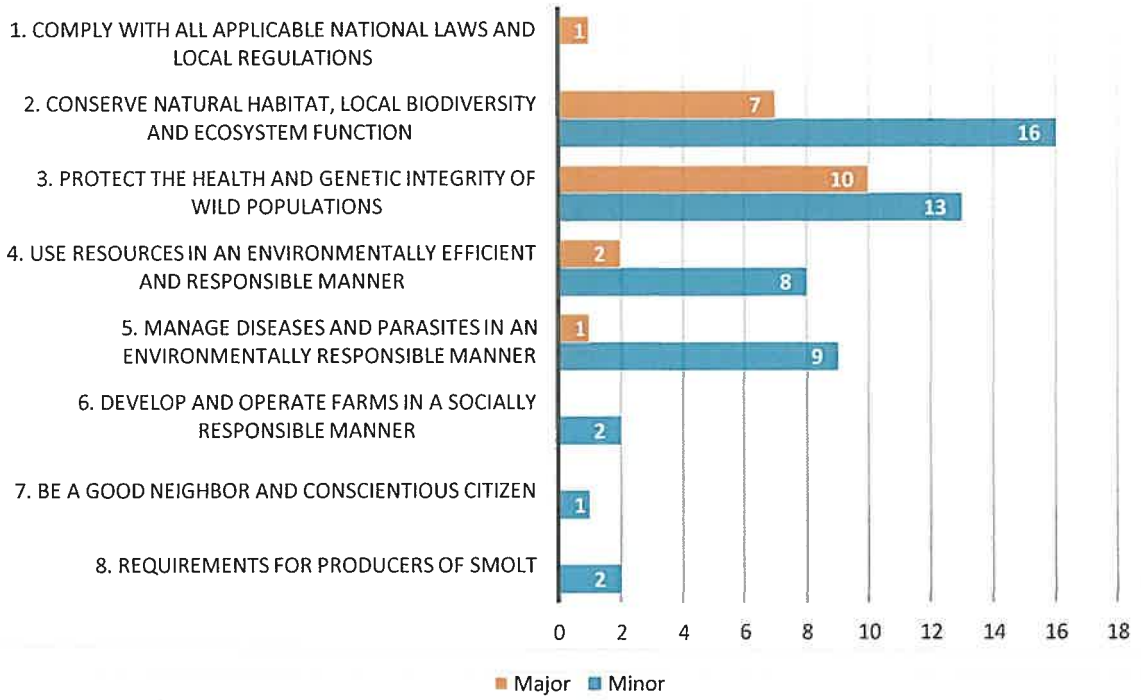


Figure 13. U.K. (Scotland): Major and minor non-conformities by principle

Failure to Raise Non-conformities

On review of the specific metric indicators globally, 102 instances of failure to raise non-conformities were found (8 Canada; 8 Chile; 10 Faroe Islands; 3 Ireland; 67 Norway; 6 U.K.). These were instances where the absence of data, or the metric value of data that was recorded, or the auditor's notes indicated that a non-conformity ought to have been raised.

The majority (88 out of 102) were related to the benthic indicators of Principle 2 (conserve natural habitat, local biodiversity and ecosystem function). Sixty-seven were a result of early auditing, meaning benthic sampling at peak biomass could not have been completed. Six audits used outdated results from previous production cycles to demonstrate conformance, which contravenes the Standard's Appendix I-1 that outlines sampling methodology for the current production cycle. A number of Norwegian audits used data from early in the production cycle (e.g. 23 per cent of peak biomass). Numerous audits raised a non-conformity for indicator 2.1.1 but did not for the other necessary benthic indicators (2.1.2; 2.1.3). One Norwegian farm failed to provide any peak biomass sampling results to demonstrate conformance during its three-year certification validity.[98] The farm's initial and surveillance audits relied on sampling done at 23 per cent of peak biomass. None of the three audits raised a non-conformity for this. In addition, 19 audits indicated benthic monitoring results breached the Standard's required threshold, yet did not raise a non-conformity.

The remaining fourteen cases of failure to raise non-conformities were related to indicators 3.1.7; 4.2.1; 4.2.2; 5.1.5; 5.1.6 and 5.2.5. In four instances farms breached the ASC's on-farm sea lice metric (3.1.7); three of these were for Norwegian farms and one was for a Faroe Island farm. Two Chilean farms nominally exceeded indicator 4.2.1 (wild fish meal dependency ratio), while one Canadian audit noted a grossly high metric for the same indicator. This farm's metric appears at odds with other Canadian and global data reported for indicator 4.2.1 and it is therefore assumed to be incorrect. One Norwegian

farm reported a high metric for indicator 4.2.2 (wild fish oil dependency ratio). The CAB raised a non-conformity for the farm's failure to submit the value to the ASC, but not for the value itself.

Indicator 5.1.5 requires that on-farm viral disease-related mortality should be equal to or less than ten per cent during the most recent production cycle. This calculation includes mortalities classified as viral disease-related, unspecified and unexplained. One Norwegian farm reported 12.46 per cent (nearly all being unexplained), and auditor notes explained another 205,048 fish were destroyed due to Infectious Salmon Anemia (ISA)) – representing approximately 20.67 per cent of the farm.[99] The auditor failed to raise a non-conformance. Another five Norway farms were assessed as compliant in their initial audits, however the auditors relied on metrics derived from the current and not yet completed production cycle. However, audit notes showed these farms exceeded the requirement during their last production cycle. The ASC audit manual instructs CABs that the most recently completed production cycle metric should be used for conformance with indicator 5.1.5.

Indicator 5.1.6 requires that the unexplained mortality rate from each of the previous two production cycles should be no more than 40 per cent of total mortalities for farms with total mortality greater than six per cent. One Norwegian surveillance audit's notes showed the farm had breached this requirement in a previous cycle with 73.9 per cent.[100] No non-conformity was raised.

Another Norwegian farm recorded a Parasiticide Treatment Index (PTI) score of 15.6 – above the indicator (5.2.5) requirement of 13 or less.[101] The CAB raised a non-conformity for the farm's failure to submit the value to the ASC, but not for the value itself.

BOX 2 FIRST NATIONS OPPOSED AND EVICTED SALMON FARMS GRANTED ASC CERTIFICATION

As part of the Standard's social sustainability indicators, Criterion 7.2 (Respect for indigenous and aboriginal cultures and traditional territories) requires that farms are respectful of the traditional territories of Indigenous groups.[102] The criterion's intent is to ensure farms identify groups who are negatively impacted by their farming activities and address those impacts satisfactorily. The Standard requires farms to have consulted with the relevant territorial government and to have come to a protocol agreement. If an agreement is not in place, the farm must be in an "active process" to establish an agreement. Criterion 7.2 requirements are stated to be consistent with the United Nations Declaration on the Rights of Indigenous Peoples. Furthermore, Criterion 7.3 (access to resources) requires farms do not restrict community access to vital resources without approval.

Despite these seemingly strong requirements, at least seven ASC certified B.C. farms[xv] are sited in unceded First Nations territories where salmon farming has been actively opposed for decades.[103] [104][105] These First Nations assert that salmon farms have affected their aboriginal rights by restricting their access to marine resources, including but not limited to, their traditional salmon and herring fisheries and shellfish beds.

During 2016 and 2017, members of the Musgmagw Dzawada'enuwx and 'Namgis First Nations issued notices of eviction to and occupied Broughton Archipelago salmon farms within their territories, leading to much media attention and legal action.[106] [107] [108][109] Some of these salmon farms are ASC certified.

In the audits for seven farms opposed by local First Nations, this review found that the auditors failed to identify the indigenous territory in which the farms are sited.[110] [111] [112] [113] [114] [115] [116] They also omitted the publicly declared First Nations opposition to the farms. Zero non-conformities were raised. Audit evidence for farm "conformance" included the auditors' general comments that the farming company(s) operate in some Indigenous territories and have several agreements in place. While salmon farming companies do have agreements in place with some B.C. First Nations, it is unequivocally clear that they do not apply to the territories in which these opposed farms operate, where no protocol agreements are in place. Only three (out of seven) of the audits recognized that no protocol agreement was in place.

Audit reports relied on company outreach to the relevant First Nation (e.g. letters inviting a meeting despite the known, public stance of opposition)[117] in answer to this criterion. Auditors failed to provide evidence of an 'active process' or 'continued consultations' as instructed by the Standard and audit manual.

Farm regulatory approvals were deemed sufficient evidence that Indigenous groups were consulted. However, this evidence of consultation was challenged in one audit report by a Kwiakah Nation representative who stated such an interpretation was not supported by section 35 of the Constitution Act, which stipulates the Crown has a duty to consult Indigenous Canadians before taking actions that may affect their aboriginal rights or title.[118]

The intent of criterion 7.2, to address potential negative impacts on indigenous communities by ensuring proactive consultation and protocol agreements, becomes moot in circumstances where First Nations adamantly oppose salmon farming in their traditional territories. In practice, the criterion only appears to 'work' when Indigenous groups are willing to engage with salmon farming within their territory. ASC-certified farms that do not have Indigenous consent to operate in their traditional waters are misrepresenting the Standard's claim to be 'socially responsible' in regard to respecting First Nations' rights and title.

[xv] First Nations opposed fish farms that are ASC certified as of May 2018: Burdwood, Doctor Islets, Glacier Falls, Maude, Phillips Arm, Sir Edmund and Wicklow.

Closure of Non-conformities

There were 64 audits that recorded major and/or minor non-conformities closed past the CAR stipulated deadlines. A further three audits were found to have 'open' major non-conformities, yet the farms remained certified.

The CAR states[xvi] major non-conformities should be closed within three months of the date of the initial audit, otherwise a full re-audit is required. Major non-conformities should also be closed before certification can be granted. After initial certification, major non-conformities identified at surveillance audits (or anytime during the validity of the certificate) should also be closed within three months – however a onetime extension of three months is allowed in the event of "circumstances beyond the control of the client".[119]

A total of 153 major non-conformities across 48 audits (25 initial; 21 surveillance; 2 re-certification) were found to have closure dates past the required three months (i.e. 94 days or longer). The closures ranged from 94 to 322 days. These violations of the CAR requirement occurred globally in audits (e.g. Australia, Canada, Chile, Faroe Islands, Ireland, Norway and Scotland). Auditors recorded extensions to 27 major non-conformities. Eight major non-conformities attributed their late closure dates to delayed VR approvals. The remaining 118 major non-conformities simply listed closure dates beyond the three month deadline.

CAR version 2.1 states minor non-conformities should be closed within three months, however, a one-year extension is allowed "if necessary". Therefore, auditors can take up to 458 days to close a minor non-conformity. On review, 173 minor non-conformities over 22 audits were found to have been closed past the deadline. These ranged from 460 to 807 days.

An additional three audits were found to have open major non-conformities representing a clear violation of the CAR requirement. The auditor for a certified Faroes farm that exceeded the required Parasiticide Treatment Index (PTI) score by more than 100 per cent stated that the closure of the major non-conformity awaited ASC's approval of a variance.[120] However, 15 months later no such variance is recorded on the ASC website.[121] Another audit recorded an open major due to the farm exceeding the phosphorus effluent level for smolt producers. Despite this, the auditor granted certification, stating, "SCS recommends the farm be certified provided the new production cycle will not use smolt from open systems".[122]

One Australian audit listed two open major non-conformities in relation to the farm's smolt provider's repeated exceedance of the phosphorus effluent level and recorded degradation of the downstream environment.[123] The auditor notes the "[Client Action Plan] has been approved by the Audit Team and the major non-conformity remains open, without auditable deadlines detailed in the CAP", and that "final demonstration of conformance" is scheduled for nearly two years after the audit; at which time suspension of the farm's certificate will be initiated unless demonstration of improvement is evidenced.

To validate their actions, the CAB cited an interpretation on the ASC's Interpretation Platform.[124] The platform allows the ASC to provide clarifications to auditors on items such as terminology or text within a Standard or CAR document. In this case, the ASC provided their interpretation[125] of the CAR's "action plans" and "conformity" regarding the closure of major non-conformities,[xvii] stating:

- the implementation of an action plan (i.e. not the closure of a non-conformity) must begin within three months of the major non-conformity's detection;

[xvi] CARv2.1 17.10.1.2
[xvii] 17.10.1.2 d) iii. A-D

- the closure of the major non-conformity may be extended to a timeline informed by the requirement in the Standard indicators or action plan milestones (i.e. closure may be beyond six months);
- surveillance audits should be used to assess progress of the corrective actions (i.e. leaving the major non-conformance open for annual review); and
- suspension of the farm's certificate should be initiated where the client fails to meet action plan milestones.

The ASC interpretation fails to provide a maximum time allowed for the extension/closure of major non-conformity; thereby enabling major non-conformities to remain open for an indefinite amount of time. This is in direct conflict with the CAR which states major non-conformities may only be extended "once for a maximum period of three months"[xviii] and that a CAB should "suspend the certificate if a major non-conformity remains open after six months".[xix]

While client action plans may be an effective way to encourage a farm to conform with the Salmon Standard, in this case the ASC has used the interpretation platform to substantially alter the requirements for certification. The interpretation opens the door to certification of farms clearly not performing according to the Standard: an auditor could recommend granting certification or the continued certification for a farm despite finding an unlimited number of major non-conformities which may remain open for an unspecified length of time, provided an action plan exists.

Furthermore, there was no evidence found that this, or other ASC interpretations, were vetted through a governance body such as the ASC's Technical Advisory Group or Supervisory Board. Such substantial amendments to the CAR or Standard should be required to go through a due process such as an operational review.

Findings

- Globally, a total of 3,726 non-conformities have been raised by auditors: 790 major and 2,936 minor.
- The average initial farm audit detected 2.33 major and 9.30 minor non-conformities. The average surveillance audit had 0.98 major and 2.82 minor non-conformities. The average recertification audit had 1.31 major and 4.68 minor non-conformities. Only 32 (out of 456) audits had zero non-conformities: two initial and 30 surveillance audits.
- Chilean farms typically have the highest number of non-conformities with an average of 13.1 non-conformities per audit (3.8 major and 9.3 minor).
- Early auditing, before harvest, is the reason for the high number of non-conformities raised under Principle 2 (benthic monitoring indicators), where audits are conducted before peak biomass sampling. These were the most commonly raised indicators for all regions except Australia.
- Despite the ability to do so, no CAB has ever raised a non-conformity against a client under CAR requirement 17.1.2.1 for failing to have all required performance data because of early auditing.
- Aside from the non-conformities relating to early auditing and Principle 2's benthic monitoring indicators, the following were commonly raised: marine mammal and bird mortalities in Australia; various sea lice indicators for Canada, Faroe Islands, Ireland, Norway and Scotland; various Principle 6 (social impacts) indicators in Faroe Islands, Ireland and Norway; and various Section 8 (smolt facilities) indicators in Australia, Chile and Norway.

[xviii] 17.10.1.2 d) ii.
[xix] 17.10.1.2 f)

- Principle 7 (be a good neighbour and conscientious citizen) community engagement indicators were commonly raised in Australia, Ireland and Norway. Non-conformities in relation to evidence of regular and meaningful consultation and engagement with community representatives and organisations (7.1.1) was particularly pronounced.
- The absence of non-conformities in relation to Principle 7 Criterion 7.2 (respect for Indigenous and aboriginal cultures and traditional territories) was noted in Canadian farm audits, despite First Nations opposition to salmon farming in their unceded territories. A number of these opposed farms are ASC-certified.
- There were 102 instances where audit evidence or metrics indicated a non-conformity ought to have been raised but wasn't. This equates to 12 per cent of audit reports (56 out of 456) where auditors failed to raise a non-conformity. It is most often the benthic indicators (2.1.1-2.1.3) against which auditors fail to raise a non-conformity and this explains why some audit reports had more than one failure noted. In addition, there were at least 29 instances where metric data clearly violated the Standard.
- There were 326 instances (153 major; 173 minor) where the reported closure of non-conformities was past the stipulated CAR deadline. This equates to 14 per cent of audit reports (64 out of 456) where the auditors failed to close out non-conformities within the required timeframe.
- Three audits were found to have open major non-conformities – yet the farms remained certified. One of these audits relies on an ASC interpretation that allows a major non-conformity to remain open (with an action plan and assessed progress) without a time limit for closure. This contravenes the CAR's stated deadlines for extension, closure and for initiating suspensions.

Farm Performance

The Salmon Standard's requirements aim to "minimize or eliminate" key environmental and social impacts associated with salmon aquaculture.[126] A number of the requirements rely on farm-level metrics to demonstrate conformance. Farms are also required to submit farm-level performance data directly to the ASC on a regular basis, as per Appendix VI.

Key environmental impacts were reviewed across regions using evidence recorded by CABs and other publicly reported farm-level metrics for specific indicator requirements. These included: disease and sea lice, fish escapes, chemical use, dependency on wild fish for feed and marine mammal deaths. Environmental impacts were chosen based on the commonly accepted concerns associated with aquaculture.[127]

Key Indicators: Disease and Sea lice

Indicator 3.1.1: Area Based Management

Indicator: Participation in an Area-Based Management (ABM) scheme for managing disease and resistance to treatments that includes coordination of stocking, fallowing, therapeutic treatments and information-sharing. Detailed requirements are in Appendix II-1.

Requirement: Yes

The objective of area-based management (ABM) is to monitor, coordinate and operate human activities within a defined area in a way that integrates biophysical, socioeconomic and governance measures to ensure the sustainable use of marine resources and fosters the protection of biodiversity.[128] The ABM approach has been demonstrated to be a crucial element for effectively managing sea lice and disease in salmon aquaculture.[129] [130] [131] Without an effective ABM scheme negative environmental impacts are more likely to transpire. The absence of ABM was found to be a contributing factor to the 2007 ISA outbreak in Chile's farmed salmon industry.[132]

ABM is a requirement of the ASC Salmon Standard. The rationale for indicator 3.1.1 states, "Farms that don't have ABM schemes already established in their jurisdiction will need to show leadership in working with neighboring farms to establish such a scheme, even if the regulatory structure doesn't require it."[133]

Appendix II-1 of the Salmon Standard outlines the necessary attributes and components of the ABM that must be met in order for farms to demonstrate conformance with the Standard. These include the application and rotation of treatments (including the consideration and tracking of cumulative use), same year class stocking, coordinated fallowing, monitoring of disease, pathogens, resistance and wild salmon populations, as well as setting and revising a maximum ABM lice load.

This review of all global audit reports discloses that no farms actually participated in an ABM scheme that meets *all* of the attributes and components as set out in the Standard's Appendix II-1. Most ASC farms refer to local regulations or management systems to demonstrate ABM conformance. However, it was found that none of these schemes considered the cumulative use of antibiotics classified as "highly important" by the WHO or tracked the cumulative use of parasiticides within the ABM. The setting and revising of a maximum ABM lice load was not a requirement in cited management systems. In addition, same year stocking and fallowing were not mandatory in some regions.

Australia

In Tasmania, an ABM scheme is referred to as an Area Management Agreement (AMA). Currently, an AMA[134] only exists for Macquarie Harbour farms where the three major Tasmanian producers all have leases. The AMA was a condition of the significant expansion within the harbour approved in 2012 (from 564 ha to 926 ha lease area).[135] The Macquarie Harbour AMA does not fully meet the ASC Standard's Appendix II-1 requirements. Note: as sea lice are not present in Tasmania, these ABM requirements are not applicable. Data on stocking, medical treatments, disease and pathogen monitoring are required to be collected in a central AMA database which feeds monthly and annual reports.[136] However, while the AMA requires a Fish Health and Environmental Management Plan, fallowing is a recommended 'best practice' and is not mandatory.[137] Stocking of same-year fish is also not required. In addition, antibiotic resistance monitoring or the cumulative use of antibiotics classified as "highly important" by the WHO is not addressed in the AMA.

In addition to the noted deficiencies of the Macquarie Harbour AMA, industry conflict in Tasmania appears to be impeding the functioning of the scheme. All five Macquarie Harbour farm ASC audits cite the AMA for conformance. However, in a recent recertification audit report the auditor raises a minor non-conformity as it appears the AMA has become ineffective and largely inactive. Many of the AMA requirements such as data sharing (e.g. stocking and fallowing information), work plans and review meetings have not been followed for over a year.[138] The breakdown of the Macquarie Harbour AMA is likely a result of industry disagreement regarding the management of the harbour. In February 2017, Huon Aquaculture launched litigation proceedings against the Tasmania Department of Primary Industries, Parks, Water and Environment (DPIPWE), alleging the government authority failed to sustainably manage Macquarie Harbour biomass levels.[139] Industry rivals joined the court proceedings in favour of the respondent, DPIPWE.[140] The conflict between industry competitors is apparent and on public record.[141]

Audits representing the cluster of farms in the Huon and D'Entrecasteaux Channel region, where two companies overlap, state no AMA currently exists. A minor non-conformity was raised in the farms' initial assessment and closed in a surveillance audit with other measures, such as the creation of an industry biosecurity plan. A minor non-conformity was again raised for no formal AMA in the second surveillance audit, which was then retained in the farms' re-certification with an extension for closure. Consequently, these farms are now in their fourth year of ASC certification with no formal AMA in place. For all other farming regions (i.e. not Macquarie Harbour or Huon D'Entrexasteaux Channel), no AMA schemes are in place. These farms are excused by the auditors as the same company owns the neighbouring farms.

Canada (B.C.)

The CAB application of ABM indicator 3.1.1 has been inconsistent in B.C. audits. Farms are either certified with no ABM at all or the audit refers to Canadian regulations, which do not encompass all of the elements of ABM.

Twenty-four audits were found to have no ABM listed. These were excused by the auditors due to the same company owning the neighbouring farms (i.e. no other companies operate within the "area" as defined by the auditor). Yet the Salmon Standard requires all farms except those "that release no water" to participate in an ABM.[142] Therefore, even farms within an area owned by the same company are required to participate in an ABM as outlined by the Standard.

Another 15 audits apply variances (No. 145-147)[143] which defer to Fishery and Oceans Canada (DFO)'s Pacific Region Marine Finfish Integrated Management of Aquaculture Plan (IMAP) in lieu of an ABM

scheme. As the ASC allows variances to be applied to subsequent audits where similar conditions prevail, auditors routinely apply these variances to the benefit of B.C. farms.

The original variances were granted for three Clayoquot Sound farms where the auditor found "the company fails in one aspect of best area management in that is there is more than one year-class in each area". The CAB recommended approval be granted based on DFO's management of stocking where single year-class is encouraged but not required (i.e. multiple year classes are allowed within an area if "siting or production limitations" exist).[144]

Despite the variance's reference to IMAP, it is actually the DFO's Conditions of Licence (CoL)[145] for FinFish Aquaculture that outline specific operational and reporting requirements for B.C. salmon farms. This includes the requirement of a Health Management Plan that details such items as biosecurity protocols, disease monitoring and classification, chemical storage and treatment records. However, the CoL fall short of the following ASC Standard Appendix II requirements: coordinated treatments plans, consideration of cumulative use of treatments (e.g. antibiotics classified as "highly important" by WHO) and tracking of cumulative use of parasiticides are not required.

Furthermore, Appendix II-1 (application and rotation of treatments) states: "Farmers must be able to demonstrate a coordinated treatment plan and evidence that the schedule and rotation of treatments are being implemented." A peer reviewed study strongly suggests DFO's management policy to be inadequate for meeting ABM requirements for the application and rotation of treatments.[146] The study found DFO sea lice management policy to be "not sufficient" and instead recommended a cooperative, coordinated ABM approach be adopted. Specifically, the study observed a lack of coordination between farms, as demonstrated by the offset treatment schedules at some farms, including those owned by the same company.

In granting the variances, the ASC reasoned that farms complying with the DFO regime are aligned with the intent of the ASC Salmon Standard. Yet the farms' failing to meet at least two of the five coordination components of Appendix II-1 appears to contravene the Salmon Standard requirement that "farms must meet 100 percent" conformance in order to be certified. Therefore, the ASC's reasoning appears flawed.

Further to the approval of the variances, the ASC variance request committee recommended that the company "contacts and discusses with DFO on the development of an ABM based on Appendix II-1".[147] Two years later, there is no evidence that DFO has pursued this matter.

Chile

Chilean farm audits typically refer to ABM agreements within established Aquaculture Management Areas (AMAs), but these were found to not meet all the required components of Salmon Standard Appendix II-1.

AMAs, also known as the neighbourhood system, were implemented by the Chilean authorities following the devastating ISA disease outbreak in 2007.[148] There are nine AMAs in the Chilean aquaculture industry. The AMA's primary purpose is disease control within the neighbourhood. This includes biosecurity protocols and measures, no mixing of year-class restrictions and mandatory fallowing between year-classes, along with farm coordination of stocking, treatments, harvest and fallowing.[149] However, synchronized parasiticide treatments are mandatory only when defined trigger limits are reached.[150]

Most Chilean audit reports refer to the legal requirements of Chile's regulations as if they were equivalent to the Standard's definition of ABM. However, the AMAs' regulations fall short of meeting the required cumulative components of Appendix I-1: cumulative use of treatments (e.g. antibiotics classified as "highly important" by WHO) and tracking of cumulative use of parasiticides. This is particularly important given concerns that Chile's Authorized Areas for Aquaculture are not regulated to ensure cumulative impacts remain within carrying capacity ecological limits.[151]

Treatment resistance monitoring and sharing within AMAs are also not mandatory for Chilean farms. Antimicrobial resistance is a "problematic" concern, [152] alongside sea louse resistance to parasiticide treatments in Chile.[153]

Denmark (Faroe Islands)

Faroes' audits acknowledge no formal ABM scheme is in place for the three companies that operate in the region. Audits identify that company farm sites are mostly segregated and don't typically overlap at a fjord level. Regardless, CABs state that farms are in conformance with the ASC Standard and that farms do practice the Appendix II requirements. Detailed information on conformance is limited. However, auditors note regular meetings between the companies and the Faroese Veterinarian Act on Aquaculture[154] which mandates a one generation-based farming model, fallowing periods, biosecurity protocols and sea lice management measures. There is no evidence that cumulative impacts (as per Appendix I-1) are being addressed.

Ireland

All Irish audits refer to ABM agreements that are administered by the state-run Marine Institute, however these were found to be insufficient in meeting all Appendix II requirements.

In 1998, the Department of the Marine and Natural Resources established Coordinate Local Aquaculture Management System (CLAMS).[155] The management system specifies the bio-physical characteristics, concerns and potential opportunities, as well as the aquaculture activities for a defined specific area. CLAMS also integrate Single Bay Management (SBM) arrangements among salmon farming producers to coordinate separation of generations, annual fallowing and strategic treatment application, as well as to ensure good fish health management and cooperation between farms.[156] SBMs are utilized primarily as a sea lice control strategy.[157] Each SBM is updated annually by the Marine Institute.[158]

SBMs appear not to address the cumulative components of Appendix I-1: cumulative use of treatments (e.g. antibiotics classified as "highly important" by WHO) and tracking of cumulative use of parasiticides. Nor does it appear to address resistance or wild salmon populations monitoring. As the sea lice is the main focus of SBMs, it is unclear the extent to which disease and pathogen monitoring and information sharing between farms occurs. Finally, there is no mention on the Marine Institute website on setting a maximum SBM lice load.

In addition, one ASC certified farm received an ASC variance approval[159] for mixed year-class stocking, which diverges from the Appendix II requirement of single year-class. The variance appears to be an exception due to stock relocation between farms, and so far has not been used as a precedent in other Irish farms.

Norway

Norwegian audits report that signed ABM agreements are in place. While these agreements are termed voluntary, it is stated that all farms in defined zones are signatories and participate in agreements. Audit reports for farms within an area that are owned by the same company state that they meet the Standard's Appendix II requirements. Audit reports note the ABM agreements are typically managed

by an independent organisation in cooperation with the salmon farming companies. Meeting records in reports note regular information and knowledge sharing, protocols on disease reporting, coordinated stocking, treatments and fallowing. However, cumulative effects (as defined by Appendix I-1) are largely missing from ABM agreements.

In October 2017, the Norwegian Department of Fisheries and Aquaculture defined 13 production zones.[160] The aim of the new zonal system is to address cumulative impacts such as those caused by sea lice, based on an area's carrying capacity and environmental conditions. The Norwegian Food Safety Authority oversees sea lice plans, including coordination of treatments, biomass allowances and enforcement.

In addition, operation plans approved by the Norwegian Directorate of Fisheries are required by all farms. The Norwegian industry has moved towards single year-class stocking and two-month coordinated fallowing periods. Disease control zones are established in the event of suspicion of disease.

It remains to be seen whether the zonal system, in concert with farms' ABM agreements, will lead to effective management of sea lice. Sea lice are currently considered the greatest threat to the Norwegian salmon farming industry.[161] Sea lice resistance to parasiticide treatments is another significant concern.[162] Already there has been critique of the new zonal management system's lack of consideration to other impacts on the ecosystem, including those affecting wild salmon.[163] It is also unclear whether the zonal system will address cumulative impacts of antibiotics and parasiticide use.

U.K. (Scotland)

Scottish audits refer to ABM schemes, known as Farm Management Agreements (FMAgs) which meet some, but not all, Salmon Standard Appendix II requirements.

Scottish farms must be part of a Farm Management Area (FMA) or a Farm Management Statement in the case of individual farms.[164] The Scottish Salmon Producers' Organisation initiated FMAgs via their Codes of Good Practice (CoGP).[165] FMAgs are now legally enforceable under the Aquaculture and Fisheries (Scotland) Act 2013.[166] FMAgs encompass such things as fish health management, sea lice control strategy, resistance testing, as well as synchronized fallowing and treatment plans. There is also an emphasis on data collection and exchange. FMAgs are to be reviewed at least every two years.
The CoGP states that sites within a FMAg should use single year-class fish and a minimum fallow period of four weeks at the end of each cycle, although exceptions are allowed where a risk assessment has been completed. One farm that was allowed an exception also received a variance from ASC[167] from the Standard Appendix II's requirement, which states that farms should have a fallow period in coordination with other farms in the ABM. However, the official response from the ASC VR Committee included the following: "Its success will be monitored through annual surveillances and if it fails, the farm would lose their certificates [sic]". The farm is currently listed as 'withdrawn' on the ASC website,[168] though it is unclear if the decision to withdraw is related to the variance.

Unfortunately, FMAgs are not required to address the cumulative components of Appendix I-1: cumulative use of treatments (e.g. antibiotics classified as "highly important" by WHO) and tracking of cumulative use of parasiticides. No setting of a maximum FMAg lice load is mentioned. Elevated sea lice abundance and high use of parasiticides in Scotland's salmon farms remain a serious concern. [169]

Indicator 3.1.6: Sea lice monitoring on wild salmonoids

Indicator: In areas of wild salmonids, monitoring of sea lice levels on wild out-migrating salmon juveniles or on coastal sea trout or Arctic char, with results made publicly available. See requirements in Appendix III-1.

Requirement: Yes

Acknowledging that sea lice interactions between farmed and wild populations is a "high-priority issue", the ASC Salmon Standard requires that "farms located in areas of wild salmonids must participate in monitoring of lice levels on wild out-migrating juvenile salmon or other important salmonids in the area, such as coastal sea trout or Arctic char".[170] Collaboration with researchers and/or regulatory bodies to conduct the monitoring is expected. Out of a total of 257 farms reviewed globally, 31 actually met the requirements of Indicator 3.1.6.

For Norway, Ireland and Scotland, the ASC has approved variances[171] [172] [173] that, in practice, exempt farms within these regions from sea lice monitoring on wild salmonoids. As a result, there is no evidence for what is arguably one of the most critical indicators of ecosystem health. These regions prohibit the handling of wild salmon due to their endangered status. In approving the variances, the ASC also required the farms "to engage proactively with the relevant government agency about their interest and willingness to collaborate in the research outlined in Appendix III-1 of the Standard".[174] Additionally, they required the auditors to raise a minor non-conformity to be closed with corrective actions (i.e. steps towards a collaborative sea lice project with authorities). Therefore, one would expect all certified farms in these regions would be certified subject to a minor non-conformity for indicator 3.1.6. This is not the case.

In Norway, for example, only 14 out of 274 audits raised this. When the variance is cited, it is often treated as an exemption from the indicator. When the variance is not used, CABs for Norwegian farms use government sea lice monitoring and research from the Norwegian Institute of Marine Research for conformance. Such research may indeed be meeting the intent of the indicator. However, it is recommended that auditors confirm that the evidenced research was conducted with the necessary rigour and made publicly available. This would provide greater assurance that some alternative sea lice monitoring on juvenile wild salmon is taking place and is preferable to applying a variance as, in effect, an exemption from the indicator.

In Ireland, early audit reports refer to a possible research project through the European Commission's Horizon 2020 programme to meet the requirement of the variance regarding collaborative research. However, no further information on whether such a project has begun was found. In Scotland, farms have contacted local chapters of the non-governmental organisation, Fisheries Trust, to conduct sea lice research on their behalf. It remains unclear whether this has progressed. Audit reports for Faroe Island farms state there is very limited knowledge of sea trout locations and migration routes. No monitoring on wild fish occurs, but at least one large producer is involved in a "lice dispersion project".

Indeed, the only region that fully meets the requirements of Indicator 3.1.6 is B.C. Canada. For example, Cermaq Canada contracted a third party to conduct sea lice monitoring on wild salmonids in the following regions for 2017: Discovery Islands, Georgia to Johnston Strait, Broughton Archipelago and Clayoquot Sound.[175]

Indicator 3.1.7: Sea lice counts

Indicator: In areas of wild salmonids, maximum on-farm lice levels during sensitive periods for wild fish. See detailed requirements in Appendix II, subsection 2.

Requirement: 0.1 mature female lice per farmed fish

The SAD Sea Lice Technical Report found on-farm sea lice abundance can pose a "significant threat" to wild populations.[176] To effectively manage the issue, the report called for a "concerted precautionary approach" and a requirement of 0.1 mature female lice per farmed fish was established.

All regions with wild salmonids had at least one farm that breached the ASC sea lice requirement. It should be noted that the small number of breaches in the Faroes, Ireland and Scotland are reflective of the fact that only a limited number of farms are certified in these areas. However, despite this, the Faroes and Scotland did register values up to 21 times the Standard threshold.

On-farm sea lice levels in British Columbia, Canada, were found to be well above both the Standard's requirement, as written, and the varied requirement. Canadian farms registered sea lice counts up to 149 times the Standard requirement and 10 times the varied requirement.

Canada (B.C.)

B.C. farms do not adhere to the Standard's sea lice indicator as written due to variances. These variances replace the ASC Standard's threshold of 0.1 mature female lice per fish with the DFO Pacific Aquaculture Regulation's (PAR) three motile *L. salmonis* per fish. Fifteen of the 31 ASC certified farms met or exceeded the PAR threshold during the sensitive period (defined as 1 March to 30 June). Farm levels ranged from 3 to 34.4 motile lice per fish.

Denmark (Faroe Islands)

Five (out of six) Faroe Island farms breached the ASC requirement during the sensitive period (defined as 1 April to 30 June). Values ranged from 0.12 to 2.1 mature female lice per fish.

Ireland

One farm (out of four) breached the ASC requirement during the sensitive period (March to May) with a value of 0.15 mature female lice per fish.

Norway

Fifty-five (out of 121) farms breached the ASC requirement during the sensitive period (mid-April to May was reviewed; although some areas have slightly different sensitive periods). Values ranged from 0.11 to 0.67 mature female lice per fish.

U.K. (Scotland)

Two (out of three) farms breach the ASC requirement during the sensitive period (March to May). Values ranged 0.2 to 2.1 mature female lice per fish.

Indicator 5.1.5: Fish Mortality: Maximum viral disease

Indicator: Maximum viral disease-related mortality on farm during the most recent production cycle

Requirement: ≤ 10%

Acknowledging that fish farms have the potential to amplify and transfer disease to wild fish, the Standard requires farms to keep viral disease mortalities at or below 10 per cent.

A total of 319 out of 456 audits reported a metric for maximum viral disease mortality. Values ranged from 0 to 67 per cent mortality by total fish stocked. Seventeen farms recorded a value over the metric limit, yet remained certified:

- Two Irish farms recorded the highest values (67 and 34 per cent) due to Cardiomyopathy Syndrome (CMS).[177]
- Four Norwegian farms experienced elevated viral disease mortality due to CMS and Heart Skeletal Muscle Inflammation (HSMI).[178] Auditors closed two of these non-conformities, accepting an action plan by the company to ensure farms within the immediate area transition to single year-class. This strongly suggests that these two farms' ABM scheme did not conform with the ASC definition of ABM. The remaining two Norwegian farms closed their non-conformities with the aid of variance No. 222. See variance chapter for more discussion.
- Six Norwegian farms recorded breaches in the metric value without specifying the cause. Auditors failed to raise a non-conformity for five of these.
- One Norwegian farm experienced an Infectious Salmon Anemia (ISA)[179] outbreak. While the auditor records conformance for the indicator, notes state that a total of 205,048 salmon were culled, representing approximately 20 per cent of the farm.
- Three Australian farms recorded high, unexplained fish mortality but failed to appropriately classify and record the percentage of which were due to viral disease.
- One Canadian farm experienced elevated mortality rates due to viral haemorrhagic septicaemia virus (VHSV).[180] This raised a minor non-conformity that was closed with the proposal of action plans.

Key Indicators: Escapes

Indicator 3.4.1: Maximum number of escapes

Indicator: Maximum number of escapees in the most recent production cycle

Requirement: 300

Recognizing the significant concerns associated with the risk of establishment and gene pool degradation of at risk wild salmon populations, the Salmon Standard requires no more than 300 escapees allowed in the most recent production cycle.

Six large escape events were found reported in the public domain. However, only two events could be found on the ASC website.

Australia's Middle Harbour farm reported 6,458 escapes in 2013.[181] Despite the initial assessment audit report acknowledging the escape, the auditor used footnote clause 47, which allows for one rare exceptional escape episode over a ten-year period. [xx] In doing so, the auditors' manual states that farms "must provide a full account of the episode and must document how the farm could not have predicted the events that caused the escape episode".[182] The rational provided by the auditor fails to explain what caused the event accident or how the farm could not had predicted the events that led to the escape episode. It states: "Atlantic salmon is not a native species to Australia. DPIPWE did not issue any corrective actions requests following the escapee notice. In addition, since the incident there have been significant improvements in actual counts resulting in better estimates of number of fish half way through growout phase (at time of splitting into multiple pens) and at harvest. In addition, the pen/net design and manufacturing has improved significantly and holes in netting due to seal predation are much less likely."[183]

Evidence suggests the Chilean farm, Aracena 3, experienced an escape event of approximately 10,000 fish in July 2016. [184] Unfortunately, despite the requirement to do so, no audit reports have been posted on the ASC website for Aracena 3 in two years.[185] Consequently, it is unknown if or how this farm has been held to conformance with indicator 3.4.1. The farm remains certified.

Public reporting for the Norwegian farm, Valoyan, lists 1,415 escaped fish in July 2016.[186] Contrary to this, the farm's second surveillance report, dated October 2016, states no escapes have occurred. [187] Gulin and Storm Bay farms experienced large escape events shortly after their surveillance audits. Gulin farm (Faroe Islands) recorded 109,515 fish escapes due to "weather conditions" in December 2017.[188] In May 2018, the Storm Bay farm in Tasmania experienced an escape event during wild weather that resulted in around 120,000 escapes.[189] Both remain certified. Perhaps the auditors for Guiln and Storm Bay farms are awaiting the next (second) surveillance audits to address the non-conformities. However, this raises the question as to when is an appropriate time for CABs to raise non-conformities or suspensions when a certified farm is in major non-conformance with the Standard. Addressing these at surveillance audits, instead of immediately, allows farms in major non-conformance with the Standard go to market with the ASC logo. The ASC CAR has no rules stating otherwise.

xx [47] A rare exception to this Standard may be made for an escape event that is clearly documented as being outside the farm's control. Only one such exceptional episode is allowed in a 10-year period for the purposes of this Standard. The 10-year period starts at the beginning of the production cycle for which the farm is applying for certification. The farmer must demonstrate that there was no reasonable way to predict the events that caused the episode. See auditing guidance for additional details.

One CAB did take immediate action after being notified that the Chilean farm, Punta Redonda, experienced an escape event of around 900,000 (600,000~ after recapture efforts)[190] in July 2018. The farm was suspended[191] – thereby disallowing any remaining or recaptured fish the ability to enter the market with the ASC logo.

BOX 3 FARMS IN MAJOR NON-CONFORMANCE SOLD PRODUCT WITH THE ASC LOGO

A number of Standard indicators have a maximum allowed metric (e.g. escapes/marine mammal deaths/sea lice count per fish/parasiticide use/antibiotic use). Breaches of Standard thresholds raise the question of whether such instances should result in immediate suspension and/or certificate withdrawal. The CAR does not provide guidance on when the decision to withdraw a client's certificate is necessary and when the CAB should take action if a farm is in major non-conformance during the validity of their ASC certificate.

SeaChoice's What's Behind the Label? report found that the B.C. farm, Marsh Bay, has successfully harvested and entered the market with the ASC certification twice despite seven sea lion deaths.[192] More recently, three B.C. Clayoquot Sound farms that experienced high on-farm sea lice levels (up to 10 times the varied threshold) had entered the market with the ASC eco-label for approximately two months.[193] Following media attention to the issue, Cermaq Canada voluntarily ceased using the logo on the harvesting farms.[194] This was followed by farm suspensions by the CAB.[195] This was an unusual step as the ASC CAR does not require CABs to act immediately on major non-conformities, allowing CABs to wait until the next annual surveillance audit, by which time the farm could have benefited from the ASC logo in the marketplace.

The CAR allows a major non-conformity (once raised) to remain open for up to six months before instructing CABs to suspend the farm's certificate.[xxi] During this period farms can enter the market with the ASC certification. The ability to market products as ASC certified while being in major non-conformance undermines the credibility of the eco-label and contradicts the assertion in the Salmon Standard that farms must meet 100 per cent of requirements to be certified.

[xxi] CARv2.1 17.10.1.2f)

Key Indicators: Chemical Use

Indicators 5.2.9 and 8.16 Antibiotics use

Indicator: Number of treatments of antibiotics over the most recent production cycle

Requirement: ≤ 3

With the aim of minimizing the risk to the surrounding environment and reducing the use of antibiotics important for human medicine, the Standard stipulates no more than three antibiotic treatments over the production cycle.

Of the 433 audits with reported metrics, 80 per cent (350 audits) reported zero antibiotic treatments in the grow-out stage, for Indicator 5.2.9. Fifteen per cent (16 audits) reported one to two treatments. Five per cent (22 audits) reported three treatments or more during the grow-out stage of the production cycle.

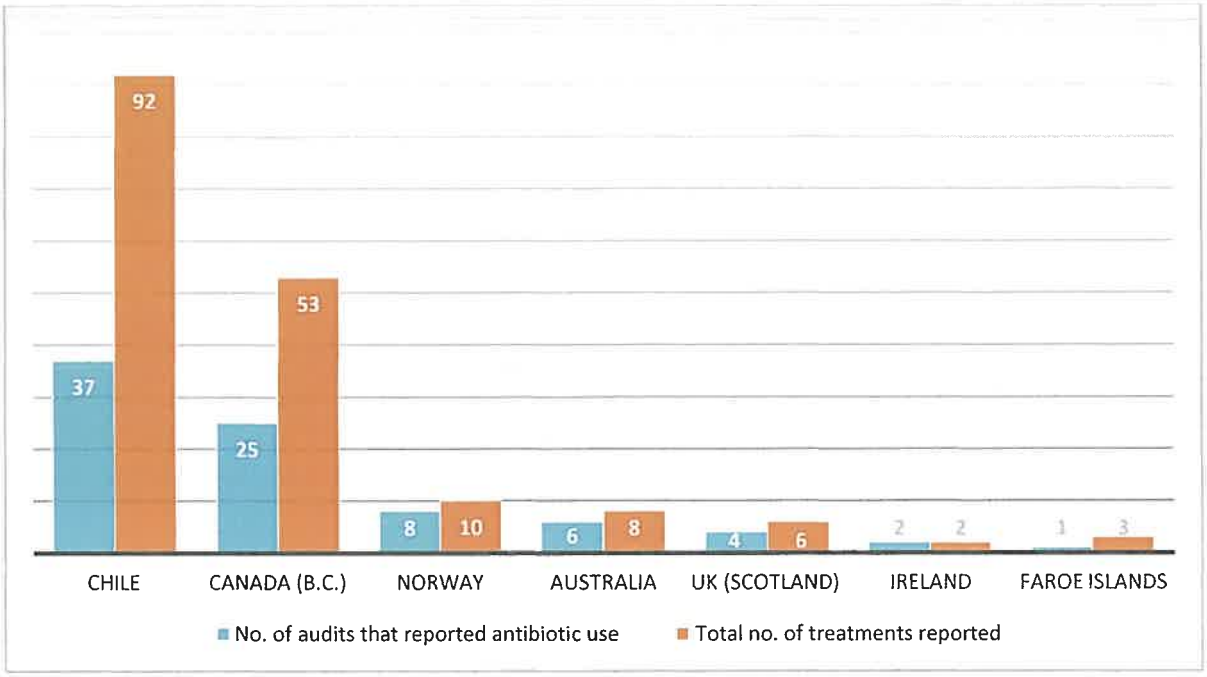


Figure 14. Number of audits that reported antibiotic use and the total number of treatments by country

Chilean and Canadian audits typically report antibiotic use counts, while Norwegian farms rarely report antibiotic use.

CABs used various interpretations of the phrase, "most recent production cycle" in scoring this indicator. Some auditors applied the requirement to the most recently *completed* production cycle, while others used the antibiotic treatment count to date based on the *current* (i.e. incomplete) production cycle.

Farms with three or more antibiotic treatments under Indicator 5.2.9 were reviewed to determine if antibiotic use under Indicator 8.16 (smolt stage) was also counted towards the maximum three antibiotic treatments allowed in the production cycle. Auditors for farms in Australia, Canada, Chile and Faroe Islands were found to be allowing three antibiotic treatments for the smolt stage and another three antibiotic treatments for the grow-out stage (six antibiotic treatments in total for the cycle), instead of three antibiotic treatments per production cycle as required by the Standard.

Antibiotic counts can also omit treatments that occurred on intermediary farms (e.g. smolt-entry sites, transfer pens, nursery pens or initial grow-out sites). Interim stages of the production cycle can occur in Australia, B.C. Canada and Scotland. Transferring fish between sites has also been observed in Norwegian audit reports. Intermediary sites are likely to use antibiotics because smolts transitioning from freshwater to saltwater are more prone to infections such as *Tenacibaculum maritimum*[196] and stomatitis.[197] Consequently, antibiotic use figures for ASC products that have employed intermediary sites could be misleading as they do not reflect the true antibiotic use in the production cycle.

Indicator 5.2.5: Parsiticide Treatment Index

Indicator: Maximum farm level cumulative parasiticide treatment index (PTI) score as calculated according to the formula in Appendix VII

Requirement: PTI score ≤ 13

The Parasiticide Treatment Index (PTI) aims to minimize the reliance on and use of chemical treatments while allowing a capped amount to be used to protect wild salmon populations from high sea lice loads. Four-hundred and eighteen audits, representing 236 farms globally, reported a PTI score. Seventy-one per cent of Norwegian audit reports (194 out of 271) recorded parasiticide use. B.C. farms also have the same report rate of 71 per cent (32 out of 45). In comparison, only 14 per cent of Chilean audits (11 out of 79) reported a PTI score. This is surprising given the Chilean industry's overall high parasiticide use.[198] One reason may be the localities of some of the certified Chilean farms as sea lice outbreaks are reportedly uncommon for farms located in the Magallanes area (Region XXII).[199]

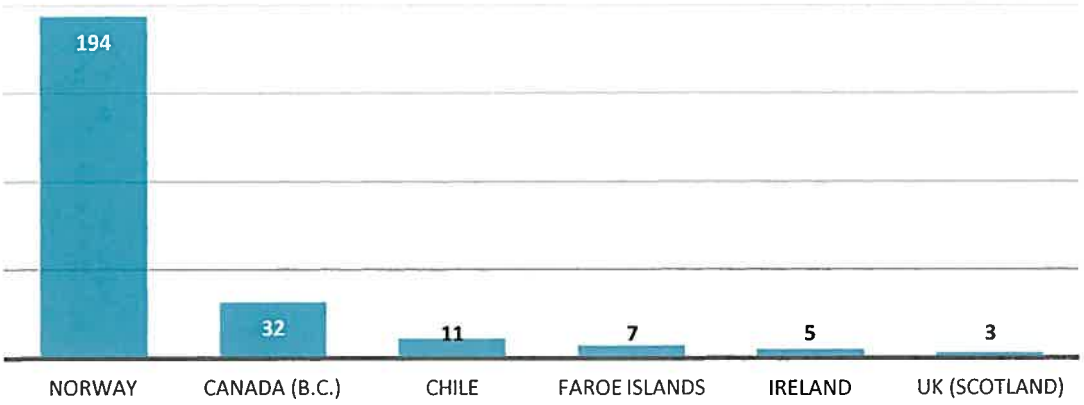


Figure 15. Number of audits that reported parasiticide use by country

Globally, PTI scores ranged from zero to 132. The average audit had a score of 4.5, while the median was 3.2. All regions recorded average and median scores below the limit (i.e. PTI score ≤ 13). Sixteen audits recorded a metric above the PTI limit: 12 in Norway, 2 in Chile and 2 in Faroe Islands. This data shows 96 per cent of certified farms are able to successfully meet the Standard's PTI requirement.

Table 3. PTI Score range, mean and median by Country.

Country	Number of farms	Number of audits	PTI Scores (Range)	PTI Score (Mean)	PTI Score (Median)
Canada (B.C.)	31	45	0-9.6	4.4	3.2
Chile	69	79	0-24	1.4	0
Faroe Islands	6	10	0-28.8	9.1	9.6
Iceland	2	2	0	0	0
Ireland	4	6	0-8	5.3	6.4
Norway	121	270	0-132	5.2	3.2
U.K. (Scotland)	3	6	0-8.4	3.8	3.5
TOTAL	236	418	0-132	4.5	3.2

*Australia, Denmark and Poland excluded

In March 2015, the ASC initiated an operational review of the Salmon Standard, including a review of the PTI indicator.[200] After an initial public consultation, a PTI technical working group was established. A second public consultation on the proposed changes was conducted in September 2017.[201] A replacement measure termed the Weighted Number of Medicinal Treatments (WNMT) was proposed. A Global Target (GT) was defined as four parasiticide treatments (an increase from the current PTI score that represent two to three treatments depending on a number of factors). In addition, a regional approach combined with an improvement model was proposed. Entry Gate (EG) values were defined for each region (ranging from four to 11 treatments). SeaChoice's review of the proposal found the GT would represent up to a 100 per cent increase from the current PTI metric; while the regional EG values would represent an increase of up to 450 per cent (depending on the region).[202] For example, Chilean farms could become certified with eleven sea lice treatments. The proposal states that EGs represent 50 to 66 per cent of farms within that particular region. Progress requirements for EG farms were also proposed to encourage eventual conformance with the GT value – however this 'step-wise' approach would take up to 15 years.

The shift to regional thresholds ignores the reality that some geographical locations have an inherently lower environmental risk than others in regard to salmon aquaculture and that proper siting is a fundamental component of effective sea lice management. The SAD sea lice technical working group report[203] described the importance of siting: "another important issue relates to the optimal location of salmon farms; establishment of "safe sites" should lead to minimizing risks and maximizing benefits to all concerned parties" and "proper siting of farms, or coordinated treatment of farms in a local area, can prevent spread of sea lice from farm to farm, and re-infection from local reservoirs. This may reduce the need for chemical treatment, and lessen the spread of sea lice to wild hosts...". Furthermore, the SAD chemical use technical working group report found "...there is a significant potential for salmon farms to impact local waters, especially if poorly sited or poorly managed".[204]

The current PTI requirement includes a 'sensitive time factor' that acknowledges crustacean species, such as lobster, are particularly sensitive to parasiticide treatments at certain times. The proposed WNMT model removes the sensitive time factor despite recent studies showing that parasiticide exposure can have negative effects on lobster populations and associated fisheries.[205] [206] [207] [208]

The current Salmon Standard explicitly states an ultimate goal of zero paracitiside use, however the WNMT proposal moves the Salmon Standard further from this goal. In some cases, the PTI proposal allows for certification of farms with parascitide use higher than normal for farms in the region (e.g. B.C.).

On review of the data used for the proposal, the GT and EG values data provided by industry were limited and incomplete. No ASC certified farm PTI data was used in the proposal's analysis. Despite the absence of ASC-reported farm data, the consultation paper states "from the perspective of ASC, salmon producers, NGOs and other stakeholders, use of the PTI failed to drive down the use of medicines in sea louse control, failed to help reduce sea lice numbers on farms and failed to slow the development of drug resistance in sea lice populations". No further explanation or analysis demonstrating the ASC certified farm data and the PTI score's lack of leverage is provided in the paper.

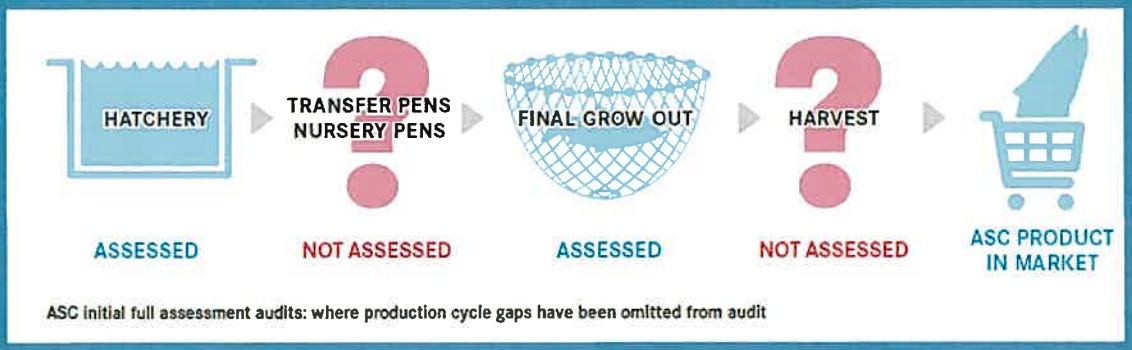
The consultation paper states "the conformance with the PTI should be a challenge to certification not a barrier".[209] Our data shows 96 per cent of certified farms are able to meet the PTI; meaning the PTI score is likely not a barrier for the top 27 per cent of the industry's global production volume (i.e. the current volume percentage of the global industry already ASC certified). Additionally, a recent claim by GSI suggests farms are improving their practices with GSI members reducing their parasiticide use by 40 per cent over the last five years.[210]

BOX 4 INTERMEDIARY FARM SITES

ASC defines a 'unit of certification' to include all production, harvest and processing sites up to the point where the product enters the chain of custody.[xxii] Intermediary stages (e.g. smolt-entry site, transfer pen, nursery pen or initial grow-out site) are commonly used during the farmed salmon production cycle in Tasmania, B.C. and Scotland. Transfers between sites have also been observed in Norwegian audit reports. Intermediary farms are typically used between the hatchery and final grow-out stage. Consequently, it would be expected all stages of the production cycle be assessed against the Standard's environmental and social criteria. In practical application of the ASC Salmon Standard, CABs typically omit interim farms from conformance with the Standard.

SeaChoice's What's Behind the Label? report found that up to a year of production time could be excluded from conformance with the ASC Standard.[211] Audit evidence for ASC-certified Marsh Bay farm shows the CAB underreported the PTI score for the most recent production cycle due to simply omitting the intermediary farm from the assessment and thereby omitting a sea lice treatment.[212] Had the sea lice treatment been included in the production cycle's PTI score, the Marsh Bay farm would have exceeded the ASC PTI threshold. This example demonstrates that until such time as auditors are required to assess the true production cycle, Standard metric thresholds such as sea lice treatment frequency counts (i.e. PTI or WNMT), antibiotic counts, escapes, marine mammal and bird deaths will likely be false and underreported.

The ASC recently condoned the omission of intermediary farms from conformance, stating that such sites are "out of scope".[213] ASC's interpretation amends the CAR's unit of certification definition and contravenes numerous Salmon Standard indicators that rely on data or evidence derived from a full production cycle to demonstrate conformance. In fact, ASC acknowledged in their interpretation that the SAD's intent for the Salmon Standard was to assess all stages of the production cycle for environmental and social impacts. In effect, ASC's interpretation weakens the Standard as written and intended, thereby further eroding the credibility of the certification.



ASC initial full assessment audits: where production cycle gaps have been omitted from audit

[xxii] CARv2.1 Annex A – The ASC Vocabulary

Key Indicators: Wild Fish in Feed

Salmon aquaculture continues to depend on wild fish stocks for feed. However, the industry has managed to reduce their inclusion rates over the last decade or so. The Standard recognizes this progress and aims to "support the trend toward lower inclusion rates and increasingly efficient use of marine resources".[214]

The Standard requires farms to meet two fish dependency ratio limits. At the release of the Standard in 2012, the Fishmeal Forage Dependency Ratio (FFDRm) required a limit of 1.35 or lower. Meanwhile, the Fish Oil Forage Fish Dependency Ratio (FFDRo) required a limit of 2.95 or lower. Following an operational review, the limits were lowered with the release of Standard version 1.1 in April 2017. The current limits are: 1.2 FFDRm and 2.52 FFDRo.

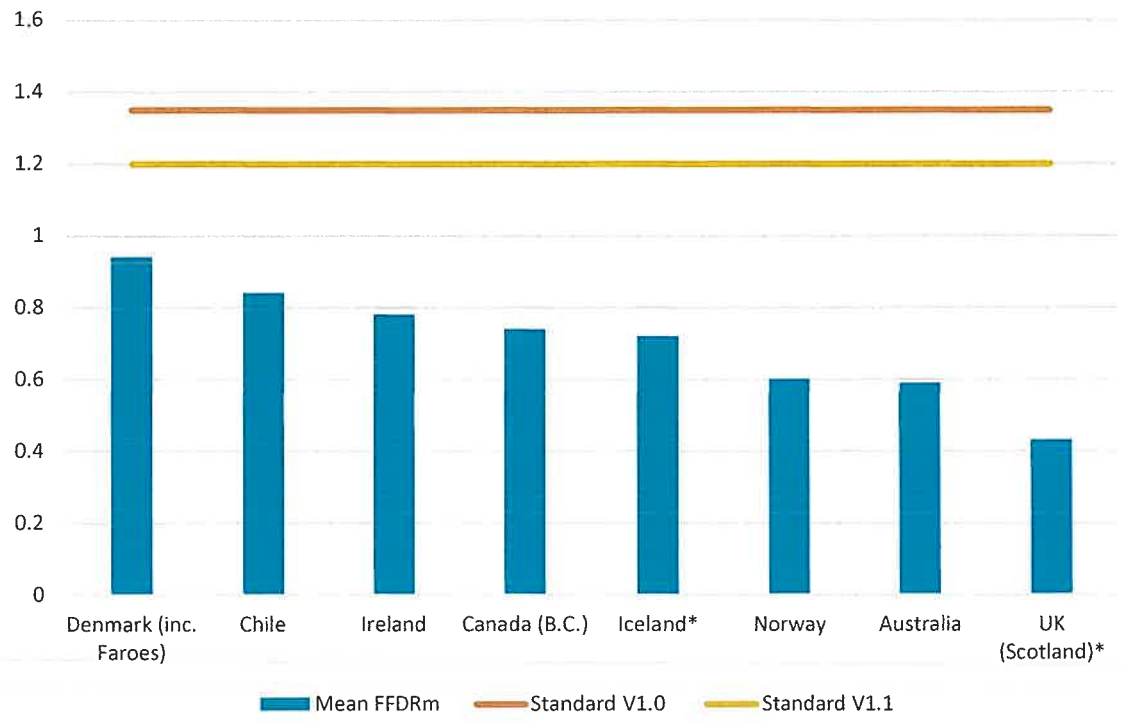
On review of all global audits, this report finds 95 per cent were successfully meeting the ratio limits. The results indicate the operational review could have further lowered the expected ratios.

Indicator 4.2.1: Fishmeal FFDRm

Indicator: Fishmeal Forage Fish Dependency Ratio (FFDRm) for grow-out (calculated using formulas in Appendix IV- 1)

Requirement: < 1.2 [<1.35 before 2017]

Ninety-five per cent of certified farms meet the current Fishmeal Forage Fish Dependency Ratio FFDRm requirement of <1.2. A total of 397 (out of 456) audits reported a (FFDRm) value, ranging from from 0 to 1.37. Only two audits listed values above the original Salmon Standard (v1.0) limit of 1.35. However, these were nominal exceedances at 1.36 and 1.37, respectively. Another 14 reported values were above the current Standard (v 1.1) limit of 1.2 FFDRm. All but one conformed with v1.0 of the Standard at the time of their assessment. It is noteworthy that 13 per cent of audits failed to record a metric value for this indicator.



*limited number of audits

Figure 16. Mean FFDRm by country

The average FFDRm by country ranged from 0.43 (Scotland) to 0.94 (Denmark/Faroe Islands). The global average value was 0.67 FFDRm.

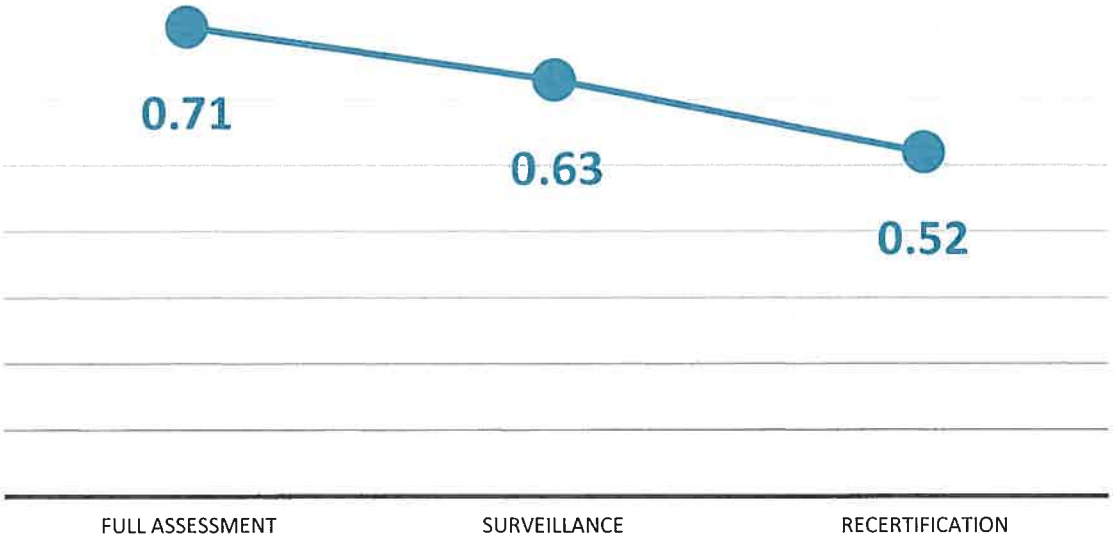


Figure 17. Mean FFDRm over audit time series

The average (mean) FFDRm was calculated and compared across initial, surveillance and re-certification audits. Globally, the mean for full assessment (initial) audits is 0.71; surveillance 0.63; re-certification 0.52. This declining trend demonstrates, overall, ASC certified farms are improving their FFDRm.

The ASC implied that the new FFDRm limit of <1.2 reflected the best performers. Non-industry stakeholders proposed the limit should be further reduced, to set the bar at 1.0 or less. The ASC responded that "... it may be counterproductive in the immediate term because it would mean a number of farms currently certified would no longer be able to meet the Standard". However, our analysis of 397 audits shows farms are meeting the new limit. In fact, 89 per cent of certified farms are able to meet a FFDRm *below* 1.0.

Indicator 4.2.2: Fish Oil FFDRo

Indicator: Fish Oil Forage Fish Dependency Ratio (FFDRo) for grow-out (calculated using formulas in Appendix IV- 1), or, Maximum amount of EPA and DHA from direct marine sources (calculated according to Appendix IV-2)

Requirement: FFDRo < 2.52 [previously <2.95]
or
(EPA + DHA) < 30 g/kg feed

Ninety-five per cent of certified farms can meet the current Fish Oil Forage Fish Dependency Ratio (FFDRo) indicator. In total, 398 audits (out of 456) reported an FFDRo value, ranging from 0 to 6.24. Three audits reported values higher than the Salmon Standard version 1.0 limit of 2.95 (6.24; 3.62; 2.97). Two raised minor non-conformities for exceeding the threshold, while one CAB raised a minor non-conformity for failing to report the value to the ASC. Another 14 audits had values over the Standard's version 1.1 value of 2.52, however all were in conformance at the time of audit under version 1.0 of the Standard.

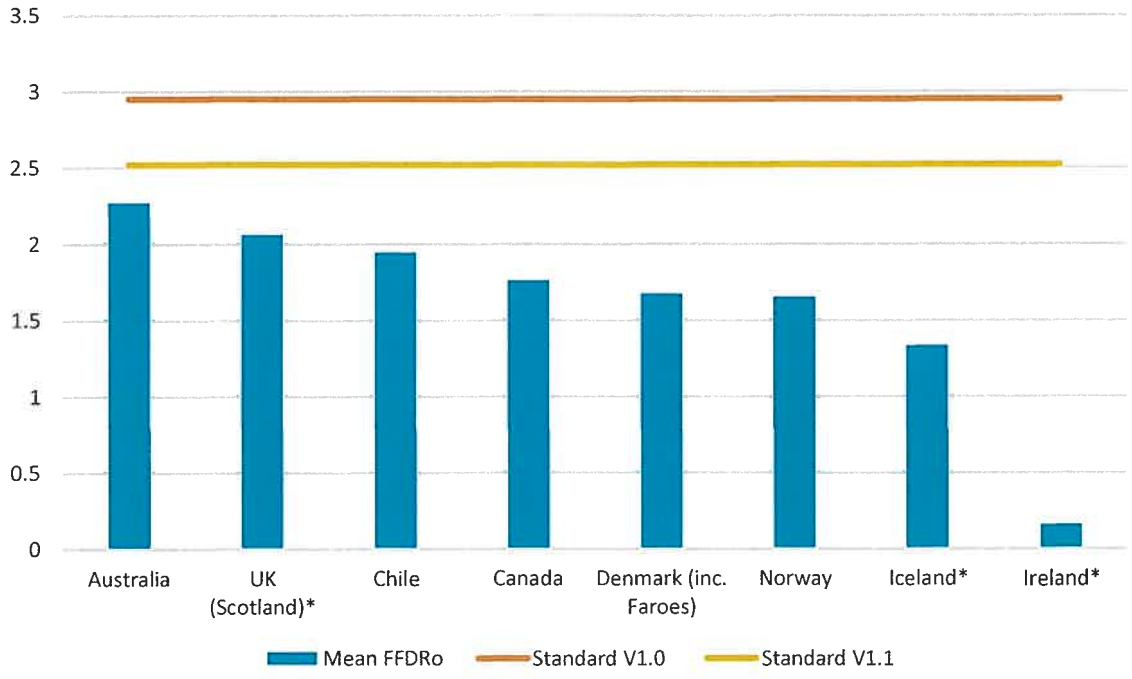


Figure 18. Mean FFDRo by country
*limited number of audits

The average country's FFDRo ranged from 0.16 (Ireland) to 2.27 (Australia). The global average value is 1.72 FFDRo. Ireland's substantially lower mean is a result of three (out of five) audits reporting the inclusion of trimmings (i.e. by-products from fish processing that are not fit for human consumption) within their fish oil sourcing. The Standard encourages the use of by-products and such sources are excluded from the calculation. Instead, the calculation focuses solely on the direct dependency on wild fish stocks.

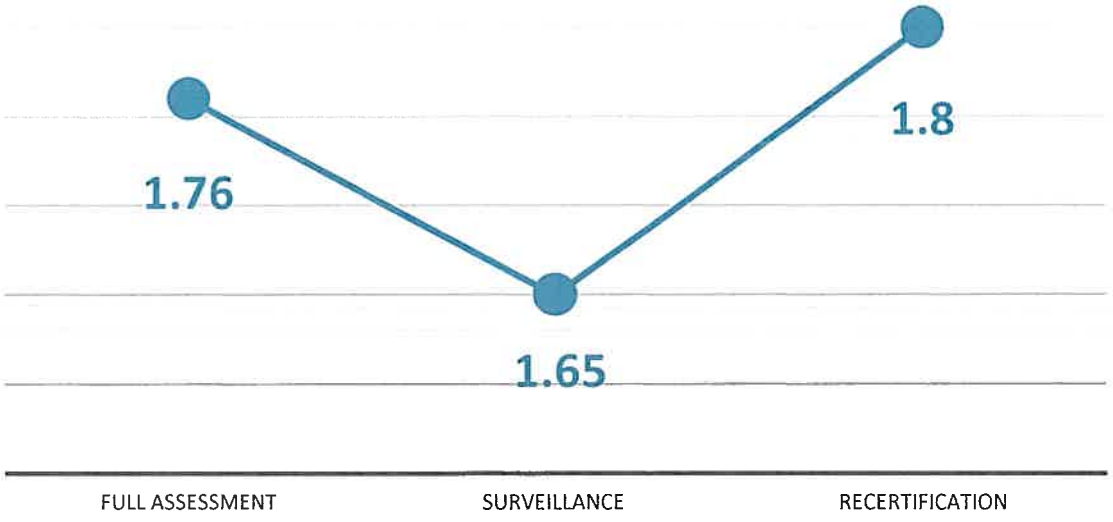


Figure 19. Mean FFDRo over audit time series

The average (mean) FFDRo was calculated and compared across initial, surveillance and re-certification audits. Globally, the mean for full assessment (initial) audits is 1.76; surveillance 1.65; re-certification 1.80 FFDro. Unlike the mean FFDRm that appears to be on a declining trend, FFDRo appears to be stable across audits. This suggests the ASC farms' ability to reduce their reliance on forage fish for fish oil is limited.

Overall, our analysis shows nearly all farms are easily able to meet the ASC's FFDRo threshold, although there is no lowering trend in industry performance overall. In fact, 90 per cent of certified farms are able to meet an FFDRo *below* 2.3.

Key Indicators: Marine Mammal Deaths

Indicator 2.5.5: Maximum Lethal Incidents

Indicator: Maximum number of lethal incidents on the farm over the prior two years

Requirement: < 9 lethal incidents, with no more than two of the incidents being marine mammals

The Standard requires farms to meet a limit on the number of lethal incidents of accidental and intentional mortalities of "predators or other wildlife".[215] The Standard disallows mortalities of endangered or red listed marine mammals or birds. Otherwise, there is a maximum of nine lethal incidents allow, with no more than two of these being marine mammals.

Globally, five ASC farms – four Australian and one Canadian farm – reported breaching the marine mammal limit. One company is responsible for the Australian breaches, where the majority of seal deaths were due to entanglements in farms nets or trapping within the predator false bottom of the farm. Auditor notes typically refer to the increasing population of Australian fur seals (*Arctocephalus pusillus doriferus*) as the cause for the incidents. Historically, the Tasmanian salmon aquaculture industry has struggled with ongoing seal interactions.[216] As a means of avoiding shooting or the accidental drowning of seals, authorities introduced a seal relocation program in 1990. Following backlash from wild fisheries located within the relocation areas, the program was halted in December 2017.[217] The same farming company that reported the seal deaths in their ASC audits has traditionally relocated seals as a mechanism to control interactions. [218] The company reported a total of 1,344 relocations for May 31 to December 25, 2017.[219] This is significantly higher than another company that has upgraded farm infrastructure to double steel nets.[220] Given the government has ceased the relocation program, it remains to be seen whether interactions will increase overall and whether all companies will upgrade their netting infrastructure as an alternative measure. One Canadian farm experienced seven California sea lion (*Zalophus californianus*) deaths due to entanglement. The farm's temporary suspension during its production cycle was lifted before the farm's harvest for market. No details on corrective actions to prevent future incidents (or lift the suspension) were provided by the auditor.[221]

In addition, by-catch of other wildlife (i.e. not marine mammals or birds) is not assessed by auditors. Footnote 30 defines a lethal incident as including "all lethal actions as well as entanglement or other accidental mortalities of non-salmonids".[222] It would then be expected that the incidental catch of other fish species that can occur at salmon farms would be counted. In 2017, B.C. salmon farms reported a total of 54,160 fish as by-catch.[223] However, the ASC audit manual states, "The term "non-salmonid" was intended to cover any predatory animals which are likely to try to feed upon farmed salmon. In practice these animals will usually be seals or birds".[224] Consequently, lethal incidents such as fish by-catch, are dismissed by auditors.

Findings

Disease and Sea Lice

- Globally, no farms conformed with all of the ABM requirements as written in the Standard's appendix. Most ASC audits deferred to local regulations or management systems (by applying a variance or simply citing the regulation) to demonstrate ABM conformance. However, it was found that none of these schemes consider the cumulative use of antibiotics classified as "highly important" by the WHO or track the cumulative use of parasiticides within the ABM. Setting and revising a maximum ABM lice load was not a requirement in cited management systems. In addition, same-year stocking and fallowing were not mandatory in some regions.
- Only the B.C. industry contracted sea lice monitoring of sea lice levels on wild out-migrating salmonid juveniles. Atlantic regions had variances in place due to regional legislation that prohibits the handling of wild salmonids. These variances were applied as exemptions from the criterion. However, some audits cited that sea lice monitoring research was being conducted by other bodies (e.g. Norwegian Institute of Marine Research) that could indeed be meeting the intent of the indicator. Having auditors confirm the rigour and transparency of such research, would provide greater assurance that some alternative sea lice monitoring on juvenile wild salmon was taking place and would be preferable to a variance.
- In all regions with salmonoids, at least one farm breached the ASC sea lice threshold. The Faroes and Scotland registered values up to 21 times the Standard. All certified B.C. farms take advantage of variances for sea lice levels, which permit much higher lice counts (three motile as opposed to 0.1 female). Despite this, B.C. farms have had reported counts up to 10 times the varied limit.
- The majority of farms were able to meet the maximum viral disease mortality. The 17 farms that recorded a value over the limit remained certified.

Escapes

- Six publicly reported large escape events have occurred at ASC certified farms. Only two of these escape events could be found to be assessed within an audit report on the ASC website.

Chemical Use

- Eighty per cent of audits listed zero antibiotic treatments for the grow-out farm. Fifteen per cent of audits reported one to two treatments. Five per cent reported three treatments or more. Chile had the most audits that reported antibiotic use.
- The Parasiticide Treatement Index (PTI) score is likely not a barrier for the currently certified 27 per cent of industry (by volume). Ninety-six per cent of ASC certified farms successfully met the current PTI score. Only 16 audits recorded a metric above the limit.
- The ASC's initiative to alter the PTI score with the proposed Weighted Number of Medicinal Treatments (WNMT) is inconsistent with the best practices approach to which the Standard claims to adhere. Approximately two-thirds of the global salmon farming industry could meet the proposed WNMT 'Entry Gate' limits, suggesting that the ASC is seeking to reframe the Standard as one that merely excludes the worst performers, rather than rewarding best practices and incentivising improvement.

Wild Fish in Feed

- Nearly all farms (95 per cent) are easily able to meet the FFDRm limit of <1.2. All regions averaged a value less than 1.0 FFDRm. In addition, the data shows ASC farms are improving their FFDRm over time.
- Nearly all farms (95 per cent) are able to meet the FFDRo limit of <2.95. All regions averaged a value less than 2.3 FFDRo. However, the data shows this value has remained stable over time, with little improvement.

Marine Mammal Deaths

- Five audits reported marine mammal deaths above the Standard limit. Four of these were Australian farms and one Canadian.

Standard Application

- Farms in major non-conformance with the Standard can sell their product as ASC certified. This suggest ASC's suspension and revocation rules are inadequate and/or underused.
- Intermediary stages of the production cycle are never assessed against the ASC Standard. Up to a year is omitted from conformance with the Standard. Recently the ASC deemed intermediary stages to be "out of scope". This ASC interpretation amends the CAR's 'unit of certification' definition and contravenes numerous Salmon Standard indicators that rely on data or evidence derived from a full production cycle to demonstrate conformance.
- Metric counts and data reporting may be false or underreported given that treatments and environmental values from the intermediary stage are not included. It is also common for auditors to allow indicator limits to be applied to each stage of the production cycle, rather than to the complete production cycle. This can result, for example, in tripling the quantity of parasiticides or other therapeutants used.

Part 3. The (Varied) Standard: Evaluating the Extent and Impact of Variances

In situations not addressed by a species Standard, audit manual or CAR document, or if the auditor believes the evidence indicates an appropriate case for excusing a farm from meeting any of the Standard criteria, the CAB can submit a variance request to the ASC's Variance Request (VR) Committee.[225] The VR Committee is composed of the ASC Standards Director, Chair of ASC TAG, Chair of the ASC Supervisory Board and ASC's CEO. These requests are supposed to be supported by evidence sufficient to enable ASC to conclude that the principles underlying the Standard indicator in question are not compromised by the variance. Variance requests allow CABs to seek an ASC interpretation or variance of either the Standard criteria or CAR requirements. In practice, an approved variance can allow the CAB to successfully close out, or avoid raising, a non-conformity.

SeaChoice's *ASC Certification in Canada: Technical Report*[226] found that the variance approval process lacks stakeholder engagement, independent scientific scrutiny or independent oversight. However, there appears to be opportunity for industry to influence the process through the submissions made in support of the variance request. Furthermore, there is no requirement for the committee to seek technical or scientific advice on a variance request's subject matter.

Part three of this report compares the number of variance requests across the eight ASC Standards and two CAR versions, and then takes a deeper look at variances from the Salmon Standard. The number of approved variances used and reused within audit reports is examined both globally and by country. The content of commonly used variances is reviewed.

Total Number of ASC Variance Requests

As of April 2018, a total of 267 variance requests have been submitted and 213 approved.[227] Figure 22 shows over half of these (138) are related to the Salmon Standard (versions 1.0 and 1.1) alone. In comparison, the Trout Standard accounts for 18; Shrimp Standard 11; Bivalve Standard seven; Tilapia Standard four; Abalone Standard one; and Seriola/Cobia and Pangasius Standards have none. Eighty-seven are related to the various CAR versions.

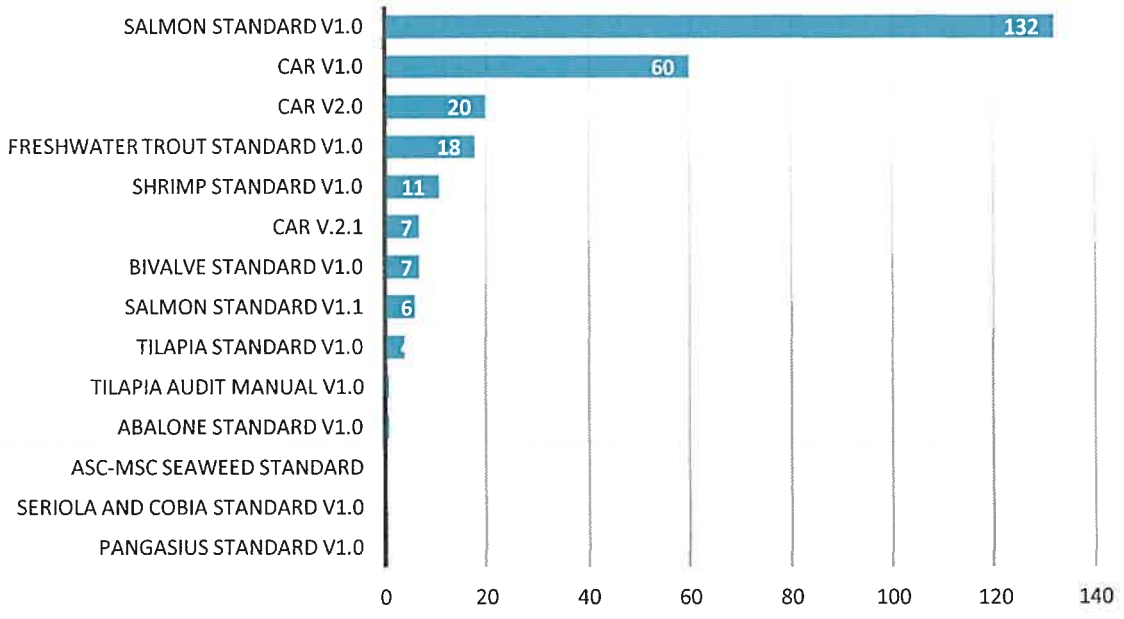


Figure 20. The number of variance requests by Standard and CAR

Salmon Standard Variances

Of the 138 variance requests related to the Salmon Standard, 115 have been approved and only one has not been approved. Six were deemed 'not applicable' (e.g. ASC advisement that a variance was not needed) and 16 remain open.

Once a variance has been approved by the VR Committee, it can be reapplied to "an identical situation".[228] This has resulted in auditors frequently reapplying variances across regions and regulatory regimes, and often without recording reasons justifying the application of the variance to the farm being audited. In essence, variances are treated as if they set a precedent for entire regions, rather than just "identical situations". To assess the extent reapplication of variances occur, each of the 115 variances were recorded by country and compared to the number of variances cited in audit reports, which were also recorded and categorized by country (Table 4). The analysis shows approved variances have been reapplied to a total of 866 times and the reuse of variances is common in Australia, Canada, Chile and Norway.

Table 4. The number of variances approved and cited by country

Country	Variances approved	Variances cited
Australia	5	27
Canada (B.C.)	21	145
Chile	28	99
Denmark inc. Faroes	4	6
Ireland	3	9
Norway	35	567
Switzerland	1	N/A*
U.K. (Scotland)	18	13
TOTAL	**115**	**866**

*No record of farm on ASC website.

Only 99 of 456 audits, or 21 per cent of certified farms met the Standard as written (i.e. without varied criteria). On review, 357 (out of 456) audit reports cited at least one variance. Globally, the number of variances referenced ranged from zero to nine per audit. The mean was 2.4 variances applied per audit.

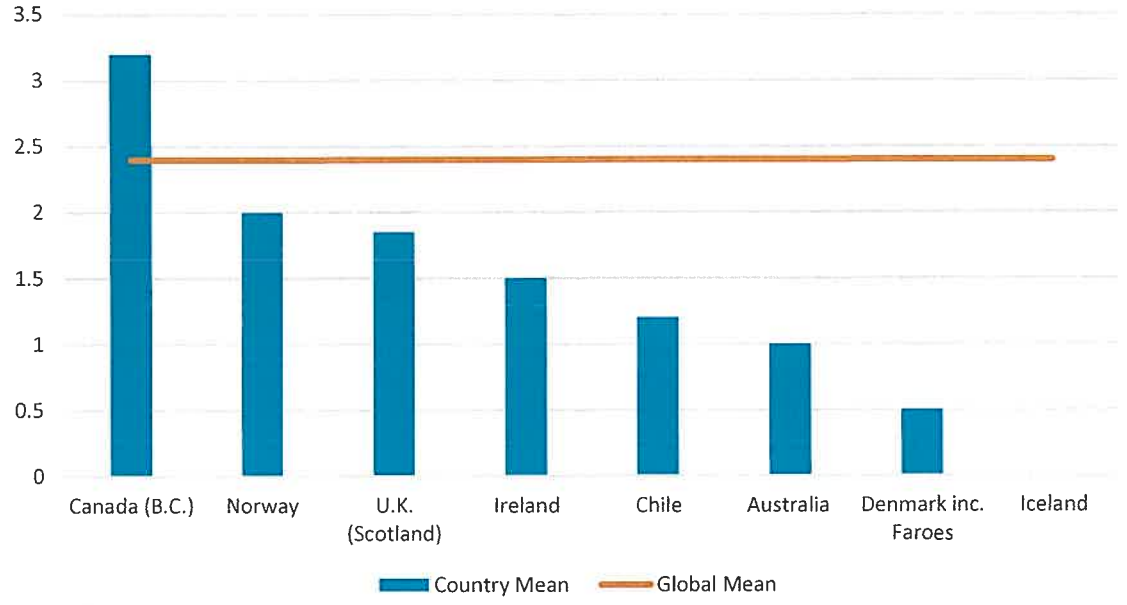


Figure 21. Mean number of variances used by country per audit

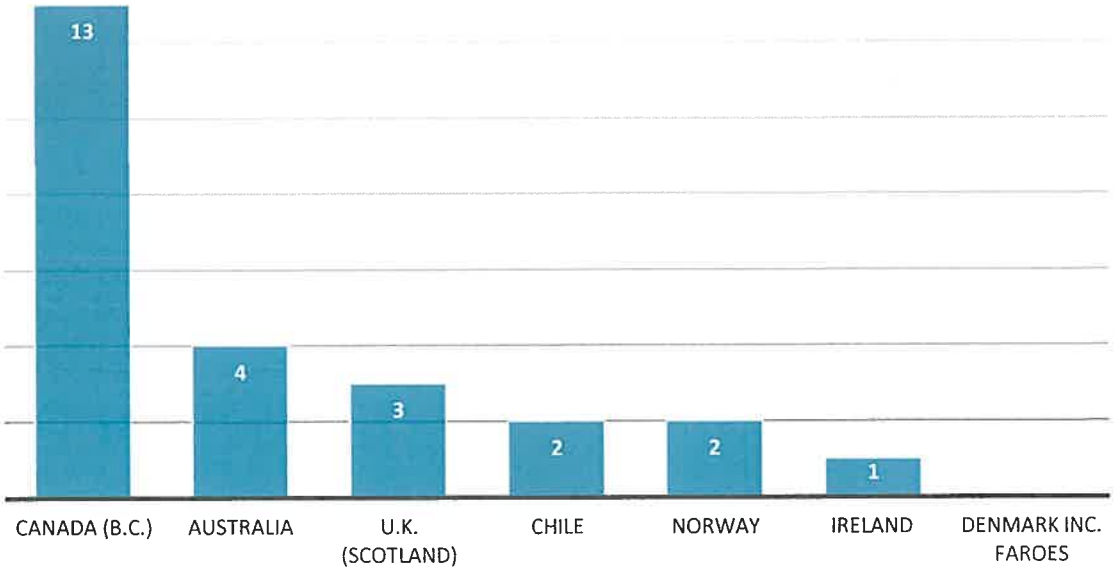


Figure 22. Total number of variances that defer to government regulations by country

A number of variances defer to government regulation, meaning that farms do not need to meet the ASC Salmon Standard requirements for the subject indicator. Instead, conformance with the regional management regime is substituted. Deference to government regulation is most predominant in B.C. farms. Examples of such deference include Tasmania's benthic monitoring procedures, Canada's sea lice regime, Chile's parasiticide treatment regulations and the prohibition of wild salmon handling in Scotland, Ireland and Norway. Many of these variances have permanently changed a Standard requirement.

BOX 5 MACQUARIE HARBOUR CASE STUDY

Approximately one-third of Tasmania's Macquarie Harbour (MH) is located within the boundaries of the Tasmania Wilderness World Heritage Area (TWWHA).[229] It is also home to the Endangered Maugean Skate (Zearaja maugeana).[230] In recent decades, it has also been the home of Tasmania's west coast salmon farm industry. Of late, Tasmania's MH has been the subject of legal action and media attention.

Immediately following the expansion of the industry to 15,490 mT within the harbour in 2013, scientific studies showed declining dissolved oxygen (DO) coinciding with the increased biomass.[231] Leaked industry emails described concerns regarding environmental impacts and biomass caps.[232] Despite this, authorities proposed a further expansion in 2016.[233] However, the maximum biomass cap was revised and lowered after benthic conformance surveys found 19 breaches of the licence conditions.[234] A subsequent conformance survey found further breaches,[235] while an Institute of Marine and Antarctic Studies (IMAS) technical report demonstrated negative impacts on the adjacent World Heritage area.[236]

This prompted the Tasmania Environmental Protection Agency (EPA) to order one non-compliant farm to be destocked.[237] In May 2017, a MH TWWHA Status Report found a decline in abundance and the number of species within the TWWHA.[238] Another IMAS report shows an increase in the prevalence of Beggiatoa (a pollution indicator species).[239] This prompted the EPA director to state that the harbour is "under a level of stress that may not be sustainable in the longer term" alongside announcing a reduction in stocking for the harbour.[240] A further review found an increase in dissolved reactive phosphorous at the TWWHA.[241] The latest IMAS report found very low levels of DO and a decline in benthic faunal abundance within the TWWHA.[242] The industry has also experienced numerous mass scale fish mortality events. Most recently, 1.35 million fish died over a six month period in 2017/2018 due to the outbreak of disease.[243] In May 2018, the EPA announced another reduced biomass limit of 9,500 mT[244] in spite of calls to fallow the harbour.[245]

Despite the negative environmental impacts and fish die off events, a number of MH salmon farms are ASC certified. The first farms (MF 214 and MF 219) received ASC certification in 2014.[246] A variance was approved for the farms to depart from the Salmon Standard's benthic monitoring and water quality indicators.[247] Farms instead follow local regulations that allow benthic impacts to be monitored by visual assessment, rather than sampling and testing relevant parameters. Water is monitored only for nitrogen, not phosphorus.

The farms' initial assessment acknowledged the approval of the variance and stated "Tassal will report on visual surveys now that the variance request is granted".[248] However, the farms' subsequent surveillance reports did not assess these indicators for conformance (although the CAR requires it). For example, the 2016 surveillance audit simply states, "The ASC approved variance is still in place" (2.1.2; 2.1.2) and "As a surveillance audit, the focus of the audit has revolved around open non-conformities, with several other criteria checked at random. These criteria was [sic] not evaluated during the 2016 audit" (2.1.3; 2.2.1).[249]

It was during the 2016 surveillance audit that the Franklin lease (MF 266) was added to the certification. A few months later, benthic surveys found Franklin had 14 breaches of conformance and it was ordered to destock.[250] After public outcry, Tassal voluntarily withdrew the ASC eco-label from their Franklin farm.[251] The negative impacts were not addressed until the re-certification of MF 214 and MF 219 where the auditor raised a major non-conformity under Standard indicator 1.1.1 (legal conformance) and 2.1.1 (benthic impacts). After conferring with the EPA, the non-conformities were closed and certification was regranted.[252]

MH farms have also been granted a variance that exempts farms from the Standard indicator 5.4.1 - which requires single year-class fish in order to prevent the amplification and spread of disease.[253] Instead, MH farms can stock two-year classes at the one site. Such stocking practices have been criticized by industry peers and blamed for the recent outbreak of pilchard orthomyxovirus (POMV) in the harbour.[254]

Common and Problematic Variances per Region

Australia

Variances (VRs #22; 23; 24; 150) for the benthic (2.1.1; 2.1.2 and 2.1.3) and water monitoring (2.2.3) indicators have been applied 20 times in Tasmanian audits. All Tasmanian farms benefited from variances that defer to local governmental regulation. [255] VRs are often treated as exemptions by auditors as evidence of conformance *to the varied criteria* (including metrics) are often missing from audit reports.

Variance 116 departs from Standard indicator 5.4.1, which requires farms to stock single year-class fish, and has been applied seven times in audits. The rationale for the Standard's single year-class requirement is to prevent the amplification and spread of disease between farmed and wild fish. Tasmanian salmon farms can host two-year classes within the same farming lease in order to provide a year-round supply for market. [256] In lieu of following the Standard requirements, these farms follow regional biosecurity and mitigation measures.

These variances have been used to certify Tasmanian salmon farms that have experienced benthic degradation and disease outbreaks (see box 5). Consequently, it appears these variances have failed to meet the intent of the Standard requirements – to minimize negative impacts on the benthic environment and prevent the spread/amplification of disease. Furthermore, the ASC label does not even certify that the farms are compliant with the local governmental regulations which are bring used in lieu of Salmon Standard criteria, as auditors cease to investigate or record conformance with the variance during their audits (i.e. the variances are treated as 'exemptions' from any criteria).

Canada (B.C.)

Variances (VRs 88; 141) for Standard indicator 3.1.7, which requires farms to maintain on-farm lice levels at 0.1 mature female per fish during and immediately prior to sensitive periods, has been applied 48 times in B.C. audits. [257] [258] The variances defer to Department of Fisheries and Oceans' (DFO) Pacific Aquaculture Regulation (PAR) defined three motile *L. salmonis* per fish. The variances have been applied to the benefit of all B.C. salmon farms. Audit evidence shows that CABs routinely cite the variance number and the PAR regime, but no conformance with a metric threshold is required and no upper limit on lice per fish is applied. In practice, farms are treated as exempt from needing to meet a sea lice metric. Consequently, the variances are undermining the intent of the Standard's sea lice indicator to protect migrating juvenile salmon during their sensitive period (see box 6).

Standard indicator 3.1.1 requires farms to participate in an ABM scheme for managing disease and resistance to treatments – as detailed in Appendix II-1 of the Standard. Variances (VRs 145; 146) allow B.C. farms an "exception" to the ABM requirement by deferring to the DFO regime[259], despite a scientific study[260] that suggested DFO's management regime does not meet ABM principles. The two variances have been applied 24 times in Canadian audits. Part 2 of this report found B.C. farms failed to meet all required ABM components as outlined in the Standard's Appendix II. Consequently, the deferral to the local regime has diluted the intent of the requirement and the Standard's stated necessity for 100 per cent conformance.

Variance 92 for indicator 8.4, which limits phosphorus release for smolt facilities, has been applied 20 times in audits. The variance allows a B.C. hatchery to discharge effluent directly into the marine environment without needing to conform with the Standard.[261] The ASC approved the variance, reasoning that the provisions of the Standard with regard to discharge to the marine environment are less than binding. The exemption rationale provided by the CAB is that phosphorus can be a polluting nutrient only in freshwater ecosystems, not marine ecosystems. An operational review of indicator 8.4

appears warranted to ensure the latest scientific research informs appropriate criteria for both freshwater and marine-discharging hatcheries. This would ensure both types of hatcheries are held accountable for their potential environmental impacts by the Standard. For example, nitrogen discharge limits may be more appropriate for hatcheries that discharge to the marine environment.

Copper monitoring results for ASC certified farms located in Clayoquot Sound, B.C. are typically above the Standard indicator 4.7.4 limit. The CAB submitted that this was likely a result of background copper levels within the region and proposed the farms' allowance of "naturally high" copper levels with continued monitoring. [262] [263] The associated variances (VRs 143; 144) have been applied 16 times with continued monitoring evidenced. However, it appears these variances are unnecessary as the ASC Standard and audit manual instructs CABs to review reference site copper levels in relation to background concentrations when copper levels are above the Standard requirement.[264]

Variance 91 for Standard indicator 5.4.4, which requires certain procedures in the event that an OIE-notifiable disease is confirmed on the farm, has been reapplied 15 times in B.C. audits. The ASC approved the variance on the basis that Viral Haemorrhagic Septicaemia virus (VHSV) is endemic to B.C. and farms instead follow Canadian authority procedures.[265] In practicality, this means VHSV infected farms are not required to immediately cull fish (as per indicator 5.4.4), unless instructed by the Canadian Food Inspection Agency to do so. ASC's rationale for the exemption of endemic OIE-notifiable diseases from Standard requirements is unclear. Endemic viruses may still pose a risk to vulnerable species. For example, VHSV "is considered a serious disease of wild Pacific herring, causing large scale fish kills and likely contributing to population level declines".[266] A study found that B.C. salmon farms can act as virus reservoirs and transmit VHSV via 'spillback' to naïve Pacific herring.[267] CFIA records show VHSV was reported on Atlantic salmon in B.C. in 2014[268]. Whether the farm was required to cull their stock is unknown. Regardless, the intent of the OIE requirement – to hold certified farms to a higher Standard than that of local authorities – is weakened by the approved variance.

Variance 198 for water quality indicators 2.2.3 and 2.2.4 has been applied 11 times for one B.C. salmon farming company. The variance allows the company to follow modified water quality testing procedures.[269] Within the variance request the CAB correctly states that Canada has no national monitoring and water classification system and so the company is required to conduct its own monitoring. Oddly, the same CAB states that another salmon farming company within the area is not bound by such a requirement. Updates to the Salmon Standard version 1.1 included changes to indicator 2.2.4 sampling requirements that should have led to the expiration of the variance. However, the variance still appears to be in use. This suggests there is a need for the ASC to define time limits on approved variances. Likewise, the ASC should define the scope of application for variances. In this case, as Canada has no national monitoring and water classification system, all Canadian farms should be bound to conduct water monitoring.

BOX 6 B.C.'S SEA LICE VARIANCES

The most routinely applied variances in B.C. farms are the two sea lice variances under Principle 3 of the Standard. These variances replace the ASC Standard's threshold of 0.1 female lice per fish with the DFO Pacific Aquaculture Regulation's (PAR) three motile L. salmonis per fish. SeaChoice's What's Behind the Label? report found these sea lice variances enable B.C. farms to be ASC certified.[270]

The variance requests were supported by a literature review commissioned by industry. No stakeholder or other scientific advice was sought by the ASC VR-Committee before their approval.

Farms with sea lice loads up to 10 times the PAR requirement and 149 times the original Standard requirement have been certified.[271] Fifteen B.C. farms have breached the three motile threshold at some point while certified or in assessment. When a Standard criterion is varied, it is logical to expect that farms would need to demonstrate conformance with the varied criterion in order to achieve and maintain ASC certification. In the case of the sea lice variances, however, the interpretation of the variance is also at issue. CABs apply the variances as a "management objective" instead of requiring farms to demonstrate that they maintained lice levels at or below three motile lice per fish throughout the sensitive period.

Despite calls from the accreditation body ASI and from stakeholders, the ASC has yet to clarify to auditors the varied metric threshold to which B.C. farms should be held. After two formal complaints regarding the sea lice variances, ASI warned ASC that such VRs are "probably putting at risk the program integrity".[272] They further recommended, "In case a VR changes the original intent of the Standard it is recommended that this should not be possible without public consultation and stakeholders review ".

The impact from salmon farm-derived sea lice on wild salmon populations remains a concern in B.C. For example, one recent analysis based on 15 years of field work modelled a 23 per cent loss to Broughton Archipelago pink salmon population due to 2015 high L. salmonis lice loads.[273] Given B.C. certified farms are not held to an absolute maximum sea lice limit, there is the real potential that at least some ASC certified farms are contributing to high lice loads on juvenile salmon. The intent of the sea lice indicator, to protect vulnerable migrating juvenile salmon from high sea lice loads, is unfulfilled by the approved variances.

Chile

Auditor evaluation criteria for indicators 2.1.2 and 2.1.3 require CABs to verify that sulphide concentration and highly abundant taxa results conform with the Standard requirements. Two Chilean farms did not meet the required score and were granted variances (VRs 93; 94; 95; 96) based on other environmental surveys that suggested salinity fluctuations and abiotic conditions are normal for the area.[274] These variances have been applied 33 times in Chilean audits. The application of the variance has since benefited other farms, yet it is unclear whether the other farms are equally justified for not meeting the Standard's requirements. This highlights the need for ASC to identify the scope for which approved variances should apply (i.e. which farms, region, etc).

Chile does not have a national monitoring and water classification system, as required by Standard indicator 2.2.3. Consequently, Chilean farms are bound to indicator 2.2.4 requirements to conduct water quality monitoring. Numerous variances (VRs 61; 129; 197; 218; 219) allow farms to alter their monitoring procedures[275] and have been applied 14 times in audits. Changes to indicator 2.2.4 under the Salmon Standard version 1.1 ought to have led to the expiration of these variances. However, the

variance still appears to be in use. This suggests there is a need for the ASC to define time limits on approved variances.

The Chilean authorities-mandated sea lice treatments has led to two variances (VRs 181; 182) where farms have exceeded the Standard's PTI required level.[276] The ASC approved the variances based on the rationale that high sea lice loads were due to "unusual environmental conditions" and treatments are set by the Chilean regime. These variances are yet to be reused by other farms. Given that the ASC allows approved variances to set precedents, it is possible that other Chilean farms that exceed the PTI threshold could easily apply the variances. Such practice would undermine the intent of the PTI indicator to limit the use of sea lice chemicals entering the environment and to prevent chemical resistance.

Ireland

Variance 42 for indicator 3.1.6, which requires companies to conduct sea lice research on wild salmonoids, has been applied five times in Irish audits. The variance was approved based on the fact that Irish regulations prohibit the handling of wild Atlantic salmon. [277] As discussed in Part 2, such variances are typically applied as exemptions to the indicator. Instead, it would be of greater benefit for auditors to confirm whether some alternative sea lice monitoring on juvenile wild salmon is taking place (e.g. by government authorities or academia), and is conducted with the necessary rigour and made publicly available.

Norway

Variances (VRs 39; 45; 46; 47; 48; 51; 53; 58) for indicator 8.4, which limits phosphorus release for smolt facilities, have been used 219 times in Norwegian farm audits. These variances exempt Norwegian hatcheries that discharge directly into the marine environment from the Standard requirement. The ASC approved the variance, reasoning that the provisions of the Standard with regard to discharge to the marine environment are somehow less than binding[278] (see Canada, B.C. variance section for further discussion on indicator 8.4 variances).

In Norway, a number of variances (VRs 128; 195; 196; 206; 207; 223) have been approved in regard to Standard indicator 5.2.5, the maximum Parasiticide Treatment Index (PTI) score. PTI variances have been used 149 times in audits. These variances relate to farms that exceeded the PTI score and were approved by the ASC based on corrective and/or preventive actions. A variance granted to a Scottish farm (98) is the most commonly cited and used in Norwegian audits; it allows farms to calculate the PTI score differently. The variance states that parasiticide treatments targeting individual pens within the larger farm should be counted as a percentage of a full treatment. For example, if 9 out of ten pens are treated, this represents 90 per cent of a single site treatment. This fraction is then incorporated into the PTI calculation. The approach aims to reflect a more "prudent and targeted use of therapeutant[s]".[279] The high use of this variance strongly suggests such an approach should be assessed via the ASC's PTI operational review currently in progress. In addition, a number of variances have been approved for Norwegian farms that have exceeded the PTI score threshold (up to four times the required level). As the ASC allows for approved variances to be reused, these variances have the potential to be applied to other farms that breach the PTI requirement – thereby the intent to limit the amount of parasiticides released into the marine environment is defeated.

Variance 136 for indicator 3.1.6, (the indicator requiring companies to conduct sea lice research on wild salmonoids), has been used 19 times in Norwegian audits. The variance was approved on the basis that the sampling of wild salmon is prohibited by Norwegian regulations. [280] As discussed previously, such variances are applied as exemptions and it would be preferable for CABs to confirm an alternative monitoring program was in place that ensured the intent of the Standard was being met.

Variances (VRs 54; 55; 56; 57) for Standard indicator 5.4.4 (which requires certain procedures in the event that an OIE-notifiable disease is confirmed on the farm) have been applied 17 times in Norwegian audits. The ASC approved the variances on the basis that Pancreas Disease is now considered endemic in large parts of Norway and farms follow local authority procedures.[281] ASC's rationale for the exemption of endemic OIE-notifiable diseases from Standard requirements is unclear. Regardless, this variance demonstrates a weakening of the intent of the requirement to hold ASC farms to a higher Standard than that imposed by local regulators.

Findings

- Over half of ASC's approved variances relate directly to the Salmon Standard.
- The majority of audits cite at least one variance. The average audit references 2.4 variances. On average, B.C. farms have the most variances of all regions.
- Only 21 per cent of certified farms followed the Standard as written (i.e. without varied criteria).
- ASC's variance process sometimes overrides the multi-stakeholder agreements on which the Standard's social licence is based. The process lacks stakeholder engagement, as well as independent technical and scientific advice.
- A number of variances depart from the Standard and defer to government regulations. Many of these variances were found to weaken the requirements and, thereby, also the intent to hold farms to a higher Standard than those imposed by local regulators. B.C. farms have the greatest number of distinct variances that replace criteria from the Standard with government regulation.
- Variances can become precedent-setting, *defacto* regional changes to the Standard. The ability for auditors to reuse variances has resulted in a number of variances being applied at a regional level to the benefit of all farms within that area. This means farms are held to different Standard requirements in different regions. Additionally, variances have no expiration date. This results in the ability for auditors to apply them indefinitely with no requirement to assess or explain their continued applicability (unless an operational or CAR review alters the requirement).
- Variances can enable farms that would otherwise be in major non-conformance with the Standard to be certified. This is particularly the case for B.C. salmon farms, where failure to control sea lice would prevent farms from being certified but for the variance.
- Auditors often apply variances as exemptions from Standard requirements. Conformance with the varied criteria can go unassessed. There is evidence to suggest such practice has allowed environmental impacts, such as the benthic impacts from Tasmania's Macquarie Harbour farms, to be missed.

Conclusion

This review assessed global and regional ASC certified farm conformance and performance with the Salmon Standard. It found that, for the most part, certified farms did meet the thresholds for the following indicators: reported escapes, maximum viral disease mortality, antibiotic use, the parasiticide treatment index (PTI) score, wild fish in feed ratios and marine mammal deaths. In fact, the high level of conformance with the PTI threshold suggests that the operational review of this criterion is unwarranted. Certified farms' public reporting on Standard metrics was found to be relatively compliant. Often the reporting is above what government authorities require or, if required, is provided in a timelier manner.

Conversely, it was found that no farms conformed with all the ABM requirements as written in the Standard's appendix. Meeting sea lice-related indicators such as on-farm sea lice counts and sea lice monitoring on wild fish was found to be inconsistent, as evidenced by the number of variances used for these. Faroes and Scottish farms recorded on-farm sea lice levels up to 21 times the ASC threshold. While B.C. farms recorded sea lice levels up to 10 times their varied threshold. Atlantic farms are typically exempted, by way of variances, from demonstrating that some sort of monitoring of sea lice levels on wild out-migrating salmonid juveniles is occurring. These are essential Standard requirements intended to protect wild salmon from potential farm-derived impacts.

Despite the Standard requiring 100 per cent conformance, non-conformities are regularly raised and farms can be certified with open minor non-conformities. The average salmon farm is certified with 2.33 (closed) major and 9.3 (open or closed) minor non-conformities. The auditors' guidance document, known as the Certification and Accreditation Requirements (CAR), provides rules and deadlines for addressing and closing non-conformities including when outstanding open non-conformities should lead to suspension. The ASC has given an interpretation that violates these CAR rules by allowing certified farms to have indefinitely open major non-conformities (with an action plan and assessed progress but no specified deadline) and all the while still being able to use the eco-label.

Variances can represent substantial alterations to the Standard criteria. The Salmon Standard has, by far, the largest number of variances of any ASC Standard. The average salmon farm audit cites 2.4 variances. This report reviewed the extent and impact of these departures from the written Standard. It was found that variances enable farms that would otherwise be in major non-conformance with the Standard to be certified. Some of the most controversial farms (such as those with high PTI scores, B.C.'s high sea lice levels and Tasmania's Macquarie Harbour farms with water quality and benthic impacts) have benefited from variances. It was found that the ASC's variance approval process lacks stakeholder engagement, as well as independent technical and scientific advice. The process overrides the multi-stakeholder agreements on which the Standard's social licence is based.

In addition, a number of auditing processes of concern were also found. The ASC's suspension and revocation rules appear to be inadequate to stop farms in major non-conformance with the Standard from selling their product as ASC certified. Furthermore, the interpretation by ASC that excludes intermediary farms from audit conformance causes a number of challenges: from missing instances of non-conformance to false and underreported metric values.

Organisations like the GSI have announced that they intend to acquire certification for all their member farms by 2020. Given the importance of farmed salmon to the ASC scheme, this puts the ASC and third-party auditors under some pressure to bring more farms on board. Therefore, for the ASC to maintain its claims of representing best practice and its reputation among all stakeholders, it is crucial that the ASC be extremely cautious and rigorous with its handling of non-conformities, variances, metric reporting and changes to the stringency of the Standard's requirements. The evidence suggests that

amendments to the Standard through variances, interpretations and operational reviews, such as the PTI proposal, have or could weaken the scheme's adherence to best practices.

This creates a question as to whether the ASC's theory of change is being operationalized: is the Standard still focused on incentivising best practices in order to access market premiums for more sustainable seafood? Or, has it shifted toward merely excluding the worst performers in favour of bringing more farms into the program?

The strength of the ASC's certification scheme derives in part from the social licence it built through its foundational Aquaculture Dialogues. Changes and processes that weaken the Standard, or undermine compromises and agreements from those dialogues, have the potential to erode that social licence, reduce or reverse environmental and social gains incentivised by the Standard and devalue the credibility of the certification's "responsibly farmed" eco-label in the marketplace. The intent of this report is to provide the rationale and options for immediate and medium-term actions the ASC can take to reform key deficiencies and maintain or enhance the scheme's credibility and its positive environmental and social impact.

Recommendations

This global review of the ASC Salmon Standard has identified a number of concerns that have the potential to erode the credibility of the certification. SeaChoice recommends the ASC implement the actions below.

Aside from specific Salmon Standard noted actions (i.e. relating to the PTI and FFDR), the following recommendations are easily applicable to all ASC Standards as many recommendations stem from concerns systemic across the ASC scheme. For example, the auditing processes and variances are relevant to all ASC certifications, regardless of the species Standard.

Auditing Processes

1. Strengthen the Quality Assurance (QA) framework

a. Ensure CABs submit audit reports to the ASC for posting on the website by the required timeline as outlined in the CAR. Assess conformance to this requirement under the Quality Assurance (QA) framework.
b. Continue to monitor under the QA framework that CABs are providing the required metrics to demonstrate conformance with the Standard; raising non-conformance appropriately and consistently; and closing non-conformance within the stipulated time limits.
c. Consider developing a public data reporting template for use on company websites to ensure reporting consistency and accessibility; this template should include current and historical data over the validity of the farm's certificate. Ensure public reporting is at the farm level and not aggregated.
d. Ensure Standard indicators that rely on data from a complete production cycle are applied as such (i.e. not by production cycle stage). Incorporate this into QA framework reviews.

2. Clarify the application and consequence of non-conformities

a. Validate the Standard's stated 100 per cent conformance requirement by reinforcing that farms are either 'conforming' (i.e. meets the Standard) or 'non-conforming' (i.e. does not meet the Standard). Minor non-conformities should be non-critical in nature (e.g. administrative). Farms in major non-conformance to the Standard should not be certified.
b. Modify the CAR to require major non-conformities identified during the validity of a certificate be raised immediately upon identification and, if still open at time of harvest, stipulate that the ASC label should not be used.
c. Amend the CAR to provide further guidance for the suspension, re-instatement and withdrawal of certificates, paying attention to the timely disclosure of evidence supporting these decisions, transparency and stakeholder engagement.
d. Adopt a specific rule that suspension must be enforced at any time the auditor becomes aware of major non-conformance (that would dis-entitle an applicant on an initial audit of certification) in order to bring the CAR in line with the Salmon Standard that requires 100 per cent conformance with the Standard.

e. Provide guidance to CABs to ensure that when early audits occur, a minor non-conformity must be raised against requirement 17.1.2.1 which states: "All clients seeking certification shall have available records of performance data covering the periods of time specified in the Standard(s) against which the audit(s) is to be conducted". This non-conformity should be closed out on receipt of full production cycle performance data from the client and when such data[xxiii] has been reviewed for Standard conformance.

Standard Conformance and Performance

3. Revise the PTI proposal to reflect actual global 'best practice'.

a. Do not allow regional variations. While it is recognized that there are environmental variabilities across regions, the Standard should continue to define what is the top global performance (i.e. top 15 to 20 per cent of industry producers).
b. Do not remove potential lobster impacts from the criteria. Ban parasiticide application during the moulting period of relevant species in regions where potential impacts could occur. Require farms in these regions to map lobster settlement grounds in relation to the farm site location, and assess potential impacts under siting criteria.
c. Require an acceptable ABM parasiticide load to be more aligned with ASC's stated best practice. Establish a cumulative effect indicator that assesses the number of allowed treatments within the ABM.

4. Consider further reductions to the Fishmeal and Fish Oil Forage Fish Dependency Ratios (FFDRm and FFDRo) indicators.

a. SeaChoice recommends the following values: 1.0 FFDRm and 2.30 FFDRo to reflect current best practices.

5. Require further performance indicators to be publicly reported.

a. These should include, but not limited to: escapes, parasiticide and antibiotic use.

6. Develop an ABM approach to all Standards

a. Establish requirements for potential cumulative impacts in relation to Standard environmental indicators. The ASC Standards were created to be farm-site specific and are currently deficient in addressing cumulative impacts of collective certified farms.

Variance Requests and Interpretations

7. Improve the Variance Request process and its application

a. Incorporate expert and stakeholder input into the variance request approval process. Reassess existing variances following a stakeholder inclusive process where needed.
b. Eliminate variances that permanently change a Standard requirement (metric, indicator, procedure) unless specifically envisioned in the Standard. Any such amendments should occur via an operational review only.
c. Revise the CAR to prevent the application of variances to subsequent applications for certification in the absence of express evidence that "identical situations" exist. Consider stipulating the evidentiary requirements in more detail. At approval, the ASC VR-Committee should define the variance's scope to avoid incorrect reapplication by CABs (e.g. applicable farm, area, time period with expiration date, etc).

[xxiii] Full production cycle performance data should include, but not limited to: i) end-of-cycle calculations, such as estimated unexplained loss, total disease mortality, total antibiotic and parasiticide use and ii) indicators that focus on whether an event occurs beyond a stipulated threshold during a stated period up to and including the production cycle under audit, such as maximum number of lethal incidents, on-farm lice levels and escapes.

d. Include the application of variances within audits in the quality assurance program to ensure CABs are applying varied criteria to conformance and are not using them as exemptions or Standard-altering precedents.

8. Ensure the interpretations platform is used for clarifications only

a. The platform should be used strictly for providing clarification to auditors and not for interpretations that amend the intent of the Standard or CAR. Such interpretation amendments should be done in consultation with the Technical Advisory Group and via an operational review where appropriate.
b. Rescind the ASC interpretation that states intermediary sites are "out of scope". Align the CAR and Salmon Standard definitions of Unit of Certification to ensure that audits assess the complete production cycle impacts. Consider a specific direction to include hatchery, nursery and initial grow-out or other intermediary sites in the assessment, accounting for all relevant Standard indicators at all sites within the unit of certification.
c. Correct the ASC interpretation, which states the closure of a major non-conformity may be extended without an ASC defined deadline, to correctly reflect the CAR's stipulated timelines for closing a major non-conformance, the onetime three month extension and suspension after six months.

Monitoring and Evaluation

9. Demonstrate that ASC certification is leading to sustainability improvements

a. Conduct a data driven analysis to determine if certified farms are improving their practices.

References

1 FAO (2018) The State of World Fisheries and Aquaculture 2018 – Meeting the sustainable development goals. Rome. Available at: http://www.fao.org/3/i9540en/I9540EN.pdf [Accessed July 2018].

2 Potts, J, Wilkings, A, Lynch, M & McFatridge, S (2016). State of Sustainability Initiatives Review: Standards and the Blue Economy. Available at: https://www.iisd.org/sites/default/files/publications/ssi-blue-economy-2016.pdf [Accessed April 2018]

3 Jonell, M, Phillips, M, Ronnback, P & Troell, M (2013). Eco-certification of Farmed Seafood: Will it Make a Difference?, Ambio, vol. 42, pp. 659-674.

4 Tlusty, M (2011). Environmental improvement of seafood through certification and ecolabelling: theory and analysis, Fish and Fisheries, vol. 13, pp. 1-13.

5 Ibid.

6 Bailey, M, Parker, H, Schiller, L, Tlusty, M & Swartz, W (2018). The role of corporate social responsibility in creating a Seussian world of seafood sustainability, Fish and Fisheries, Available at: https://onlinelibrary.wiley.com/doi/abs/10.1111/faf.12289

7 Tlusty, M (2011). Environmental improvement of seafood through certification and ecolabelling: theory and analysis, Fish and Fisheries, vol. 13, pp. 1-13.

8 Parkes, G, Young, JA, Walmsley, SF, Abel, R, Harman, J, Horvat, P, Lem, A, McFarlane, A, Mens, M & Nolan, C (2010) Behind the signs – a global review of fish sustainability information schemes, Reviews in Fisheries Science, vol. 18, pp. 344–356.

9 ASC (2018). History. https://www.asc-aqua.org/about-us/history/ [Accessed March 2018].

10 WWF Global (2010). Aquaculture Stewardship Council appoints independent accreditation agency. http://wwf.panda.org/wwf_news/?194990/Aquaculture-Stewardship-Council-appoints-independentaccreditation-agency [Accessed March 2017].

11 Tassal (2018). "Gold Standard" Accreditation for Tassal An Australian Aquaculture Industry First http://tassalgroup.com.au/gold-Standard-accreditation-for-tassal-an-australian-aquaculture-industry-first/ [Accessed June 2018].

12 Cermaq (2016). Two Cermaq Canada salmn farms near Campbell River certified to "Gold Medal" ASC Standard https://www.cermaq.com/wps/wcm/connect/cermaq-ca/news/two-cermaq-canada-salmon-farms-near-campbell-river-certified-to-gold-medal-asc-Standard/ [Accessed June 2018].

13 ASC (2014). ASC Theory of Change. Available at: https://www.asc-aqua.org/wpcontent/uploads/2017/07/Theory-of-Change_2014_FINAL.pdf [Accessed March 2018]

14 ASC (2018) Certification Update: May 2018. https://mailchi.mp/asc-aqua/xr162vrjvq 2157917?e=[UNIQID] [Accessed May 2018].

15 ASC (2018). We've got more great news to share! https://pbs.twimg.com/media/DbDYlf-W4AARMqr.jpg [Accessed April 2018].

16 FAO (2018) The State of World Fisheries and Aquaculture 2018 – Meeting the sustainable development goals. Rome. Available at: http://www.fao.org/3/i9540en/I9540EN.pdf [Accessed July 2018].

17 ASC (2012). Salmon Standard handed over to ASC. https://www.asc-aqua.org/news/latest-news/salmonStandard-handed-over-to-asc/ [Accessed February 2018].

18 ASC (2014) First salmon farm achieves ASC certification. https://www.asc-aqua.org/news/latest-news/firstsalmon-farm-achieves-asc-certification/ [Accessed February 2018].

19 Roebuck, K & Wristen, K (2017). Aquaculture Stewardship Council (ASC) in Canada: Technical Report. SeaChoice, September 2017. Available at: http://www.seachoice.org/wp-content/uploads/2017/09/ASC-SeaChoice-Technical-Report-FINAL.pdf

20 Thorstad, E.B & Finstad, B. (2018). Impacts of salmon lice emanating from salmon farms on wild Atlantic salmon and sea trout. NINA Report 1449, pp. 1-22. Available at: https://brage.bibsys.no/xmlui/bitstream/handle/11250/2475746/1449.pdf?sequence=1&isAllowed=y [Accessed June 2018].

21 Miranda, C.D, Godoy, F.A & Lee, M.R (2018). Current Status of the Use of Antibiotics and the Antimicrobial Resistance in the Chilean Salmon Farms, Frontiers in Microbiology, vol. 9, pp.1284-1290.

22 The Guardian (2017). Salmon farming in crisis: 'We are seeing a chemical arms race in the seas'. https://www.theguardian.com/environment/2017/apr/01/is-farming-salmon-bad-for-the-environment [Accessed June 2018].

23 Cascadia Magazine (2018). Swanson Occupation: The battle for wild salmon https://www.cascadiamagazine.org/features/swanson-occupation-the-battle-for-wild-salmon/ [Accessed June 2018].

24 ASC (2018). Our Standards. https://www.asc-aqua.org/what-we-do/our-Standards/ [Accessed May 2018].

25 ASC (2018). Creation of our initial Standards. https://www.asc-aqua.org/what-we-do/our-Standards/history-of-our-Standards/ [Accessed May 2018].

26 ASC (2010). Aquaculture Stewardship Council Supervisory Board Regulations. https://www.ascaqua.org/wpcontent/uploads/2017/06/var_www_asc2010_upload_20110421_Regulations_SB_posted_on_website.pdf [Accessed March 2017].

27 ASC (2012). ASC TAG TOR and Rules. Available at: https://www.asc-aqua org/wpcontent/uploads/2017/07/ASC-TAG-TOR-and-Rules_v-1-0_20120927.pdf [Accessed March 2017].

28 ASC (2018). About our certification. https://www.asc-aqua.org/what-you-can-do/get-certified/about-our-certification/ [Accessed May 2018].

29 ASC (2017). ASC Certification and Accreditation Requirements. Version 2.1. August 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Certification-and-Accreditation-Requirements-v.2.1_including-multi-site_clean-1.pdf [Accessed May 2018].

30 ASC (2018). Governance. https://www.asc-aqua.org/about-us/governance/ [Accessed April 2018].

31 ASC (2018). Multi-site certification. ttps://www.asc-aqua.org/what-we-do/programme-improvements/multi-site-certification/ [Accessed May 2018].

32 ASC (2018). Group certification. https://www.asc-aqua.org/what-we-do/programme-improvements/group-certification/ [Accessed April 2018].

33 ASC (2018). Governance. https://www.asc-aqua.org/about-us/governance/ [Accessed April 2018].

34 ASC (2018) Provide input https://www.asc-aqua.org/what-you-can-do/participate/provide-input/ [Accessed March 2017].

35 ASC (2018). Get certified: Farms https://www.asc-aqua.org/what-you-can-do/get-certified/farms/ [Accessed March 2017].

36 ASC (2018). Governance. https://www.asc-aqua.org/about-us/governance/ [Accessed April 2018].

37 MSC (2017). Chain of Custody Partnerships. https://www.msc.org/get-certified/supply-chain/chain-ofcustody-partnerships-asc [Accessed April 2017].

38 ASI (2018). Aquaculture Stewardship Council (ASC). http://www.accreditation-services.com/programs/asc
[Accessed April 2017].
39 ASC (2018). Provide Input, Complaints and objections procedures. https://www.asc-aqua.org/what-you-cando/participate/provide-input/ [Accessed March 2018].
40 ISEAL Alliance (2018). About us http://www.isealalliance.org/about-us [Accessed March 2018].
41 ASC (2017). Find a farm. http://asc.force.com/Certificates/ [Accessed April 2018].
42 ASC (2017). ASC Certification and Accreditation Requirements. Version 2.1. August 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Certification-and-Accreditation-Requirements-v.2.1_including-multi-site_clean-1.pdf [Accessed May 2018].
43 Tassal (2016). Tassal Sustainability Report 2016. Available at: http://www.tassal.com.au/wp-content/uploads/2013/12/Tassal-Sustainability-Report-2016.pdf [Accessed June 2018].
44 Ryan, MA (2016). Tassal Group Limited letter addressed to ABC Four Corners. Available at: http://www.abc.net.au/reslib/201610/r1631821_24948899.pdf [Accessed June 2018].
45 ASC (2017) Costs for using the ASC logo. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/06/ASC-Costs-Document-January-2017.pdf [Accessed June 2018].
46 ASC (2017). ASC Salmon Standard Version 1.1 April 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Standard_v1.1.pdf [Accessed April 2017].
47 Ibid.
48 Ibid.
49 Ibid.
50 DNV GL – Business Assurance. ASC Salmon Standard Audit Report: ASC Initial Audit Final Report Salmones
Multiexport S.A. Chile. Arbolito site. Available at:
http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertD
etails2%3Fid%3Da01 24000008Rwj6AAC&file=00P24000005ogn2EAA [Accessed April 2017].
51 ASC (2018). ASC Interpretations Platform. http://variance-requests.asc-aqua.org/ [Accessed April 2018].
52 ASC (2016). CAR V.2 Audit Report Template. Available at: https://www.asc-aqua.org/wpcontent/
uploads/2017/07/ASC-Salmon-Audit-Manual_v1.1-1.pdf [Accessed July 2017].
53 ASC (2017). ASC Certification and Accreditation Requirements. Version 2.1. August 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Certification-and-Accreditation-Requirements-v.2.1_including-multi-site_clean-1.pdf [Accessed May 2018].
54 ASC (2018). About our certification. https://www.asc-aqua.org/what-you-can-do/get-certified/about-our-certification/ [Accessed May 2018].
55 ASC (2014). ASC Theory of Change. Available at: https://www.asc-aqua.org/wpcontent/
uploads/2017/07/Theory-of-Change_2014_FINAL.pdf [Accessed March 2018].
56 FAO (2018) The State of World Fisheries and Aquaculture 2018 – Meeting the sustainable development goals. Rome. Available at: http://www.fao.org/3/i9540en/I9540EN.pdf
[Accessed July 2018].
57 FAO (2018). Aquaculture Production Statistics.
http://www.fao.org/figis/servlet/SQServlet?file=/usr/local/tomcat/8.5.16/figis/webapps/figis/temp/hqp_7514990694878348268.xml&outtype=html [Accessed April 2018].
58 GSI (2018). Sustainability Certification – ASC Standard. https://globalsalmoninitiative.org/en/what-is-the-gsi-working-on/sustainability-certification-asc-Standard/ [Accessed April 2018].
59 GSI (2018). The Path to the Future We All Want – Starts With Transparency https://globalsalmoninitiative.org/en/news/the-path-to-the-future-we-all-want-starts-with-transparency/
[Accessed April 2018].
60 ASC (2018). We've got more great news to share! https://pbs.twimg.com/media/DbDYlf-W4AARMqr.jpg [Accessed April 2018].
61 ASC (2018) Certification Update: May 2018. https://mailchi.mp/asc-aqua/xr162vrjvq-2157917?e=[UNIQID] [Accessed May 2018].
62 BAP (2018). May2018 Newsletter.
63 ASC (2017) Certification Update: May 2017 https://mailchi.mp/asc-aqua/xr162vrjvq?e=[UNIQID] [Accessed May 2017].
64 ASC (2018) Certification Update: May 2018. https://mailchi.mp/asc-aqua/xr162vrjvq-2157917?e=[UNIQID] [Accessed May 2018].
65 ASC (2018) Certification Update: May 2018. https://mailchi.mp/asc-aqua/xr162vrjvq-2157917?e=[UNIQID] [Accessed May 2018].
66 ASC (2018) Certification Update: May 2018. https://mailchi.mp/asc-aqua/xr162vrjvq-2157917?e=[UNIQID] [Accessed May 2018].
67 ASC (2018). Direct communication.
68 ASC (2017). ASC Salmon Standard Version 1.1 April 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Standard_v1.1.pdf [Accessed April 2017].
69 ASC (2018). What makes us different? Available at: https://www.asc-aqua.org/what-we-do/our-approach/what-makes-us-different/ [Accessed April 2018].
70 ISEAL (2018) Assuring Conformance with Social and Environmental Standards ISEAL Code of Good Practice. Version 2.0. January 2018. Available at:
https://www.isealalliance.org/sites/default/files/resource/2018-02/ISEAL_Assurance_Code_Version_2.0.pdf [Accessed April 2018].
71 Ibid.
72 SAI Global (2014). Aquaculture Stewardship Council Salmon Standard Final Assessment Report. Non-confidential issue. Marsh Bay farm site. Available at:
http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Frid%3Da0124000008RwkHAAS&file=00P24000005L2nwEAC
[Accessed April 2018].
73 ASC (2018). Programme assurance. https://www.asc-aqua.org/what-we-do/programme-assurance/ [Accessed May 2018].
74 ASC (2017). ASC Response to SeaChoice Report Aquaculture Stewardship Council (ASC) certification in Canada: Technical Report. Available at: https://www.asc-aqua.org/news/latest-news/asc-response-seachoice-report-aquaculture-stewardship-council-asc-certification-canada-technical-report-2/ [Accessed April 2018].
75 Ibid.
76 ASC (2017). Audit Manual – ASC Salmon Standard v1.1. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Audit-Manual_v1.1-1.pdf [Accessed April 2018].
77 MHC (2018). Additional Information Sharing. http://marineharvest.ca/planet/environmental_commitment/additional-data-reporting/ [Accessed April 2018].
78 BarentsWatch (2018). Norwegian fish health. https://www.barentswatch.no/en/fishhealth/ [Accessed April 2018].
79 GSI (2018). Sustainability Report. https://globalsalmoninitiative.org/en/sustainability-report/sustainability-indicators/ [Accessed April 2018].
80 ASC (2017). ASC Salmon Standard Version 1.1 April 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Standard_v1.1.pdf [Accessed April 2017].
81 ASC (2017). ASC Certification and Accreditation Requirements Version 2.1. August 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Certification-and-Accreditation-Requirements-v.2.1_including-multi-site_clean-1.pdf [Accessed March 2018].

82SCS Global Services (2016). ASC Full-Assessment Report for Cermaq Chile S.A. Estero Navarro Farm. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000MM5fTAAT&file=00P24000009kTe8EAG [Accessed June 2018].

83Bureau Veritas Certification (2016). Form 3- Public Disclosure Form, Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000SRDaYAAX&file=00P2400000Cs6XdEAJ [Accessed June 2018].

84 SAI Global (2016). Aquaculture Stewardship Council. Salmon Standard. Final Assessment Report. Nonconfidentialissue. Marine Harvest Canada. Monday Rock, Quatsino Sound. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertD etails2%3Fid%3Da012400000KFkCYAA1&file=00P24000007jSkKEAU [Accessed March 2017].

85 ASC (2018). VR 139: Sampling during peak biomass. Available at: http://variance-requests.asc-aqua.org/questions/vr-139/ [Accessed April 2018].

86 Roebuck, K & Wristen, K (2017). Aquaculture Stewardship Council (ASC) in Canada: Technical Report. SeaChoice, September 2017. Available at: http://www.seachoice.org/wp-content/uploads/2017/09/ASC-SeaChoice-Technical-Report-FINAL.pdf

87 ASC (2017). ASC Response to SeaChoice Report Aquaculture Stewardship Council (ASC) certification in Canada: Technical Report. Available at: https://www.asc-aqua.org/news/latest-news/asc-response-seachoice-report-aquaculture-stewardship-council-asc-certification-canada-technical-report-2/ [Accessed April 2018].

88 ASI (2016). Living Oceans Society vs. SAI Global Assurance at ASC-SAI-002 Marine Harvest Canada Marsh Bay Farm Site. Complaint Investigation Report: Public Summary COMP201509152 Available at: http://www.accreditation-services.com/document/complaint-living-oceans-society-vs-sai-global-assurance-atasc-sai-002/ [Accessed March 2017].

89 SAI Global (2016). Aquaculture Stewardship Council. Salmon Standard. Final Assessment Report. Nonconfidentialissue. Marine Harvest Canada. Monday Rock, Quatsino Sound. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertD etails2%3Fid%3Da012400000KFkCYAA1&file=00P24000007jSkKEAU [Accessed March 2017].

90 ASC (2018). VR 139: Sampling during peak biomass. Available at: http://variance-requests.asc-aqua.org/questions/vr-139/ [Accessed April 2018].

91 ASC (2018). VR 22: Benthic biodiversity and water quality. http://variance-requests.asc-aqua.org/questions/vr-22/ [Accessed April 2018].

92 ASC (2018). VR 88: Sea lice monitoring. http://variance-requests.asc-aqua.org/questions/vr-88-sea-lice-monitoring/ [Accessed April 2018].

93 ASC (2018). VR 141: Maximum on-farm lice levels. http://variance-requests.asc-aqua.org/questions/vr-141-maximum-on-farm-lice-levels/ [Accessed April 2018].

94 ASC (2018). VR 143: Background copper concentrations. http://variance-requests.asc-aqua.org/questions/vr-143-background-copper-concentrations/ [Accessed April 2018].

95 ASC (2018). VR 144: Background copper levels. http://variance-requests.asc-aqua.org/questions/vr-144-background-copper-levels/ [Accessed April 2018].

96 ASC (2017). Audit Manual – ASC Salmon Standard v1.1. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Audit-Manual_v1.1-1.pdf [Accessed April 2018].

97 ASC (2018). VR 42: Sea lice counts in wild salmonids. http://variance-requests.asc-aqua.org/questions/vr-42-sea-lice-counts-in-wild-salmonids/ [Accessed April 2018]

98 ASC (2017). Marine Harvest Norway ASC-DNV-167090 Available at: http://asc.force.com/Certificates/ASCCertDetails2?id=a0124000008RwiwAAC [Accessed April 2018].

99 Bureau Veritas Certification (2018). Form 3 – Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwmuAAC&file=00P1o00000v9zscEAA [Accessed April 2018].

100 Bureau Veritas Certification (2017). Form 3 – Public Disclosure Certification. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwmGAAS&file=00P1o00000vA0AdEAK [Accessed April 2018].

101 SAI Global (2017). Form 3 – Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwkPAAS&file=00P2400000fGwJREAS [Accessed April 2018].

102 ASC (2017). ASC Salmon Standard Version 1.1 April 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Standard_v1.1.pdf [Accessed April 2017].

103 Musgamagw Dzawada'enuxw Nation (2018). Musgamagw Dzawada'enuxw are removing fish farms from their unceeded territory. Link Arms with Us. https://cleansingourwaters.com/ [Accessed June 2018].

104 BCAFN (2018). BC Regional Chief Terry Teegee Stands with 'Namgis First Nation in Support of their Jurisdiction over Fish Farms in the Broughton Archipelago http://bcafn.ca/bc-regional-chief-terry-teegee-stands-with-namgis-first-nation-in-support-of-their-jurisdiction-over-fish-farms-in-the-broughton-archipelago/ [Accessed June 2018].

105 Phillips Watershed Recovery Initiative (2017). Fish farm operations in Phillips Arm. http://www.pwr-initiative.com/finfish-aquaculture [Accessed June 2018].

106 Musgamagw Dzawada'enuxw Tribal Council (2016). Cleansing Our Waters. http://www.mdtc.ca/cleansing-our-waters [Accessed June 2018].

107 Gathering Allies (2018). Fish Farm Occupations. https://www.gatheringallies.org/fish-farm-occupations/ [Accessed June 2018].

108 North Island Gazette (2018). First Nation files judicial review of provincial salmon farm tenure extensions. https://www.northislandgazette.com/news/first-nation-files-judicial-review-of-provincial-salmon-farm-tenure-extensions/ [Accessed June 2018].

109 'Namgis First Nation (2018). 'Namgis First Nation sues to prevent restocking of open-net fish farm at Swanson Island without DFO testing for disease http://www.namgis.bc.ca/wp-content/uploads/2018/03/2018Mar13-NamgisRelease-Aquaculture.pdf [Accessed June 2018].

110 Acoura Marine Ltd (2017). Form 3 - Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000V7tyIAAR&file=00P1o00000vCUr1EAG [Accessed June 2018].

111 SAI Global (2017). Form 3 – Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000vAgzIAAC&file=00P1o00000nmyRwEAI [Accessed June 2018].

112 SAI Global (2017). Form 3 – Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000vAgsKAAS&file=00P1o00000pafbAEAQ [Accessed June 2018].

113 SAI Global (2017). Form 3 – Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000tTx6EAAS&file=00P2400000csIQZEAY [Accessed June 2018].

114 SAI Global (2017). Form 3 – Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000tTx5pAAC&file=00P2400000ZnxykEAB [Accessed June 2018].

115 SAI Global (2017). Form 3 – Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000tTwyxAAC&file=00P2400000ZoLSmEAN [Accessed June 2018].

116 SAI Global (2017). Form 3 – Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000hl06VAAQ&file=00P2400000ToOQhEAN [Accessed June 2018].

117 Ibid.

118 SAI Global (2017). Form 3 – Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000hl06VAAQ&file=00P2400000ToOQhEAN [Accessed June 2018].

119 ASC (2017). ASC Certification and Accreditation Requirements. Version 2.1. August 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Certification-and-Accreditation-Requirements-v.2.1_including-multi-site_clean-1.pdf [Accessed May 2018].

120 Acoura Marine Ltd (2017). Form 3 – Public Disclosure Form. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwjIAAS&file=00P2400000VUssTEAT [Accessed June 2018].

121 ASC (2018). Variance Requests. Available at: http://variance-requests.asc-aqua.org/wp-content/uploads/Variance-Requests-20180716-1.xlsx [Accessed June 2018].

122 SCS Global Services (2018). Aquaculture Stewardship Council Salmon Standard. Initial Certification Assessment Report. Aquachile S.A. Quilque Sur Farm. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000018tCdAAAU&file=00P1o00000vB6R4EAK [Accessed June 2018].

123 SCS Global Services (2017). Aquaculture Stewardship Council Salmon Standard. 2017 Surveillance Assessment Report. Petuna Seafoods – MF178 Longreach. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000R7N56AAF&file=00P1o00000t95TREAY [Accessed June 2018].

124 ASC (2018). ASC Interpretations Platform http://variance-requests.asc-aqua.org/ [Accessed June 2018].

125 ASC (2018). Q&A6_CAR_v.2.0_17.10.1.2.d.iii http://variance-requests.asc-aqua.org/questions/qa6_car_v-2_17-10-1-2-d-iii/ Accessed [June 2018].

126 ASC (2017). ASC Salmon Standard Version 1.1 April 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Standard_v1.1.pdf [Accessed April 2017].

127 Monterey Bay Aquarium Foundation (2018). https://www.seafoodwatch.org/ocean-issues/aquaculture [Accessed May 2018].

128 Young, O.R, Osherekо, G, Ekstrom, J, Crawder, L.B, Ogeden, J, Wilson, J.A, Day, J.C, Douvere, F, Ehler, C.N, McLeod, K.L, Halpren, B.S & Peach, R (2007). Solving the Crisis in Ocean Governance: Place-Based Management of Marine Ecosystems, Environment: Science and Policy for Sustainable Development, vol. 49, pp. 20-32.

129 Murray, A.G & Salama, N.K.G (2016). A simple model of the role of area management in the control of sea lice, Ecological Modelling, vol. 337, pp. 39-47.

130 Peacock, S.J, Krkosek, M, Proboszcz, S, Orr, C & Lewis, M.A (2013). Cessation of a salmon decline with control of parasites, Ecological Applications, vol. 3, pp. 606-620.

131 Werkman, M, Green, D.M, Murray, A.G & Turnball, J.F (2011). The effectiveness of fallowing strategies in disease control in salmon aquaculture assessed with an SIS model, Preventative Veterinary Medicine, vol. 98, pp. 64-73.

132 The International Bank for Reconstruction and Development/The World Bank (2014). Reducing Disease Risk in Aquaculture. World Bank Report Number 88257-GLB. Available at: http://documents.worldbank.org/curated/en/110681468054563438/pdf/882570REPLACEM00NAME0Reantaso0Melba.pdf [Accessed June 2018].

133 ASC (2017). ASC Salmon Standard Version 1.1 April 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Standard_v1.1.pdf [Accessed April 2017].

134 DPIPWE (2016). Macquarie Harbour Environmental and Fish Health Monitoring Review. Available at: http://dpipwe.tas.gov.au/sea-fishing-aquaculture/marine-farming-aquaculture/macquarie-harbour-environmental-and-fish-health-monitoring-review [Accessed May 2017].

135 EDO Tasmania (2018). Salmon Farming in Macquarie Harbour: timeline of key events. Available at: http://www.edotas.org.au/wp-content/uploads/2018/04/Mac-Harbour-timeline-update-April-2018.pdf [Accessed May 2018].

136 DPIPWE (2012). Area Management Agreement for salmonid aquaculture in Macquarie Harbour between Huon Aquaculture Group Pty Ltd Petuna Aquaculture Pty Ltd Tassal Operations Pty Ltd. Schedule 4: Data to be collected and retailed under the Macquarie Harbour Area Management Agreement. Version 1.0 December 2012. Available at: http://dpipwe.tas.gov.au/Documents/MHR%20- %20Area%20Management%20Agreement%20Schedule%204%20Data%20Collection.pdf [Accessed May 2018].

137 DPIPWE (2012). Area Management Agreement for salmonid aquaculture in Macquarie Harbour betweenHuon Aquaculture Group Pty Ltd Petuna Aquaculture Pty Ltd Tassal Operations Pty Ltd. Schedule 1: Macquarie Harbour Fish Health Management Plan. Version 1.0. December 2012. Available at: http://dpipwe.tas.gov.au/Documents/MHR%20-%20Area%20Management%20Agreement%20Schedule%201%20Fish%20Health%20Plan.pdf [Accessed May 2018].

138 SCS Global Services (2017). Aquaculture Stewardship Council Salmon Standard Re-Assessment Report. Tassal Operations Pty Ltd – Western Zone (MF 214 Middle Harbour and MF 219 Gordon). Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwkAAAS&file=00P2400000biTRmEAM [Accessed April 2018].

139 Huon Aquaculture (2017). Summary of Huon Aquaculture court proceedings regarding Macquarie Harbour. Available at: https://www.huonaqua.com.au/wp-content/uploads/2017/02/20170206-Summary-of-Huon-Aquaculture-court-proceedings-regarding-Macquarie-Harbour.pdf [Accessed May 2018].

140 Federal Court of Australia (2017). Huon Aquaculture Group Limited vs. Secretary, Department of Primary Industries, Parks, Water and Environment. https://www.comcourts.gov.au/file/Federal/P/TAD4/2017/3779740/event/28863696/document/949568 [Accessed May 2018].

141 Huon Aquaculture (2018). Huon Federal Court action to prove Tassal exceeding biomass limit. https://www.huonaqua.com.au/huon-federal-court-action-prove-tassal-exceeding-biomass-limit/ [Accessed May 2018].

142 ASC (2017). ASC Salmon Standard Version 1.1 April 2017. https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Standard_v1.1.pdf [Accessed April 2017].

143 ASC (2018). VR 145: Exception to Area Based Management. http://variance-requests.asc-aqua.org/questions/vr-145-exception-to-area-based-management/ [Accessed April 2017].
144 DFO (2016). Marine Finfish Aquaculture Licence under the Fisheries Act. Available at: http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/licence-cond-permis-mar/licence-cond-permis-mar-eng.pdf [Accessed April 2017].
145 DFO (2018). Marine finfish aquaculture licence under the Fisheries Act – PART B. Licence conditions. http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/docs/licence-cond-permis-mar/col-cdp-eng.html [Accessed May 2018].
146 Bateman, A, Peacock, SJ, Connors, B, Polk, Z, Berg, D, Krkošek, M & Morton, A 2016, 'Recent failure to control sea louse outbreaks on salmon in the Broughton Archipelago, British Columbia', Canadian Journal of Fisheries and Aquatic Sciences, vol. 73(8), pp.1164-1172.
147 ASC (2018). VR 145: Exception to Area Based Management. http://variance-requests.asc-aqua.org/questions/vr-145-exception-to-area-based-management/ [Accessed April 2017].
148 Aguilar-Manjarrez, J, Soto, D & Brummett, R (2017). Aquaculture zoning, site selection and area management under the ecosystem approach to aquaculture. Full document, FAO/The World Bank, Rome, 2017. Available at: http://www.fao.org/3/a-i6992e.pdf [Accessed April 2018].
149 The International Bank for Reconstruction and Development/The World Bank (2014). Reducing Disease Risk in Aquaculture. World Bank Report Number 88257-GLB. Available at: http://documents.worldbank.org/curated/en/110681468054563438/pdf/882570REPLACEM00NAME0Reantaso0Melba.pdf [Accessed June 2018].
150 Arriagada, G, Stryhn, H, Sanchez, J, Vanderstichel, R, Campisto, J.L, Rees, E.E, Ibarra, R & StHilaire, S (2017). Evaluating the effect of synchronized sea lice treatments in Chile, Preventative Veterinary Medicine, vol. 136, pp. 1-10.
151 The International Bank for Reconstruction and Development/The World Bank (2014). Reducing Disease Risk in Aquaculture. World Bank Report Number 88257-GLB. Available at: http://documents.worldbank.org/curated/en/110681468054563438/pdf/882570REPLACEM00NAME0Reantaso0Melba.pdf [Accessed June 2018].
152 Grace, D (2015). Review of evidence on antimicrobial resistance and animal agriculture in developing countries. UK: Evidence on Demand. Available at: https://cgspace.cgiar.org/handle/10568/67092 [Accessed May 2018].
153 Bravo, S, Nunez, M & Silva, M.T (2013). Efficacy of the treatments used for the control of Caligus rogercresseyi infecting Atlantic salmon, Salmo salar L., in a new fish-farming location in Region XI, Chile, Journal of Fish Diseases, vol. 34, pp. 221-228.
154 Føroya landsstýri (2018). Faroese Salmon Renowned Around the World. https://www.faroeislands.fo/economy-business/aquaculture/ [Accessed May 2018]
155 Marine Institute (2018). Co-ordinated Local Aquaculture Management Systems – CLAMS. https://www.marine.ie/Home/site-area/areas-activity/aquaculture/sea-lice/co-ordinated-local-aquaculture-management-systems [Accessed May 2018].
156 Marine Institute (2018). Single Bay Management. https://www.marine.ie/Home/site-area/areas-activity/aquaculture/sea-lice/single-bay-management [Accessed May 2018].
157 DAFF (2008). A strategy for improved pest control on Irish salmon farms. Available at: https://www.agriculture.gov.ie/media/migration/seafood/aquacultureforeshoremanagement/SeaLiceControlStrategy%20230210.pdf [Accessed May 2018].
158 Marine Institute (2018). Single Bay Management. https://www.marine.ie/Home/site-area/areas-activity/aquaculture/sea-lice/single-bay-management [Accessed May 2018].
159 ASC (2017). VR 87: Restocking from alternative site. http://variance-requests.asc-aqua.org/questions/vr-87/ [Accessed May 2018].
160 Government of Norway (2017). Regjeringen skrur på trafikklyset. https://www.regjeringen.no/no/aktuelt/regjeringen-skrur-pa-trafikklyset/id2577032/ [Accessed May 2018].
161 Norwegian Veterinary Institute (2016). Fish Health Report 2016. Available at: https://www.vetinst.no/rapporter-og-publikasjoner/rapporter/2017/fish-health-report-2016 [Accessed May 2018].
162 Norwegian Veterinary Institute (2017). The surveillance programme for resistance to chermotherapeutant in salmon lice (Lepeophtheirus salmonis) in Norway 2016. Available at: https%3A%2F%2Fwww.vetinst.no%2Fen%2Fsurveillance-programmes%2Fsalmon-lice-resistance-to-chemotherapeutants%2F_%2Fattachment%2Fdownload%2Ffd60d105-b248-4d67-88d0-924104f8be2c%3A4a0b79025c2a0e35bd27d866cab22e84431e98d2%2F2017-%2520Salmon%2520lice%2520-%2520resistance%2520to%2520chemotherapeutants%25202016.pdf&usg=AOvVaw2MfKGRqYYHQHkvotIGvMEp [Accessed June 2018].
163 Fridtjof Nansen Institute (2017). Expanding aquaculture at the expense of wild salmon? https://www.fni.no/news/expanding-aquaculture-at-the-expense-of-wild-salmon-article1616-330.html [Accessed June 2018].
164 Kenyon, W & Davis, D (2018). Salmon Farming in Scotland. SPICe Briefing. The Scottish Parliament. Available at: https://sp-bpr-en-prod-cdnep.azureedge.net/published/2018/2/13/Salmon-Farming-in-Scotland/SB%2018-12%20rev.pdf [Accessed May 2018].
165 Scottish Salmon Producers Organisation and British Trout Association (2015). Code of Good Practice. Chapter 4: Seawater Lochs. Available at: http://thecodeofgoodpractice.co.uk/wp-content/uploads/2015/02/cogp-chapter-4-seawater-lochs2.pdf [Accessed May 2018].
166 Crown (2013). Aquaculture and Fisheries (Scotland) Act 2013. http://www.legislation.gov.uk/asp/2013/7/enacted [Accessed May 2018].
167 ASC (2018). VR 137: Sea lice monitoring. http://variance-requests.asc-aqua.org/questions/vr-137-sea-lice-monitoring/ [Accessed May 2018].
168 ASC (2017). Cooke Aquaculture Scotland ASC-F-0011 http://asc.force.com/Certificates/ASCCertDetails?id=a012400000KG31dAAD [Accessed June 2018].
169 Salmon and Trout Conservation Scotland (2018). A critique of the Scottish Government's new sea lice management policy for Scottish salmon farming. January 2018. Available at: https://www.salmon-trout.org/wp-content/uploads/2018/01/NASCO-Report-FINAL-1.pdf [Accessed June 2018]
170 ASC (2017). ASC Salmon Standard Version 1.1 April 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Standard_v1.1.pdf [Accessed April 2017].
171 ASC (2018). VR 141: Maximum on-farm lice levels. http://variance-requests.asc-aqua.org/questions/vr-141-maximum-on-farm-lice-levels/ [Accessed April 2018].
172 ASC (2018). VR 136: Sea lice counts and national regulation. http://variance-requests.asc-aqua.org/questions/vr-136-sea-lice-counts-and-national-regulation/ [Accessed April 2018].
173 ASC (2018). VR 138: Sea lice and wild salmon. http://variance-requests.asc-aqua.org/questions/vr-138-sea-lice-and-wild-salmon/ [Accessed April 2018].
174 Ibid.
175 Cermaq (2018). Research and Innovation. https://www.cermaq.com/wps/wcm/connect/cermaq-ca/cermaq-canada/our-promise/research-and-innovation/ [Accessed May 2018].
176 Revie, C, Dill, L, Finstad, B & Todd, C (2009). Sea Lice Working Group Report – NINA Special Report 39. Available at: http://www.nina.no/archive/nina/PppBasePdf/temahefte/039.pdf [Accessed May 2018].
177 Garseth, A.H, Fritsvold, C, Svendsen, J.C, Jensen, B.B & Mikalsen, A.B (2017). Cardiomyopathy syndrome in Atlantic salmon Salmo salar L.: A review of the current state of knowledge, Journal of Fish Diseases, vol. 41, pp. 11-26.
178 Kongtorp, R.T, Taksdal, T & Lyngoy, A (2004). Pathology of heart and skeletal muscle inflammation (HSMI) in farmed Atlantic salmon Salmo salar, Disease of Aquatic Organisms, vol. 59, pp. 217-224.
179 Mjaaland, S, Rimstad, E, Falk, K & Dannevig, B.H (1997), Genomic characterization of the virus causing infectious salmon anemia in Atlantic salmon (Salmo salar L.): an orthomyxo-like virus in a teleost, Journal of Virology, vol. 71, pp. 7681-7686.

180 Skall, H.F, Olesen, N.J & Mellergaard, S (2005), Viral haemorrhagic septicaemia virus in marine fish and its implications for fish farming – a review, Journal of Fish Diseases, vol. 28, pp. 509-529.

181 Tassal (2014). Sustainability Report 2013. Available at: http://www.tassal.com.au/wp-content/uploads/2014/04/131077 Tassal Sustain Report 2013-14_v8.pdf [Accessed April 2018].

182 ASC (2017). Audit Manual – ASC Salmon Standard v1.1. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Audit-Manual_v1.1-1.pdf [Accessed April 2018].

183 SCS Global Service (2014). Aquaculture Stewardship Council Salmon Standard Full Assessment Report. Tassal Operations Pty Ltd: Macquarie Harbour MF 214 and MF 219. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwkAAAS&file=00P24000005RQgXEAW [Accessed April 2018].

184 Intrafish (2016). Update: Nova Austral puts total salmon escapes at 10,000. http://www.intrafish.com/aquaculture/769546/update-nova-austral-puts-total-salmon-escapes-at-10000 [Accessed April 2018].

185 ASC (2017). Nova Austral ASC-DNV-197854 http://asc.force.com/Certificates/ASCCertDetails2?id=a012400000KG2umAAD [Accessed June 2018].

186 Marine Harvest (2016). Marine Harvest ASC report. Available at: http://marineharvest.com/globalassets/planet/asc-dashboard/norway/region-mid/valoyan/2016/valoyan-2016-july-08.pdf [Accessed June 2018].

187 SAI Global (2016). Aquaculture Stewardship Council Salmon Audit Report. 2nd Annual Surveillance Report. Marine Harvest Norway. Valoyan. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwkJAAS&file=00P2400000GJLGIEA5 [Accessed June 2018].

188 Bakkafrost (2018). ASC Report: Gulin / 2017. Available at: http://www.bakkafrost.com/media/1756/a06_y2018_w9.pdf [Accessed June 2018].

189 ABC (2018). Huon Aquaculture confirms 120,000 salmon escaped in May storms, amid calls for more industry 'transparency'. http://www.abc.net.au/news/2018-09-12/huon-aquaculture-salmon-death-revealed-amid-transparency-calls/10230846 [Accessed September 2018].

190 Bloomberg (2018). Great Salmon Escape Threatens to Taint Chile's Fish Farms. https://www.bloomberg.com/news/articles/2018-07-09/great-salmon-escape-threatens-to-taint-chile-fish-farm-industry [Accessed August 2018].

191 Control Union Peru (2018). Form 5-Report of Cancellation of an Audit for a New Applicant or Suspention, or Withdrawal of an Existing Certificate. http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400000MMEgpAAH&file=00P1o000019DwXdEAK [Accessed August 2018].

192 Arnold, S & Roebuck, K (2017). What's Behind the Label? Assessing the Impact of MSC and ASC Seafood Certifications in Canada. SeaChoice, September 2017. Available at: http://www.seachoice.org/wp-content/uploads/2018/02/Seachoice-ASCMSC-Report-Online.pdf.

193 SeaChoice (2018). Lousy B.C. farmed salmon enter market with ASC stamp of approval. http://www.seachoice.org/press-release/lousy-b-c-farmed-salmon-enter-market/

194 ASC (2018). ASC statement regarding sea lice issues in Clayoquot Sound Canada. https://www.asc-aqua.org/news/latest-news/asc-statement-regarding-sea-lice-issue-in-clayoquot-sound-canada/ [Accessed May 2018].

195 SAI Global (2018). ASC Form 5: Report of Cancellation of an audit for a new applicant or Suspension, or Withdrawal of an existing certificate. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da012400001CtNmMAAV&file=00P1o000012JNWtEAO [Accessed May 2018].

196 Powell, J & Podlasly, T (2015). Tenacibaculum maritum: Current Knowledge & Future Directions. Workshop Report and Synopsis. Available at: http://www.cahs-bc.ca/sites/default/files/Tenacibaculum_maritimum_Workshop_Final_Report.pdf [Accessed May 2018].

197 Morrison, D.B & Saksida, S (2013). Trends in antimicrobial use in Marine Harvest Canada farmed salmon production in British Columbia (2003--2011), The Canadian Veterinary Journal, vol. 54, pp. 160-1163.

198 SFW (2017). Atlantic and Coho salmon. Chile. Marine Net Pens. Available at: http://www.seafoodwatch.org/-/m/sfw/pdf/reports/s/mba_seafoodwatch_farmedchilesalmon_report.pdf [Accessed May 2018].

199 Undercurrent News (2017) AquaGen: Chile's salmon sector should aim for efficiency, not output. https://www.undercurrentnews.com/2017/09/11/aquagen-chiles-salmon-sector-should-aim-for-efficiency-not-output/ [Accessed June 2018].

200 ASC (2018). Operational review – pangasius, salmon. https://www.asc-aqua.org/what-we-do/programme-improvements/operational-review-salmon-pangasius-tilapia-Standards/ [Accessed May 2018].

201 ASC (2017). ASC Salmon PTI Standard Operational Review – Consultation Paper September 2017. Public Consultation. Proposals to replace ASC Salmon PTI indicators 5.2.5 and 5.2.6. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/Salmon-2-PTI-Operational-Review-Consultation-Paper-19-Sept-17.pdf [Accessed May 2018].

202 SeaChoice (2017). Re: ASC Salmon Standard Operational Review – 2nd PTI consultation. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/11/ASC-PTI-2nd-consultation-SeaChoice-stakeholder-submission.pdf

203 Revie, C, Dill, L, Finstad, B & Todd, C.D (2009). Sea Lice Working Group Report. -NINA Special Report 39. 117pp.

204 Burridge, L, Weis, J.S, Cabello, F, Pizarro, J & Bostick, K (2010). Chemical use in salmon aquaculture : A review of current practices and possible environmental effects. In: Aquaculture, Vol. 306, No. 1-4, 08.2010, p. 7-23.

205 Burridge, L.E., and Van Geest, J.L (2014). A review of potential environmental risks associated with the use of pesticides to treat Atlantic salmon against infestations of sea lice in Canada. DFO Canadian Science Advisory Secretariat Resource Document 2013/050(IV): 25 pp.

206 Page, F.H., and Burridge, L (2014). Estimates of the effects of sea lice chemical therapeutants on non-target organisms associated with releases of therapeutants from tarped net-pens and well-boat bath treatments: a discussion paper. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/103. v+ 36 p.

207 Coullard, C.M., and Burridge, L.E.(2015). Sublethal exposure to azamethiphos causes neurotoxicity, altered energy allocation and high mortality during simulated live transport in American lobster. Ecotoxicology and Environmental Safety, vol. 115, pp. 291-299

208 SARF098: Towards Understanding of the Environmental Impact of a Sea Lice Medicine –the PAMP Suite, (2016). A study commissioned by the Scottish Aquaculture Research Forum (SARF). Available at: http://www.sarf.org.uk [Accessed April 2018].

209 ASC (2017). ASC Salmon PTI Standard Operational Review – Consultation Paper September 2017. Public Consultation. Proposals to replace ASC Salmon PTI indicators 5.2.5 and 5.2.6. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/Salmon-2-PTI-Operational-Review-Consultation-Paper-19-Sept-17.pdf [Accessed May 2018].

210 GSI (2018). The Path to the Future We All Want – Starts With Transparency. https://globalsalmoninitiative.org/en/news/the-path-to-the-future-we-all-want-starts-with-transparency/ [Accessed April 2018].

211 Arnold, S & Roebuck, K (2017). What's Behind the Label? Assessing the Impact of MSC and ASC Seafood Certifications in Canada. SeaChoice, September 2017. Available at: http://www.seachoice.org/wp-content/uploads/2018/02/Seachoice-ASCMSC-Report-Online.pdf.

212 Roebuck, K & Wristen, K (2017). Aquaculture Stewardship Council (ASC) in Canada: Technical Report. SeaChoice, September 2017. Available at: http://www.seachoice.org/wp-content/uploads/2017/09/ASC-SeaChoice-Technical-Report-FINAL.pdf

213 ASC (2018). Q&A11_Smolts, temporarily held in saltwater, scope of the requirements of the ASC Salmon Standard. http://variance-requests.asc-aqua.org/questions/are-smolts-that-are-temporarily-held-in-saltwater-pens-but-are-not-yet-in-final-stage-grow-out-sites-within-scope-of-the-requirements-of-the-asc-salmon-Standard-v1-0-1-1-if-so-which-principl/ [Accessed April 2018].

214 ASC (2017). ASC Salmon Standard Version 1.1 April 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Standard_v1.1.pdf [Accessed April 2017].

215 Ibid.

216 DAFF (2007). National Assessment of Interactions between Humans and Seals: Fisheries, Aquaculture and Tourism. Available at: http://www.agriculture.gov.au/SiteCollectionDocuments/fisheries/environment/bycatch/sealassessment.pdf [Accessed May 2018].

217 DPC (2017). Seal relocations to end in Tasmania by Christmas. http://www.premier.tas.gov.au/releases/seal_relocations_to_end_in_tasmania_by_christmas [Accessed May 2018].

218 ABC (2017). Fishers angry over relocation of 'increasingly aggressive' seals to state's north west. http://www.abc.net.au/news/2017-08-07/relocation-of-seals-from-salmon-farms-angers-north-west-fishers/8780414 [Accessed May 2018].

219 Tassal (2018). Seal Interactions. http://dashboard.tassalgroup.com.au/our-planet/seal-interactions/ [Accessed May 2018].

220 Huon Aquaculture (2018). Seals. https://www.huonaqua.com.au/sustainability/wildlife/seals/ [Accessed May 2018].

221 ASI (2018). Public Summary of the Final Complain Investigation Report. Living Oceans Society about SAI Global @ Certificate Holder (ASC-SAI-002). COMP201612207. Available at: https://asi-login.my.salesforce.com/sfc/p/#A0000000aGza/a/1H000000kBP3/D_kmWEIPCBN4_rOFRJRjZ4aJrNEIvkP_fqKkvbm2iZg [Accessed June 2018].

222 ASC (2017). ASC Salmon Standard Version 1.1 April 2017. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Standard_v1.1.pdf [Accessed April 2017].

223 DFO (2018). Incidental catch 2011 – Ongoing. Available at: http://www.pac.dfo-mpo.gc.ca/od-ds/aquaculture/incidental-accidentel-2011-ongoing-rpt-pac-dfo-mpo-aquaculture-eng.csv [Accessed June 2018].

224 ASC (2017). Audit Manual – ASC Salmon Standard v1.1. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Audit-Manual_v1.1-1.pdf [Accessed April 2018].

225 ASC (2018). About our certification. https://www.asc-aqua.org/what-you-can-do/get-certified/about-our-certification/ [Accessed May 2018].

226 Roebuck, K & Wristen, K (2017). Aquaculture Stewardship Council (ASC) in Canada: Technical Report. SeaChoice, September 2017. Available at: http://www.seachoice.org/wp-content/uploads/2017/09/ASC-SeaChoice-Technical-Report-FINAL.pdf

227 ASC (2018). ASC Interpretations Platform. http://variance-requests.asc-aqua.org/ [Accessed April 2018].

228 ASC (2018). About our certification. https://www.asc-aqua.org/what-you-can-do/get-certified/about-our-certification/ [Accessed May 2018].

229 DPIPWE (2015) Macquarie Harbour Status Report. Available at: http://dpipwe.tas.gov.au/Documents/Report%20on%20the%20Status%20of%20Macquarie%20Harbour.pdf [Accessed April 2018].

230 IUCN (2018). Zearaja maugeana. http://www.iucnredlist.org/details/64442/0 [Accessed May 2018].

231 Knight, B, Forrest, B & Johnston, C (2015). Macquarie Harbour Environmental and Fish Health Monitoring Review. Report no. 2729. Cawthron Institute. Available at: http://dpipwe.tas.gov.au/Documents/Report%20Cawthron%20Review.pdf [Accessed April 2018].

232 ABC (2015). Leaked email shows salmon producers concerned over health of Tasmanian waterways they rely on. http://www.abc.net.au/news/2015-10-24/environmental-concerns-about-aquaculture-expansion-in-tasmania/6874462 [Accessed April 2018].

233 EDO Tasmania (2018). Salmon Farming in Macquarie Harbour: timeline of key events. Available at: http://www.edotas.org.au/wp-content/uploads/2018/04/Mac-Harbour-timeline-update-April-2018.pdf [Accessed May 2018].

234 EPA (2016). EPA Conformance Summary, Macquarie Harbour, September 2016. Available at: http://epa.tas.gov.au/Documents/MH%20lease%20boundary%20conformance%20summary%20September%202016.pdf [Accessed April 2018].

235 EPA (2017). EPA Conformance Summary, Macquarie Harbour, January 2017. Available at: http://epa.tas.gov.au/Documents/MH%20Lease%20Boundary%20Conformance%20Summary%20January%202017.pdf [Accessed April 2018].

236 Ross, J & MacLeod, C (2017). Environmental Research in Macquarie Harbour. Interim Synopsis of Benthic and Water Column Conditions. IMAS. January 2017. Available at: http://epa.tas.gov.au/Documents/IMAS%20Technical%20Report%20on%20Macquarie%20Harbour%20Condition.pdf [Accessed April 2018].

237 EPA (2017). EPA directs de-stocking of Macquarie Harbour salmon lease. http://epa.tas.gov.au/Pages/News.aspx?newsstory=3677 [Accessed April 2018].

238 EPA (2017). Macquarie Harbour Tasmanian Wilderness World Heritage Area Environmental Status Report, May 2017. Available at: http://epa.tas.gov.au/Documents/Macquarie%20Harbour%20TWWHA%20Environmental%20Status%20Report,%20EPA,%20May%202017.pdf [Accessed April 2018].

239 Ross, J & Macleod, C (2017). Environmental Research in Macquarie Harbour. FRDC 2016/2017: Understanding oxygen dynamics and the importance for benthic recovery in Macquarie Harbour. IMAS. Available at: http://www.imas.utas.edu.au/__data/assets/pdf_file/0006/975894/IMAS-Progress-Report-on-Macquarie-Harbour-FRDC-2016-067.pdf [Accessed April 2018].

240 EPA (2017). EPA Director to reduce fish biomass for Macquarie Harbour http://epa.tas.gov.au/Pages/News.aspx?newsstory=3705 [Accessed April 2018].

241 EPA (2017). Macquarie Harbour 2013-2016 Nutrient Review. Internal Draft V 5/5/2017. Ma 2017. Available at: http://epa.tas.gov.au/Documents/Macquarie%20Harbour%202013-2016%20Nutrient%20Review%20May%202017%20(Internal%20Final%20Draft).pdf [Accessed April 2018].

242 Ross, J & Macleod, C (2018). Environmental Research in Macquarie Harbour. FRDC 2016/067: Understanding oxygen dynamics and the importance for benthic recovery in Macquarie Harbour. Progress Report. IMAS. February 2018. Available at: http://www.imas.utas.edu.au/__data/assets/pdf_file/0011/1086563/IMAS-Progress-Report-on-Macquarie-Harbour-_-February-2018.pdf [Accessed April 2018].

243 ABC (2018). Macquarie Harbour salmon: 1.35 million fish deaths prompt call to 'empty' waterway of farms. http://www.abc.net.au/news/2018-05-29/salmon-deaths-in-macquarie-harbour-top-one-million-epa-says/9810720 [Accessed May 2018].

244 EPA (2018). Biomass limit for salmonids in Macquarie Harbour set for 2018 to 2020. http://epa.tas.gov.au/epa/news/biomass-limit-for-salmonids-in-macquarie-harbour-set-for-2018-to-2020 [Accessed May 2018].

245 ABC (2018). Macquarie Harbour salmon: 1.35 million fish deaths prompt call to 'empty' waterway of farms. http://www.abc.net.au/news/2018-05-29/salmon-deaths-in-macquarie-harbour-top-one-million-epa-says/9810720 [Accessed May 2018].

246 SCS Global Service (2014). Aquaculture Stewardship Council Salmon Standard Full Assessment Report. Tassal Operations Pty Ltd: Macquarie Harbour MF 214 and MF 219. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwkAAAS&file=00P24000005RQgXEAW [Accessed April 2018].

247 ASC (2018). VR 22: Benthic biodiversity and water quality. http://variance-requests.asc-aqua.org/questions/vr-22/ [Accessed April 2018].

248 SCS Global Service (2014). Aquaculture Stewardship Council Salmon Standard Full Assessment Report. Tassal Operations Pty Ltd: Macquarie Harbour MF 214 and MF 219. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwkAAAS&file=00P24000005RQgXEAW [Accessed April 2018].

249 SCS Global Services (2016). Aquaculture Stewardship Council Salmon Standard. Second Surveillance Assessment Report. Tassal Operations Pty Ltd Western Zone MF 214 Middle Harbour, MF 219 Gordon and MF 266 Franklin. Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwkAAAS&file=00P2400000JHR1JEAX [Accessed April 2018].

250 EPA (2017). EPA directs de-stocking of Macquarie Harbour salmon lease. http://epa.tas.gov.au/Pages/News.aspx?newsstory=3677 [Accessed April 2018].

251 Tassal (2017). Macquarie Harbour ASC Re-certification Audit. Available at: http://tassalgroup.com.au/macquarie-harbour-asc-re-certification-audit/ [Accessed April 2018].

252 SCS Global (2017). Aquaculture Stewardship Council Salmon Standard Re-Assessment Report. Tassal Operations Pty Ltd – Western Zone (MF 214 Middle Harbour and MF 219 Grodon). Available at: http://asc.force.com/Certificates/servlet/servlet.FileDownload?retURL=%2FCertificates%2Fapex%2FASCCertDetails2%3Fid%3Da0124000008RwkAAAS&file=00P2400000biTRmEAM [Accessed April 2018].

253 ASC (2018). VR 116: Salmon in single year class. http://variance-requests.asc-aqua.org/questions/vr-116-salmon-in-single-year-class/ [Accessed April 2018].

254 ABC (2018). Macquarie Harbour salmon: 1.35 million fish deaths prompt call to 'empty' waterway of farms. http://www.abc.net.au/news/2018-05-29/salmon-deaths-in-macquarie-harbour-top-one-million-epa-says/9810720 [Accessed May 2018].

255 ASC (2018). VR 22: Benthic biodiversity and water quality. http://variance-requests.asc-aqua.org/questions/vr-22/ [Accessed April 2018].

256 ASC (2018). VR 116: Salmon in single year class. http://variance-requests.asc-aqua.org/questions/vr-116-salmon-in-single-year-class/ [Accessed April 2018].

257 ASC (2018). VR 88: Sea lice monitoring. http://variance-requests.asc-aqua.org/questions/vr-88-sea-lice-monitoring/ [Accessed April 2018].

258 ASC (2018). VR 141: Maximum on-farm lice levels. http://variance-requests.asc-aqua.org/questions/vr-141-maximum-on-farm-lice-levels/ [Accessed April 2018].

259 ASC (2018). VR 145: Exception to Area Based Management. http://variance-requests.asc-aqua.org/questions/vr-145-exception-to-area-based-management/ [Accessed April 2017].

260 Bateman, A, Peacock, SJ, Connors, B, Polk, Z, Berg, D, Krkošek, M & Morton, A 2016, 'Recent failure to control sea louse outbreaks on salmon in the Broughton Archipelago, British Columbia', Canadian Journal of Fisheries and Aquatic Sciences, vol. 73(8), pp.1164-1172.

261 ASC (2018). VR 92: Maximum total amount of phosphorus. http://variance-requests.asc-aqua.org/questions/vr-92-maximum-total-amount-of-phosphorus/ [Accessed April 2018].

262 ASC (2018). VR 143: Background copper concentrations. http://variance-requests.asc-aqua.org/questions/vr-143-background-copper-concentrations/ [Accessed April 2018].

263 ASC (2018). VR 144: Background copper levels. http://variance-requests.asc-aqua.org/questions/vr-144-background-copper-levels/ [Accessed April 2018].

264 ASC (2017). Audit Manual – ASC Salmon Standard v1.1. Available at: https://www.asc-aqua.org/wp-content/uploads/2017/07/ASC-Salmon-Audit-Manual_v1.1-1.pdf [Accessed April 2018].

265 ASC (2018). VR 91: OIE-notifiable diseases. http://variance-requests.asc-aqua.org/questions/vr-91-oie-notifiable-diseases/ [Accessed April 2018].

266 Lovy, J, Piesik, P, Hershberger, P.K & Garver, K. A (2013). Experimental infection studies demonstrating Atlantic salmon as a host and reservoir of viral hemorrhagic septicemia virus type IVa with insights into pathology and host immunity, Veterinary Microbiology, vol. 166, pp. 91-101.

267 Ibid.

268 CFIA (2014). Archived – Locations infected with viral haemorrhagic septicaemia in 2014. http://www.inspection.gc.ca/animals/aquatic-animals/diseases/reportable/2018/locations-infected-with-viral-haemorrhagic-septica/eng/1396452410303/1396452411272 [Accessed June 2018].

269 ASC (2018). VR198_Salmon_v1.0_2.2.3 & 2.2.4 http://variance-requests.asc-aqua.org/questions/vr198_salmon_v1-0_2-2-3-2-2-4/ [Accessed April 2018].

270 Arnold, S & Roebuck, K (2017). What's Behind the Label? Assessing the Impact of MSC and ASC Seafood Certifications in Canada. SeaChoice, September 2017. Available at: http://www.seachoice.org/wp-content/uploads/2018/02/Seachoice-ASCMSC-Report-Online.pdf

271 SeaChoice (2018). Lousy B.C. farmed salmon enter market with ASC stamp of approval. http://www.seachoice.org/press-release/lousy-b-c-farmed-salmon-enter-market/

272 ASI (2018). Public Summary of the Final Complaint Investigation Report. Living Oceans Society about SAI Global @ Certificate Holder (ASC SAI 002). COMP201612207. Available at: https://asi-login.my.salesforce.com/sfc/p/#A0000000aGza/a/1H000000kBP3/D_kmWEIPCBN4_rOFRJRjZ4aJrNEIvkP_fqKkvbm2iZg [Accessed June 2018].

273 Bateman AW, Peacock, SJ, Connors, B, Polk, Z, Berg, D, Krkošek, M & Morton, A (2016) Recent failure to control sea louse outbreaks on salmon in the Broughton Archipelago, British Columbia, Canadian Journal of Fisheries and Aquatic Sciences, 2016, 73(8): 1164-1172, https://doi.org/10.1139/cjfas-2016-0122

274 ASC (2018). VR 93: Shannon Wiener score of sediments. http://variance-requests.asc-aqua.org/questions/vr-93-shannon-wiener-score-of-sediments/ [Accessed April 2018].

275 ASC (2018) VR 129: Monitoring of nitrogen and phosphorous without water quality targets. http://variance-requests.asc-aqua.org/questions/vr-129-monitoring-of-nitrogen-and-phosphorous-without-water-quality-targets/ [Accessed April 2018].

276 ASC (2018). VR 192: Parasiticide treatment index. http://variance-requests.asc-aqua.org/questions/vr-182-parasiticide-treatment-index/ [Accessed April 2018].

277 ASC (2018). VR 141: Maximum on-farm lice levels. http://variance-requests.asc-aqua.org/questions/vr-141-maximum-on-farm-lice-levels/ [Accessed April 2018].

278 ASC (2018). VR 39: Maximum total amount of phosphorus. http://variance-requests.asc-aqua.org/questions/vr-39-maximum-total-amount-of-phosphorus/ [Accessed April 2018].

279 ASC (2018). VR 98: Parasiticide treatment index. http://variance-requests.asc-aqua.org/questions/vr-98-parasiticide-treatment-index [Accessed April 2018].

280 ASC (2018). VR 136: Sea lice counts and national regulation. http://variance-requests.asc-aqua.org/questions/vr-136-sea-lice-counts-and-national-regulation/ [Accessed April 2018].

281 ASC (2018). VR 54: OIE-notifiable diseases. http://variance-requests.asc-aqua.org/questions/vr-54-oie-notifiable-diseases/ [Accessed April 2018].

Appendices

Appendix A

ASC Response to Key Recommendations in SeaChoice Report: Global Review of the Aquaculture Stewardship Council's Salmon Standard

Recommendation:

1. Strengthen the Quality Assurance (QA) framework: Continue to monitor and ensure that Certification Assessment Bodies (CABs) are providing the required metrics within audit reports to demonstrate compliance; are assessing standard indicators correctly; raising and closing non-compliance appropriately; applying variances suitably and posting audit reports on time.

ASC Response: ASC have several improvement initiatives in place to strengthen quality assurance (QA) work and the quality of auditor training since the formation of our Programme Assurance team in 2017.

SeaChoice has agreed that the level of detail has already improved due to QA work and continues to improve over time. However, information related to some indicators was not recorded in detail in some of the reports completed just after the ASC Salmon Standard become operational. ASC acknowledges that it is imperative to give further instruction to auditors so they know exactly how to report metrics within audit reports and has taken steps to improve instruction to CABs.

In addition:

- **In 2017 ASC brought the QA reviewers together to evaluate the current process and seek improvements for the first time. A second meeting is planned with the reviewers later this year to ensure that they are up-to-date with changes in the system, including updates to the standards, CAR requirements and interpretations. Going forward, these meetings will be part of an annual event for both our trainers and QA reviewers.**
- **ASC has begun using two methods to review audits reports, adding a risk-based approach to review additional filings.**
- **We have created a database of QA reviews, which has provided an overview of the reporting performance of individual CABs. The information serves two purposes, providing CABs with information to inform improvements and strengthening ASI's oversight of CABs.**
- **ASC is improving the quality of auditor training by introducing case studies and providing more information on the CAR. Furthermore, we are providing instruction on how use the audit report template— especially how to fill out metric data—to improve reporting quality.**
- **Since 1 January 2017, an audit report template has been provided to CABs. The template contributes to improving consistency and improved report quality, as mentioned by SeaChoice. ASC is working to further improve this process by creating a web-based reporting format, with a template that can only be submitted if all metric information is properly submitted.**

ASC recognizes that the challenges in defining major and minor NCs are multi-fold and need to be addressed over time with the assistance of the TAG. Underlying challenges to these definitions include, but are not be limited to:

- **Inconsistencies in standards developed by different Aquaculture Dialogues over time. Some standards set clearer requirements than the others, whereas other standards give guidance for auditors within the standards.**
- **Inconsistencies within the same standards regarding types of indicators (metric-based, performance-based, practice-based). Setting well- functional level of non-conformance to different types of indicators requires both data and experience.**
- **The difference in reporting requirements by ASC in contrast to those required by other global aquaculture certifications. The performance based compliance criteria introduced by ASC requires a more robust level of reporting than the practice-based standards schemes that auditors were accustomed to.**

Major changes to the current process of raising NCs will likely take place during the next CAR review and revision in 2019, in connection with the first phase of the aligned standard.

Despite these realities, the ASC wishes to improve consistency across all of our standards and is developing further auditor guidance to provide clarity on when to raise a non-compliance and how to judge its severity. The guidance in development includes feedback on lessons learned from farm certification reports to illustrate different interpretations and to foster better understanding of the process by developing a baseline for future reference that can be used by CABs.

Recommendation:

2. Clarify the application and consequence of non-conformities: Validate the standard's stated 100 per cent compliance requirement by reinforcing that farms are either 'conforming' (i.e. meets the standard) or 'non-conforming' (i.e. does not meet the standard). Minor non-conformities should only be non-critical in nature (e.g. administrative). Farms in major non-compliance to the standard should not be certified. If a major non-compliance is raised after the initial certification, the farm should not be able to use the label. Provide further rules in regard to suspension, re-instatement and withdrawal of certificates.

ASC Response: ASC scheme documents do not define any indictors as "non-critical in nature". The programme prohibits the issue of a certificate in cases where a major non-conformity remains open after 3 months. While the independent programme maintained by ASC requires that CABs make the final certification decision, if ASC finds that a farm with open major NCs has become certified ASI will take action.

No scheme can provide 100% guarantees, however, the oversight provided by ASI and ASC as a third-party certification scheme provides a high level of assurance regarding CAB's performance.

This level of assurance is further supplemented due to the transparency of the scheme, whereby stakeholders have full access to audit reports and are actively invited to provide feedback.

ASC has already provided some guidance on differentiation between suspension and withdrawal on the interpretation platform. Further guidance, potentially including new requirements, will be considered in the next CAR revision, which will start in 2019.

Recommendation:

3. Revise the PTI proposal to reflect actual global best practice: The standard should continue to define what is the top global performance and not allow regional variations that substantially weaken the standard. Do not remove the potential lobster impacts from the criteria. Establish an acceptable ABM parasiticide load and number of allowed treatments within the ABM.

ASC Response: The PTI revision is scheduled to be completed by early 2019. The majority of these recommendations have been received from SeaChoice via the stakeholder comments during the public consultation period. ASC will reflect on these additional recommendations.

Recommendation:

4. Consider further reductions to the Fishmeal and Fish Oil Forage Fish Dependency Ratios: 1.0 FFDRm and 2.30 FFDRo which reflect current best practices.

ASC Response: The current FFDRm/o scores were revised and released in April 2017. Although it is too early to introduce a new revision at this moment, we do appreciate the numerical insights SeaChoice has provided. ASC will reflect on these numbers during the next revision of FFDRm/o.

Recommendation:

5. Require further performance indicators be publicly reported: These should include, but not limited to: escapes, parasiticide and antibiotic use.

ASC Response: ASC is developing a reporting portal for (salmon) farms which will enable us to collect and report date in a more systemic manner. We appreciate the recommendations from SeaChoice and will review them during the development of the portal.

Recommendation:

6. Develop an ABM approach to all standards: Establish requirements for potential cumulative impacts in relation to standards' environmental indicators.

ASC Response: An ABM approach for all ASC farms is not foreseen at this time. However, the recommendation has been registered and will be considered in due time.

Recommendation:

7. Improve the variance request process and its application: Incorporate expert and stakeholder input into the variance request approval process. At approval, the scope (e.g. applicable farm, area and dates) should be defined to avoid incorrect application by CABs. Eliminate variances that permanently change a standard requirement (metric, indicator, procedure) unless specifically envisioned in the standard.

ASC Response: ASC is reviewing, and where needed revising, the VR-process. We appreciate the recommendations from SeaChoice and will review them during the further review/revision of the VR-process.

Recommendation:

8. Ensure the Q&A platform is used for clarifications only: The platform should be used strictly for providing clarification to auditors and not for interpretations that amend the intent of the standard or CAR. Rescind the interpretation that states intermediary sites are "out of scope" and align the CAR and Salmon Standard definitions of Unit of Certification to ensure that audits assess the complete production cycle impacts. Correct the interpretation that states the closure of a major non-conformity may be extended without an ASC defined deadline to correctly reflect the CAR's stipulated timelines for closing a major non-conformance—the one- time three-month extension and suspension after six months.

ASC Response: The Interpretation Platform was created by ASC to meet many needs. It provides guidance and additional clarification to questions frequently asked by multiple parties. It also serves as a place to provide practical and credible interim solutions, including interpretations regarding standard or CAR requirements in the periods between scheduled review and revision process. The platform thus helps increase both the consistency and transparency of the programme.

ASC is currently revising and improving the VR process. As soon as the updates are finalized they will be published and made publically available on the ASC website.

Recommendation:

9. Demonstrate that ASC certification is leading to sustainability improvements: Conduct a data driven analysis to determine if certified farms are improving their practices.

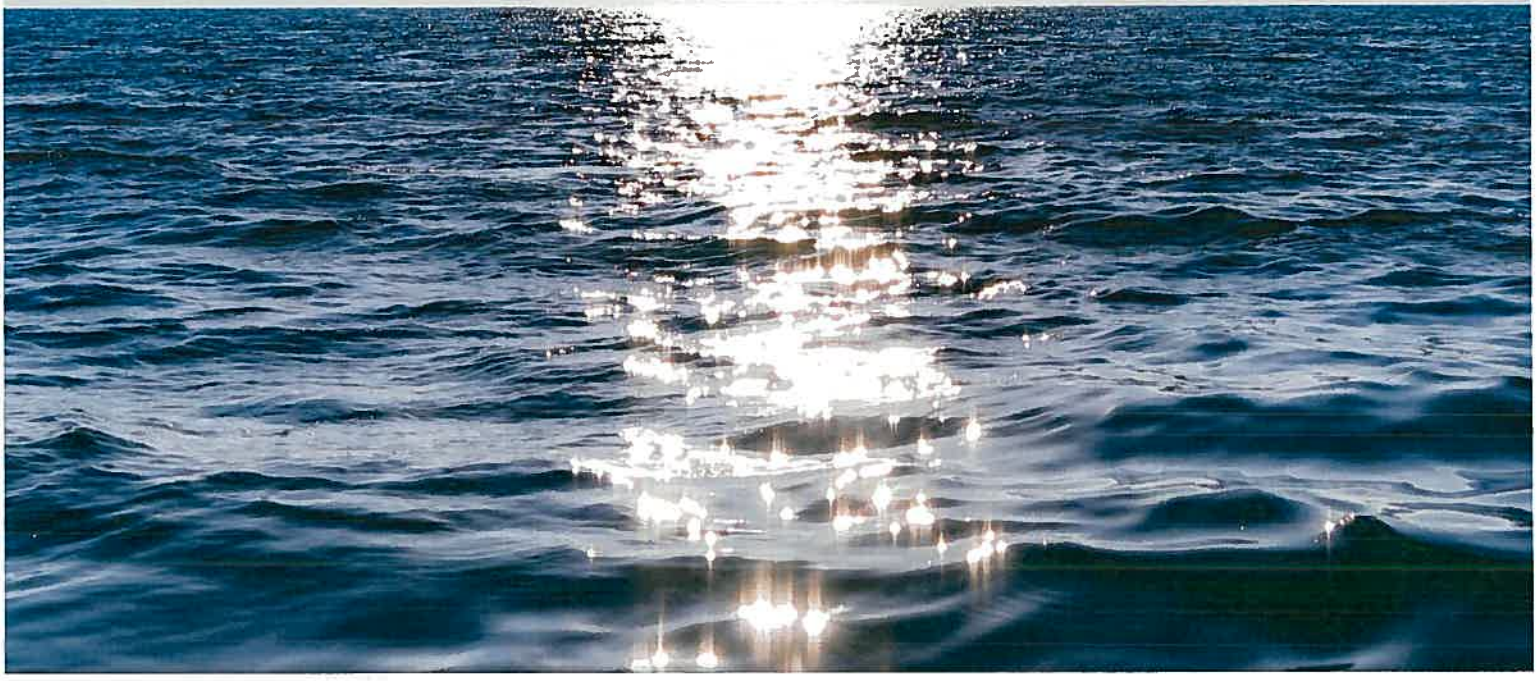
ASC Response: ASC is developing the M&E programme with the intent to publish periodic reports on the performance of farms in the programme. This data will also allow for improved insights into how the performance of ASC certified farms relate to the performance of the broader industry. As with all ASC documents, these reports will also be made public. The eTOR and framework for the M&E programme can be found on our website.

SeaChoice.org

for healthy oceans

This technical report is supported by regional and summary reports.
Visit: www.seachoice.org/asc-global-review

info@seachoice.org
SeaChoice.org



DAVID SUZUKI FOUNDATION

Ecology Action Centre

LIVING OCEANS