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EXECUTIVE SUMMARY

This document presents Huon Aquaculture Company Limited’s (Huon Aquaculture’s) vision for ensuring a sustainable Tasmanian salmon industry long into the future, a future where Tasmania is always at the forefront of world’s best practice and where the hard lessons from catastrophic industry collapses elsewhere are embraced to ensure that such collapses never happen here.

Tasmania has a once in a generation opportunity to establish a strong framework that will guide the safe, sustainable growth of a world-class salmonid industry. Huon supports policy, regulation and planning that is informed by the best of international experts across all aspects of salmonid farming. Ground-truthing what we do and what we plan to do, means we can be truly global-leading. To do that, Huon supports bringing international experts to Tasmania to meet with legislators, government, regulators, stakeholders and the wider community to share experience and build trust in a transparent and informed way.

This document presents Huon Aquaculture Company Limited’s (Huon Aquaculture’s) vision for ensuring a sustainable Tasmanian salmon industry long into the future, a future where Tasmania is always at the forefront of world’s best practice and where the hard lessons from catastrophic industry collapses elsewhere are embraced to ensure that such collapses never happen here.

It covers all aspects of the salmon farming industry. While it has been prepared by Huon Aquaculture, its vision is industry-wide and it is hoped that it can support collective changes and initiatives for the benefit of all. Huon Aquaculture welcomes industry discussion and input on all aspects of this document and hopes to develop shared views on the future sustainability framework that will guide the industry safely into the future. This is an aspirational document and Huon Aquaculture does not currently comply with all aspects of the framework. Huon Aquaculture also notes that the industry will need time to transition from where it is to today to where we aspire to be. It is important that the framework identify and set out best practice in the long term interest of a sustainable industry.

Further, it is critical that Tasmania does not repeat the experiences of other countries, where poor biosecurity practices and rapid industry growth combined to cause catastrophic industry collapse, primarily due to the uncontrolled spread of fish diseases.

In addition the significant decline in water quality in Macquarie Harbour, where dissolved oxygen levels in midwaters have been measured at or close to zero for sustained periods, highlight the need for more effective regulation and management.

There are powerful lessons to be learned from recent local experience and the collapses that have occurred overseas, including the changes to practices that were necessary to allow industry to subsequently recover and prosper once again.

The salmonid farming industry is a considerable contribution to the Tasmanian economy and community, and warrants a dedicated regulatory officer who has industry regulation as their full-time role, rather than it being the responsibility of an EPA Director who has broad responsibilities across a range of sectors.

The creation of a specific position within the EPA, nominally to be called the Finfish Aquaculture Regulator, would provide the necessary focus and attention that the industry warrants. Perhaps more than in any other primary industry, environmental and biosecurity matters are inextricably intertwined in salmonid farming and this should be reflected by an amalgamation of regulatory powers under this single person.

However, that person should report to an independent panel of experts, which could be formed by the reconstitution and enhancement of the Board of Advice and Reference (the Board). The Board could also be an industry appeal body to review decisions made by the Regulator.

The Board and Regulator should be staffed with industry, fish health and biosecurity expertise necessary to oversee the introduction of a Tasmanian Veterinary Model for regulating finfish farming, based on the following key principles:

- Strong regulation
- Separation of year classes and subclasses
- Dedicated hospital leases
- Restricted pen towing routes and ultimately phasing out of towing
- Greater use of well-boats
- Greater use of offshore leases
- Separation by tidal excursions
- Conservative fish stocking densities
- Sanitary harvest systems
- Rigorous fallowing regimes

Biosecurity principles should also be applied when new leases are applied for. New leases should meet mandatory requirements before they can be granted, including:

- Minimum separation distances between companies (2 tidal excursions)
- Minimum separation distances also between year classes and subclasses
- Access to a shore base
- Access to a hospital site
- Access to fresh water and an ability to effectively treat amoebic gill disease
- Maximum water temperature limit
- Strong flushing regime
- Use of double netted seal barriers.
In Tasmania, biosecurity is at serious risk due to the intermingling of leases held by different companies. Biosecurity must be protected by reconfiguring marine farming to achieve geographical and/or operational zoning.

Under geographical zoning, they would be physically separated by designated minimum distances. Under operational zoning, companies would coordinate their farming practices so that on neighbouring leases all year classes and subclasses are put to sea and harvested at the same time.

In southeast Tasmania, the coastal geography provides opportunities for reconfiguring the arrangement of existing leases to facilitate a significant degree of geographical zoning. In locations where geographical zoning is not possible, operational zoning should be implemented through companies coordinating their activities, either cooperatively or, if necessary, by government mandate.

In Macquarie Harbour, operational zoning could be achieved by reconfiguring the arrangement of leases so all companies farmed different year classes at different ends of the Harbour, with each year class having to be harvested and all leases fallowed for three months prior to the next year class being stocked. Operational zoning could also be achieved by mandating to companies that only one common year class can be held in the Harbour at any time, with compulsory whole-of-Harbour annual fallowing. This is likely to require first year smolt to be grown in land-based facilities before being put to sea. Macquarie Harbour operators should be required to investigate the feasibility of doing this.

These critical measures form part of a comprehensive framework presented to ensure the sustainability of Tasmania’s salmonid farming industry. The framework comprises approximately 60 individual elements. Part A of the document describes the high priority elements while Part B describes general elements. A full listing is provided in Part C.

### CRITICAL PRIORITIES - REGULATORY REGIME

<table>
<thead>
<tr>
<th>Frame</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame 3</td>
<td>The Marine Farming Planning Review Panel membership should be expanded to include current and active expertise (not just experience) in fish farming, fish health and fish biosecurity (if local expertise is not available, it should be sourced internationally).</td>
</tr>
<tr>
<td>Frame 27</td>
<td>New leases should only be approved if they meet mandatory requirements of: separation distances between companies and between year classes and subclasses; access to a shore base and hospital site; access to fresh water and ability to effectively treat amoebic gill disease; maximum water temperature limit; strong flushing regime; and use of effective seal barriers.</td>
</tr>
<tr>
<td>Frame 19</td>
<td>The transfer of environmental regulatory responsibility for the salmonid industry to the EPA Director could be further enhanced by the creation of a specific position of Finfish Aquaculture Regulator, dedicated to ensuring the long-term sustainability of the industry.</td>
</tr>
<tr>
<td>Frame 28</td>
<td>The Marine Farming Planning Review Panel and the Board of Advice and Reference should regularly review the mandatory prerequisites for new leases to ensure the highest levels of biosecurity protection for the industry.</td>
</tr>
<tr>
<td>Frame 20</td>
<td>The Aquaculture Industry Regulator should be given regulatory powers for all regulatory aspects of the salmonid industry, including environmental, biosecurity, hatcheries and land-based smolt grow-out, either explicitly or by statutory delegation under relevant Acts.</td>
</tr>
<tr>
<td>Frame 14</td>
<td>Adaptive management by industry must be accompanied by adaptive regulation by government, with regulators responding early and precautionarily to environmental monitoring data.</td>
</tr>
<tr>
<td>Frame 24</td>
<td>The marine farming decision-making process for plans, leases and licences should explicitly and comprehensively incorporate fish health and biosecurity advice and review by a body independent of the decision-maker.</td>
</tr>
<tr>
<td>Frame 15</td>
<td>Industry and regulators must be prepared to take severe precautionary action to reduce potential catastrophic failures.</td>
</tr>
<tr>
<td>Frame 25</td>
<td>The Board of Advice and Reference should be reinstated and directed by the Minister to provide an independent advisory and review role for marine farm planning, leasing and licensing decisions.</td>
</tr>
<tr>
<td>Frame 16</td>
<td>The Macquarie Harbour experience highlights the critical importance of adaptive management being implemented in deed not just in name, with unequivocal indicators of progressive environmental decline there (dissolved oxygen and benthic condition) not being matched by appropriate industry or regulator responses.</td>
</tr>
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</table>
**CRITICAL PRIORITIES - BIOSECURITY MODEL**

The future biosecurity of the industry should be based on a Tasmanian Veterinary Model (TVM), with intents and principles similar to the Faroe Islands Veterinary Model. As well as entire lease fallowing that should occur annually, individual moorings within leases should be fallowed for longer periods to allow the seabed to return to baseline conditions. This will mean more mooring positions within a lease than is used in any one year so pens can be moved between moorings as required. This will have different requirements between inshore/intermediate leases and offshore leases, with offshore leases not requiring to do this as often.

All controls and measures of the TSGA Biosecurity Program must be implemented, and supplemented with the additional measures identified in this paper and subjected to regular review.

The TVM should function to separate year classes and separate diseased and non-diseased fish in space and time, which will require close coordination and cooperation by industry, reinforced by strong government regulation.

New leases should only be approved if they meet mandatory requirements of: separation distances between companies and between year classes and subclasses; access to a shore base and hospital site; access to fresh water and ability to effectively treat amoebic gill disease; maximum water temperature limit; strong flushing regime; and use of a double-net seal barrier.

The TVM should include designated hospital leases, designated tow routes and progressive phasing out of towing, greater use of (closed-valve) well-boats, a transition to offshore farming, tidal excursion lease separation, sanitary harvest systems and rigorous fallowing regimes.

**CRITICAL PRIORITIES - BIOSECURITY IMPERATIVES**

A physical separation of companies and fish classes is of the utmost importance to the future biosecurity of the Tasmanian salmonid industry.

Macquarie Harbour salmon farming should be restricted to year classes being separated geographically or only one, common year class being held in the Harbour at any time, with compulsory whole-of-Harbour annual fallowing.

The south-eastern region should be reconfigured to achieve either an operational or a geographical separation of year classes and subclasses, either by companies coordinating their management of neighbouring leases or by lease ownership being reallocated to create geographically separate company zones.

To reflect the underlying ecological and environmental integrity of the natural system, the Huon and Channel areas should be managed under a consolidated single Marine Farm Development Plan, with a single TPDNO for the entire area.

**CRITICAL PRIORITIES - ON-FARM IMPERATIVES**

To minimise biosecurity risks and environmental impacts, fallowing strategies should aim for at least 1 month whole-lease fallowing each year for disease control, and up to 18 months pen-bay fallowing every 2 to 3 years to return the benthos to base conditions.

Pens should be provided with double-net seal barriers, unless operators can demonstrate that a single-net or other system will be equally as effective at preventing seal attacks.

Pen towing for fish relocation should be phased out through the use of closed-valve well-boats for live fish transport.
PART A: CRITICAL REGULATORY AND BIOSECURITY MATTERS
1 PURPOSE

This document presents Huon Aquaculture’s vision for ensuring a safe, sustainable Tasmanian salmon industry long into the future, a future where Tasmania is always at the forefront of world’s best practice and where the hard lessons from catastrophic industry collapses elsewhere are embraced to ensure that such collapses never happen here.

2 SCOPE

This document covers all aspects of the salmon farming industry. While it has been prepared by Huon Aquaculture, its vision is industry-wide and it is hoped that it can support collective changes and initiatives for the benefit of all.

FRAME 1:
An industry-wide Sustainability Assurance Framework will provide industry, government and the community with confidence in the long-term safety and sustainability of salmon farming in Tasmania.
3 CONTEXT

The Tasmanian salmonid (Atlantic salmon and rainbow trout) industry provides significant economic benefits to Tasmania and has contributed to the State’s reputation as a quality producer of fine foods. Within 30 years of the first commercial harvests, farmed salmonid have become the leading farming activity in Tasmania by dollar value, ahead of dairy, vegetables, poppies, pyrethrum, beef, fine wool, wine and the once iconic apple industry.

A 2015 analysis by KPMG found that the industry generates the following results per annum:

- average annual turnover or gross output of $1.12 billion (the total value of industry production)
- annual value added or net additions to Gross State Product (GSP) of $625.9 million
- annual gain to factor income of $366.8 million (income paid to individuals and firms), and
- support for approximately 2,786 FTE jobs (full time positions employed in, or supported by the industry).

In 2016 the industry produced 49,158 tonnes of salmonids with a farm-gate value of $694 million. It is now a standout Tasmanian brand icon, promoting the image of the State not just in Australia but across the Asia-Pacific region as well.

The industry continues to experience strong sales momentum with demand for salmon worldwide beginning to place pressure on all the major salmon growing regions (Scotland, Norway, Chile and the Faroe Islands) to grow at the same rate.

Population growth worldwide, particularly in the neighbouring Asian region, is driving increased protein consumption and as a result the Tasmanian market must not only grow to meet domestic demand but also to meet demand within Asia.

Tasmania’s burgeoning aquaculture industry is part of a world-wide trend, with aquaculture being the fastest growing food producing sector, accounting for approximately 50% of the world’s food fish.

Aquaculture provides much greater opportunities for the sustainable use of marine resources than is possible from the exploitation of wild fisheries. Through appropriate species selection and siting, aquaculture also offers greater levels of protection from the impacts of climate change, which can affect the distribution and resilience of wild fish populations.

Marine aquaculture, particularly deep water farming, is also inherently more buffered from climate change than land-based agriculture can be, and the worldwide reliance on aquaculture is likely to accelerate. The Tasmanian salmonid industry has enormous opportunities to capitalise on our natural environmental assets, particularly our cool, clean oceanic waters, and on our high level of technical knowledge and expertise built up over the last three decades.

The current objective of the Tasmanian salmonid industry is to grow farm gate sales to $1 billion by 2030, a target that is well within its sights and would see it become one of the largest industries in the Tasmanian economy.

To address the growth currently being experienced domestically and internationally, the Tasmanian industry must expand its marine farming operations, reconfigure existing lease space and change the way it farms. This expansion must be approached with six principles in mind;

1. Increasing production responsibly and safely
2. Improving the health and welfare of our fish
3. Improving safety for our workers
4. Reducing our environmental footprint
5. Continuing to positively participate in the community
6. Producing world-class salmonid products in Tasmania

It is critical that Tasmania does not repeat the experiences of other countries, where poor biosecurity practices and rapid industry growth combined to cause catastrophic industry collapse, primarily due to the uncontrolled spread of fish diseases.

For example, Figure 1 shows the dramatic collapse that occurred in the Faroe Islands due to ISA disease. Within just 3 years, annual production fell from 40,000 tonnes to 10,000 tonnes. The collapse led to just three companies surviving out of an original 27. The ensuing recovery was only possible by a consolidation of companies, a complete physical reconfiguration of growing areas and a new rigorous regulatory regime.

---

4. Infectious salmon anaemia
A similar collapse occurred in Chile in 2007, also caused by an ISA outbreak. Production levels have only recently returned to those prior to the collapse. There are powerful lessons to be learned from those collapses and also from the changes to practices that were necessary to allow industry to subsequently recover and prosper once again. The Faroe Islands recovery actions stand out as an exemplar of best practice and Tasmania must pre-emptively embrace similar practices to avoid collapses here.

Key learnings from those collapses include:

- One generation farming
- Fallowing periods between each generation
- Immunisation and vaccination programs
- Movement restrictions on fish and equipment
- Imposition of density limits
- Brood stock to be held only on land
- Fish not to be held in open waiting pens at harvest stations
- Minimum distances between hatcheries
- Minimum distances between farms
- Rules to fight and control sea lice

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**FRAME 2:**

The Tasmanian salmonid industry must learn from the mistakes and experiences of other countries to avoid the calamitous collapses that have occurred elsewhere due to biosecurity and environmental mismanagement.
4 REGULATORY REGIME

The current regulatory regime has been summarised in the Tasmanian Government’s submission to the recent Senate Inquiry¹, and is described below. Critical improvements that Huon Aquaculture considers essential for a sustainable industry are identified and described where appropriate.

4.1 Primary legislation


Under the Marine Farming Planning Act 1995, marine farming development plans are prepared, designating areas in state waters where marine farming may occur.

All marine farming operations must be licensed under the Living Marine Resources Management Act 1995. Licences include environmental conditions to ensure that marine farming operations are sustainable and do not have an unacceptable impact on the marine environment.

These two Acts are administered by the Department of Primary Industries, Parks, Water and Environment (DPIPWE). Regulatory powers have also recently been extended by delegation to the Director of the Environment Protection Authority (EPA) and ultimately these powers will be permanently transferred through legislation. The term DPIPWE-EPA is therefore used here to reflect this transition.

The farmed salmonid species—Atlantic salmon and rainbow trout—are hatched in freshwater hatcheries. These are regulated under the Inland Fisheries Act 1995 for which the Inland Fisheries Service has responsibility².

4.2 Marine farming development plans

Marine farm development plans designate where marine farming may occur and the controls under which they must operate.

Management controls cover a range of issues including, but not limited to:
- levels of unacceptable effect
- nitrogen outputs
- carrying capacity
- monitoring requirements
- chemical usage and reporting
- waste
- disease
- visual effects
- access and marking
- odour
- noise
- marine farming equipment
- predator control

In establishing a marine farming development plan, or progressing an amendment to a zone or zones within an existing marine farming development plan area, targeted zone assessments are undertaken by the Institute for Marine and Antarctic Studies (IMAS) and/or independent marine consultants or contractors. This environmental survey assesses substrate type, habitat distribution, bathymetry and benthic flora and fauna. Where relevant, specific surveys to target threatened species listed under the Threatened Species Protection Act 1995 or the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 are also undertaken.

The Living Marine Resources Management Act 1995 requires marine farming leaseholders to hold a marine farming licence to farm fish. A baseline environmental survey must be undertaken prior to the commencement of marine farming operations.

The licensing of a lease area for finfish is contingent on assessment and approval by DPIPWE-EPA of the baseline environmental survey report.

Marine farming licences contain specific provisions in relation to environmental monitoring and management of marine farming operations. In many cases, licence conditions contain specific conditions that expand on the provisions of management controls, defining environmental standards and outlining reporting and monitoring requirements.

Environmental standards prescribe relevant indicators and trigger levels for ongoing environmental management. Should there be a need to modify licence conditions following consideration of monitoring, research or compliance outcomes, prescribed controls can be varied at any time in accordance with provisions of the Living Marine Resources Management Act 1995.

Following the licensing of a marine farming lease area, ongoing operations are subject to a structured environmental monitoring and compliance assessment process which involves continuous review of monitoring and compliance reporting information against management controls, prescribed indicators and trigger levels.

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¹ Tasmanian Government (June 2015) Submission to the Senate Environment and Communications References Committee Inquiry into regulation of the finfish aquaculture industry in Tasmania
² The Water Management Act 1999 is also applicable, for water allocations to hatcheries
Decision-making through this process is informed not only by the outcomes of this statutory monitoring and compliance assessment, but also through reference to other relevant information. This may include data collected by industry, through research (e.g. the Institute for Marine and Antarctic Studies) or collected through other DPIWWE or EPA programs.

### 4.3 Marine Farming Planning Review Panel

The Marine Farming Planning Review Panel is established under the Marine Farming Planning Act 1995. The functions and powers of the Panel are to:

- Consider draft plans, draft amendments to marine farming development plans and draft modifications to marine farming development plans.
- Consider environmental impact statements.
- Consider comments made on draft plans, draft modifications and draft amendments.
- Make recommendations to the Minister in respect of draft plans, draft modifications and draft amendments.
- Perform any other function imposed on it under legislation or determined by the Minister.

The Panel may:

- Conduct hearings to assist it in the performance of its functions.
- Do anything necessary or convenient to perform its functions.

Huon Aquaculture notes that the Panel’s structure goes back to the original legislation’s concept of it being, as its name indicates, a planning body akin to land-based planning bodies such as the (now) Tasmanian Planning Commission. The key requirement for the Panel was to allocate leases, and its membership reflects this.

With the rapid growth and maturation of the industry, the Panel’s planning decisions now need to be much more cognisant of the operational threats that the industry faces—in particular, the biosecurity risks that have caused catastrophic industry collapses overseas. The Panel’s membership therefore needs to be expanded to include expertise in fish farming, fish health and fish biosecurity.

### 4.4 Reviews of decisions

Under the current Marine Farming Planning Act 1995, the Marine Farm Development Panel advises the Minister on marine farm development plans and the Minister then makes a final determination on the plans. Marine farm development plans specify marine farming zones within which leases may be granted.

A proposed marine farm development plan goes through a public notification and hearing process but there are no appeal provisions against the Minister’s final approval of a plan.

Appeals to the Resource Management and Planning Appeals Tribunal (RMPAT) are possible under section 95 against amendments to plans, including those that could reduce the viability of existing marine farms or reduce water quality in other lease areas.

When allocating leases within a marine farming zone, under section 52 of the Act the Minister may, in the case of a privately initiated plan, or must, in the case of a government-initiated plan, seek the advice of the Board of Advice and Reference established under section 49 of the Act.

The Board’s advice may relate to:

- the experience and knowledge of the applicant
- employment opportunities
- the applicant’s contribution to industry or site-specific research
- the applicant’s capacity to address social and environmental matters
- any other matter the Board considers appropriate.

The Board’s advisory role is not limited to lease allocations, however. Section 50 of the Act allows the Minister to seek advice from the Board on any matter and to direct the Board to perform any function.

In recent years, the Board has come to be considered redundant because of the maturation of the marine farming industry and the evolution of marine farm planning, to the extent that the Board was abolished by the Minister in July 2015 under the existing provisions of the Act.

There are provisions under section 75 of the Act for appeals to RMPAT against lease refusals and lease conditions but not against the granting of a lease.

Marine farm licences are issued to marine farm lease holders under section 64 of the Living Marine Resources Act 1995. Section 281 of that Act provides for a right of review of a licence decision to the Minister (or Secretary) and section 283 provides an ultimate right of appeal to RMPAT against the decision.

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*From time to time, this expertise may lie either in a single person or in multiple people

*Office of the Coordinator General Red Tape Audit 2016
The appeal provisions of the two Acts have rarely been used by the marine farming industry. The RMPAT decision database\(^9\) appears to contain only three appeals against marine farm decisions—one against a refusal to renew a marine farm licence, one against a refusal to renew a marine farm lease, and one\(^{10}\) relating to the making of an emergency plan; these were all between 1998 and 2001.

### 4.5 Management methodologies

The proportion of dry feed estimated to be lost by Atlantic salmon to faeces is approximately 15%. These losses result in nitrogen input to the marine environment.

Nitrogen input is the key regulatory tool used to set global limits on salmonid production in marine farm development plan areas.

This approach is most well developed in the Huon-Channel region, where the CSIRO has developed a sophisticated three-dimensional biogeochemical model. A detailed comparison of monitoring results against the biogeochemical model’s original predictions has shown general consistency\(^1\).

Studies by IMAS found that annual nitrogen fluxes through the Huon Estuary were dominated by natural oceanic inputs of nitrate during winter. Because of low light intensities and low temperature, this nitrate was mostly unutilised by phytoplankton but during summer and autumn intense phytoplankton blooms can occur. In these seasons, marine nitrate inputs are naturally low and fish farm nutrients can make a significant contribution to overall system production\(^2\).

The study also concluded that the Huon Estuary and the D’Entrecasteaux Channel were tightly coupled and that these two components needed to be studied and modelled as a single system. The IMAS biogeochemical model was developed on this basis.

The model has subsequently been used to predict water quality behaviour under a variety of scenarios to examine the potential impacts of fish farming on water quality.

Nitrogen is the most important parameter for evaluating and managing the potential impact of salmon farming on the environment. Nitrogen enters the water column and sediments through waste food and fish excreta. Nitrogen inputs from salmonid farming add to inputs from other sources (rivers, wastewater treatment plants, industrial plants and the ocean) and the management of salmonid farming is aimed at ensuring that its nitrogen contributions do not compromise the health of the estuary or channel.

The regulatory mechanism to achieve this is for government to prescribe a Total Permissible Dissolved Nitrogen Output (TPDNO) for a marine farm development plan area. This overall limit is spread amongst the operating companies in that area. The use of a nutrient input cap rather than a biomass stocking limit is a more direct reflection of the environmental variables of concern (nutrients) while also providing flexibility and incentives to industry to improve their production efficiencies, for example, by developing more efficient feed formulations that enable increased production biomass with less feed.

In addition, use of smolt entries as a management method is not sufficiently certain for farms due to differences in farming and harvest strategies. Therefore, on balance, Huon Aquaculture views TPDNO to be the most rigorous continuous improvement management method which also provides certainty for planning. Certainty for planning is a high priority due to the 3.5 year production cycle for salmonid farming.

### 4.6 Seabed fallowing

Since 1997, marine farmers have been required to undertake underwater surveys to assess sediment health under pens, either 12-monthly or in accordance with their stocking and fallowing regimes (in consultation with DPIFWE-EPA).

The program has led to the compilation of a comprehensive, area-specific dataset, providing information on environmental conditions within marine farming lease areas and specifically at compliance sites 35m inside lease boundaries\(^2\) for comparison with control sites. This information has been used to assist with the adaptive management of regulatory monitoring.

The results of monitoring in finfish lease areas around the state have confirmed that pen positioning, stocking duration and intensity are the major factors affecting detectable impacts on the benthos. Current flow is typically low and survey assessments have revealed that visible benthic impacts are localised, with solid particulate waste settlement forming distinct footprint zones directly under pens.

Unacceptable impacts fall into two main categories—any visible farm-derived impact at a compliance site 35 m outside lease boundaries for the lease area. This is based on experience at inshore sites and may require reconsideration for offshore sites.

Following requirements for leases is typically determined through the use of remote operated vehicle (ROV) visual surveys of the sea floor.

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\(^{10}\) Actually, 4 related appeals


\(^{13}\) 35 m is based on experience at inshore sites and this distance may require reconsideration for offshore sites
Detectable impacts at 35 m compliance points would indicate that a lease is overstocked and/or pens are moored too close to the lease boundary. Impacts within the lease area are usually the cumulative impact of overfeeding and/or holding a pen in a given anchor bay for an extended period of time, which leads to excessive feed and faecal deposition, deterioration of sediment health and eventual spontaneous gas bubbling from sediments.

Visual monitoring alone may not always be sufficient to provide an indication of unacceptable environmental impacts and visual monitoring may need to be supplemented with other methods.

In cases where a breach of licence conditions is detected as a result of these surveys, immediate action should be taken to determine the level and extent of the breach and the cause of the specific problem.

Changes to the management of the lease can then be implemented and, where relevant, the frequency and intensity of monitoring increased to assess the rate of recovery of an impacted site.

This program approach follows adaptive management principles (section 4.9), enabling performance-based monitoring for individual lease areas, with the frequency and intensity of monitoring surveys being adjusted according to the level of compliance and monitoring history of individual farm sites.

Fallowing requirements vary from lease to lease and the adaptive management strategy must respond not only to changes in the physical characteristics of the lease area but also to changes in pen size, anchoring arrangements and fish stocking densities.

An excessive build-up of waste beneath pens is as much a biosecurity risk to the fish as it is an environmental impact. Farmers should manage their lease areas on the basis of always having excess fallowing area. Usually, this requires planning across multiple lease sites, aiming for at least one-month whole-lease fallowing each year for disease control, and up to 18-months pen-bay fallowing every 2 to 3 years to return the benthos to base conditions.

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**4.7 Wildlife interactions**

**Seals and birds**

Seal and bird attacks on penned Atlantic salmon have been a common and costly problem for marine farming in Tasmania since the industry’s inception. The attacks can kill or injure fish, and birds and seals can also spread disease. The intense aggregations can also pose an injury threat to the animals themselves.

The Wildlife Management Branch of DPIPWE worked with industry to develop a set of protocols for the handling of seal14. These protocols will continue to be followed if and where seal interactions are unavoidable. However, the intention of industry is to avoid interactions through the use of passive deterrents, principally barrier technology.

In Huon Aquaculture’s view, an effective barrier system needs a double-net, comprising a light-weight inner net to contain the fish and a heavy15, taut outer net to keep seals at least 2 m away from the inner net.

This system requires a redesign of pens and a reconfiguration of mooring systems and cannot be retrofitted to older, unsuitable pens, but it can be rolled out with new pen deployments. Double netting should be the norm unless operators can demonstrate that a single-net system will be just as effective.

Effective seal barrier netting will do away with the requirement for seals to be caught and relocated. Barrier netting is also able to exclude other potential predators, such as sharks and whales.

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14 DPIPWE (2012) Combined protocols for the mitigation of seal interactions with aquaculture staff and infrastructure.
15 e.g. 125 mm double-knotted mesh with a break load of 1200 kg
Ineffective seal netting on a pen not only risks attacks on that pen but also encourages seals and other predators to frequent farming areas generally, creating otherwise avoidable risks and stress at other pens.

Birds have also been a significant problem on marine farms. They are attracted to pens by the fish food pellets and in some cases (e.g. cormorants) by the fish themselves, particularly smolt. As well as causing problems for farming, birds can become entangled in nets and ropes and be harmed or killed.

As with seals, appropriate pen and net design can prevent these problems. A light-weight net covering the pen and set on flexible poles to allow the net to distort as the pen flexes has been found to be effective.

In addition to controls implemented at the farm level, there would be great benefit if DPIPWE could work with industry to undertake a more comprehensive review of the issues associated with wildlife interactions.

**FRAME 8:**
To avoid physical interactions between farming and wildlife, seals and birds are being kept away from farmed fish by specifically designed underwater and over-pen netting.

**FRAME 9:**
Pens should be provided with double-net seal barriers, unless operators can demonstrate that their single-net system will be equally as effective at preventing seal attacks.

**FRAME 10:**
With the introduction of effective barrier technology for seal exclusion, seal capture and relocation should be phased out.

4.8 Monitoring obligations

Environmental monitoring associated with salmonid marine farm leases principally involves the assessment of benthic condition and water quality in marine farming development plan areas. These monitoring programs are subject to a consistent management framework applying to operational marine farming lease areas. However, industry also participates in much wider monitoring, including baseline studies, broadscale programs, wildlife interactions, marine debris, noise and threatened species surveys.

Monitoring is consistent with the world’s best practice EU Framework Directive for Marine and Coast16.

**FRAME 11:**
The Wildlife Management Branch of DPIPWE should work with the marine farming industry to undertake a comprehensive review of wildlife interactions and associated issues, with a view to developing a comprehensive set of protocols and research priorities.

**FRAME 12:**
Environmental monitoring by the Tasmanian salmonid industry must be consistent with world’s best practice.

Benthos

Stressors to benthic health associated with particulate organic waste material are managed using an adaptive monitoring and data reporting framework.

This framework provides for the assessment and management of potential effects of particulate organic waste material on benthic health in and around marine farming lease areas.

Waste material associated with salmonid marine farming activities can be in the form of fish faeces, waste fish feed and in situ net cleaning washings. Management objectives and indicators specific to benthic condition are defined in management controls and marine farming licence conditions and prescribe ongoing monitoring and reporting requirements.

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The primary monitoring tool for benthic condition is video surveillance. Operators must:

- Show evidence of surface footage showing pen bays and compass bearings on stocked pen sites
- Supply a time and date stamped differential GPS file (DGPS) showing logged positions for ROV spot dives
- Supply video footage with clear time and date stamp
- Supply a DGPS file showing the logged positions of a Standard Permanent Mark (SPM) as a quality control measure.

The submitted report, DGPS file and video footage are then reviewed and validated by DPIPWE-EPA staff.

While video monitoring is the primary routine monitoring tool, supplementary targeted monitoring includes sediment infauna, sediment physicochemistry and seabed flora and fauna.

Pen specific feed input and net cleaning information is reported to the regulator pursuant to marine farming licence conditions and used by DPIPWE-EPA to determine monitoring survey specifications and focus monitoring effort in appropriate locations within and outside the operational lease.

Monitoring surveys may be subject to audit by DPIPWE-EPA. Geo-referencing and reporting protocols are in effect to ensure that data is collected from prescribed locations.

Monitoring reports and underwater video footage must be reported by the lease holder pursuant to licence conditions and these are assessed by DPIPWE-EPA against specified criteria, aligned with relevant management objectives.

The outcomes of these assessments are then communicated to relevant stakeholders. Depending on the outcomes of the monitoring, the ongoing monitoring cycle may continue unchanged, or, if necessary, further information on benthic condition can be collected through an immediate and targeted triggered survey to verify attribution.

In the event that significant benthic impact is evident and attributable to marine farming operations, the regulator directs the lease holder to undertake a range of management responses consistent with management controls to mitigate these effects.

The spatial extent and frequency of monitoring can also be increased, thereby providing the capacity to accurately gauge the effectiveness of the chosen management response and in turn inform future management approaches. In cases where monitoring identifies effects that are unknown or difficult to clearly attribute, the management framework provides the capacity to identify and progress research priorities. This may involve collaboration between the regulator, industry and researchers. The outcomes of monitoring, compliance reporting and research can then be used to inform the refinement of the program.

### Water column

Whole benthic monitoring provides local indicators of environmental health within and around leases; water column monitoring provides broader scale indicators.

Stressors that may affect water quality include nutrient loading and dissolved oxygen depletion associated with fish metabolic processes, respiration and biogeochemical processes within organically enriched sediments.

Management objectives and indicators specific to water quality are defined in relevant management controls and marine farming licence conditions and prescribe ongoing monitoring and reporting requirements. As with benthic monitoring surveys, water quality monitoring surveys may be subject to audit by DPIPWE-EPA.

Geo-referencing and reporting protocols ensure that data is collected from prescribed locations. Original laboratory reports must be supplied to the regulator and must satisfy specified quality assurance/quality control requirements. In conjunction with the monitoring, relevant information on feed inputs (used to derive nitrogen emission figures) and biomass must be reported and this information is assessed by DPIPWE-EPA against specified criteria, aligned with management objectives.

The outcomes of these assessments are then communicated to relevant stakeholders. Should monitoring identify effects that are unexpected or difficult to clearly attribute to marine farming activities, the management framework provides for a variety of responses.

These could range from the implementation of controls on nitrogen emissions (for example, the limits that have been imposed for the D’Entrecasteaux Channel and Huon and Port Esperance Marine Farming Development Plan areas) to more focused monitoring and research. This often involves collaboration between the regulator, industry and researchers.
4.9 Adaptive management

Adaptive management is a structured, iterative process of optimal decision-making that uses the best science available to further improve our knowledge of the system over time using comprehensive monitoring. In this way, decision-making simultaneously maximises one or more resource objectives and, either passively or actively, accrues information (e.g. by monitoring and modelling through fluctuating system conditions) needed to improve future management. Through adaptive management, rigorous control can be applied that assures sustainable operation and development.

Figure 217 shows an example of the adaptive management cycle.

Adaptive management is a tool which should be used not only to change a system but also to learn about the system. Because adaptive management is based on a learning process, it improves long-run management outcomes. The challenge with using adaptive management lies in finding the correct balance between gaining knowledge to improve management in the future and achieving the best short-term outcome based on current knowledge.

At the core of the adaptive management process is a detailed and targeted environmental monitoring program and a whole-of-environment predictive model. An industry-driven environmental monitoring strategy aimed at incorporating both company-specific and statutory monitoring requirements will optimise future production management and sustainability assessment of farming activities.

These processes focus on addressing the main risks to the wider aquatic environment and farmed fish (fish health). The ultimate aim of the adaptive management program is to monitor production over time and increase knowledge in relation to the sustainability and feasibility of our operations.Monitoring any potentially adverse environmental effects will be associated with the application of relevant mitigation measures based on the severity of the observed impacts.

Adaptive management by its nature provides for flexibility, for example:

- Sampling frequency can be targeted to high risk periods
- Some parameters may be replaced by others, and/or new ones added
- Some parameters may be removed if they no longer reflect an element of risk
- The relevance of survey sites may also change with time and some may need to be created, replaced or moved.

As a general rule, monitoring is carried out not simply to accumulate a wealth of data but rather to identify and tackle specific risks and uncertainties.

The prioritised risks are identified through consultation with the regulators, relevant experts and community stakeholders. The risks are managed by the adaptive management process with continued long-term stakeholder involvement.

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Fish farm management must address several key risks. Industry level risks that:

- Farming operations might have a significant effect outside their lease areas. Examples include, but are not restricted to, eutrophication and the particular requirements of areas such as Tasmanian Wilderness World Heritage Areas and of endangered/threatened species.
- Industry’s social acceptance might be jeopardised by poor water quality and ecological outcomes, and by negatively impacting upon the local community and on other marine industries in the region.

Farm level risks that:

- Eutrophication will adversely affect water quality on the farms.
- Changes to environmental conditions might precipitate a fish health event.
- Changes to water quality or fish health on one lease might transfer to neighbouring leases.

These risks drive both the strategies (modelling/limits) and implementation plans (environmental monitoring program) of the adaptive management process.

The critical importance of robust and genuine adaptive management can be seen in the Macquarie Harbour experience. Figure 318 graphs the trend in dissolved oxygen concentrations over more than 20 years.

Figure 3: Dissolved oxygen trend in Macquarie Harbour.

Figure 3 shows how seasonal dissolved oxygen levels commenced a significant downward trend in 2010 that continued through the next 5 years. Daily dissolved oxygen levels were worse at depth, approaching and often reaching zero, for extended periods across much of the Harbour. Ultimately, in 2016 and 2017 this led to regulatory action and a decrease in stocking levels. However it is Huon Aquaculture’s view that action should have been taken much earlier, arguably in 2013 at the latest.

The graph highlights two things. First, the value of monitoring in showing when things are going wrong, and, second, the potential for catastrophic failure if remedial action is not taken soon enough.

Macquarie Harbour naturally has very high organic inputs from rivers, which in turn lead to unusually high sediment organic matter levels and consequently high biological oxygen demand. The causes of the oxygen decline in the water column are complex and require more research to understand well but there is no doubt that the declining oxygen levels could be catastrophic for the salmon farms, and urgent adaptive management action in response to those environmental changes was called for.

There have been two significant mortality events in the last two years due to low oxygen levels. In each case, it was fortuitous that the entire Harbour-wide stock was not affected by oxygen starvation causing mass mortality across the Harbour. Failure to take a precautionary approach soon enough could easily lead to catastrophic failures of the industry, as has occurred overseas.

FRAME 14:

Adaptive management by industry must be accompanied by adaptive regulation by government, with regulators responding early and precautionarily to environmental monitoring data.

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Sometimes the appropriate regulatory action may be to pre-emptively and precautionarily reduce regulated limits below what industry may want. In the case of Macquarie Harbour, for example, by October 2016 an IMAS study estimated that both fauna and oxygen levels under some salmonid pens had reached virtually zero but the regulated stocking limit for the Harbour was only reduced to 12,000 tonnes (from 20,000 then 14,000 tonnes) even though the standing biomass of 10,000 tonnes was already less than that limit.

Recently, the limits have been raised up to 16,000 tonnes on the presumption that a novel waste collection and removal system being deployed on some leases will be successful.

4.10 Regulatory changes intended by government

The government is proposing to make changes to the current regulatory regime as follows21.

In June 2016, the Minister for Primary Industries and Water announced the government’s intention to transfer the day-to-day environmental regulation of salmonid aquaculture from the Department of Primary Industries, Parks, Water and Environment (DPIPWE) to the Environment Protection Authority (EPA). The decision covers environmental regulatory functions for both marine and freshwater salmonid aquaculture activities, including hatcheries.

As an interim measure pending these permanent legislative changes, since 1 July 2016 the EPA Director has been regulating the environmental aspects of salmonid aquaculture activities by delegation under the Living Marine Resources Management Act 1995 and the Marine Farming Planning Act 1995.

Transferring environmental responsibility to the EPA will:

• Separate the statutory responsibilities for planning and development functions from the day-to-day environmental regulation of the industry
• Enhance and streamline existing regulatory processes
• Strengthen environmental regulations to ensure they keep pace with industry growth and support community and market confidence and expectations.

The process involves changes to a number of pieces of legislation including:

• Environmental Management and Pollution Control Act 1994 (EMPCA)
• Marine Farming Planning Act 1995 (MFPA)
• Living Marine Resources Management Act 1995 (LMRMA), and Inland Fisheries Act 1995 (IFA).

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Environmental Management and Pollution Control Act 1994 (EMPCA)

The establishment of an Environmental licence for salmonid aquaculture as a new regulatory instrument under the EMPCA is a key component of the legislative changes. It will apply to both freshwater and marine salmonid aquaculture and hatcheries.

The government sees the benefits of having an Environmental licence to include:

- Certainty and transparency for both industry and the community through independent regulation by the EPA
- Streamlined and efficient environmental regulation by one authority and
- Flexibility in establishing and varying environmental conditions as required.

As part of this process:

- All salmonid aquaculture operations will be included in Schedule 2 of the EMPCA as Level 2 activities and regulated through an Environmental licence issued by the EPA Director
- In addition to existing licence requirements under other legislation, both marine and inland salmonid farm operators, including hatcheries, will also require an Environmental licence to operate
- As part of the legislative amendments, transitional provisions will ensure that the environmental requirements in existing Marine Farming and Inland Fish Farm licences will remain in force until an Environmental licence is issued. Where relevant, this will also apply to Environment Protection Notices issued under EMPCA and permits issued under the Land Use Planning and Approvals Act 1993
- Provisions to avoid inconsistency and unnecessary duplication across associated pieces of legislation will also be included.

Other amendments to the EMPCA will:

- Specify penalties for failing to hold an Environmental licence where required, or for failing to comply with the conditions of a licence, and enable Infringement Notices to be issued for non-compliance
- Where possible, maintain the existing processes currently used for applications and assessments to minimise any unnecessary regulatory burden on industry
- Allow for the variation, transfer, surrender, suspension or cancellation of Environmental licences by adopting provisions similar to those in the LMRMA and IFA
- Include appeal provisions equivalent to those already in the EMPCA
- Include provisions to enable the EPA Director to refer applications for an Environmental licence for a marine farm to the EPA Board for assessment. Following this, existing Board assessment processes would be employed.

In addition to amendments to the EMPCA, the government also intends to make companion changes to other pieces of legislation that are relevant to the overall management of the salmonid industry, as follows.

Marine Farming Planning Act 1995 (MFPA)

Amendments to the MFPA will enable the EPA Director to ensure that environmental issues are considered and taken into account in relation to the development of Environmental Impact Statements, draft Management Controls and marine farming planning and development processes.

Provisions will be included to ensure that the EPA Director is kept informed of any Emergency Orders or Plans, as well as relevant matters relating to marine farming leases, subleases, subdivisions and expansions to areas that are issued under the MFPA.

Living Marine Resources Management Act 1995 (LMRA)

Amendments to the LMRMA will ensure that the EPA Director is kept informed of applications for the grant, renewal, variation, transfer, cancellation or surrender of Marine Farming licences.

Inland Fisheries Act 1995 (IFA)

Amendments to the IFA will ensure that the EPA Director is kept informed of applications for the grant, renewal, variation, transfer, cancellation and surrender of Fish Farm licences.

Timing and next steps

It is proposed that a Bill to enable the amendments to the current environmental regulatory system will be introduced into Parliament with a view to a structured implementation of the new regulatory framework over a twelve-month period.
5 ADDITIONAL REGULATORY CHANGES REQUIRED

Industry welcomes the transfer of environmental regulation from DPIPWE to the EPA Director but this must be supported by an appropriate allocation of funding and staff. The EPA already has a high workload and the addition of new responsibilities without commensurate additional resources and expertise will simply compound existing problems.

### FRAME 18:
The transfer of regulatory responsibility for the salmonid industry to the EPA must be accompanied by a commensurate allocation of additional resources and expertise.

### 5.1 Industry specific regulator

The salmonid farming industry is a considerable contribution to the Tasmanian economy and community and warrants a dedicated regulatory officer who has industry regulation as their full-time role, rather than it being the responsibility of an EPA Director who has broad responsibilities across a range of sectors.

The creation of a specific position within the EPA, nominally to be called the Finfish Aquaculture Regulator, would provide the necessary focus and attention that the industry warrants. Perhaps more than any other primary industry, salmonid farming environmental and biosecurity matters are inextricably intertwined and this should be reflected by an amalgamation of regulatory powers under one single person.

While the EPA Director (or preferably the proposed Finfish Aquaculture Regulator) and the Chief Veterinary Officer can work in concert, the salmonid industry’s separation of environmental and biosecurity management between two regulators is a historic artefact of legislation. Perhaps more than in any other primary industry, environmental, fish health and biosecurity matters in salmonid farming are inextricably intertwined and this should be reflected by an amalgamation of regulatory powers under a single person.

Again, this person could either be given explicit statutory powers through legislative changes to environmental, fish health and biosecurity legislation or, more simply, could be administratively delegated powers by the EPA Director and by the Chief Veterinary Officer under their respective Acts.

The separation of regulatory control of salmonid hatcheries and marine farms is a similarly artificial division. Biosecurity management, in particular, is a continuum from (land-based) hatching to (marine) harvest, but the same applies to other aspects of the farming cycle.

Examples include selective breeding, brood stock management, land-to-sea transfer scheduling, inter-company stock mingling and recent moves to on-grow smolt to larger sizes in land-based farms before transfer to the sea.

These inter-related aspects should be regulated under a single authority, which would require the Finfish Aquaculture Regulator to also be given powers under the Inland Fisheries Act 1995.

### FRAME 19:
The transfer of environmental regulatory responsibility for the salmonid industry to the EPA Director could be further enhanced by the creation of a specific position of Finfish Aquaculture Regulator, dedicated to ensuring the long-term sustainability of the industry.

The current proposals for regulatory change focus on environmental regulation. No companion changes are contemplated for biosecurity regulation, which is administered by the Chief Veterinary Officer under the Animal Health Act 1995.

### FRAME 20:
The Aquaculture Industry Regulator should be given regulatory powers for all regulatory aspects of the salmonid industry, including environmental, biosecurity, hatcheries and land-based smolt grow-out, either explicitly or by statutory delegation under relevant Acts.

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22 In addition to controls at the national level under the Quarantine Act 1908
5.2 Dealing with empty leases

As the industry has evolved and knowledge about optimum growing conditions and maximum stocking limits has improved, some early leases, notably in the Huon–Channel region, have been vacated. The Minister can cancel unused leases under section 68 of the Marine Farming Planning Act 1995 but this power has rarely been used.

Although vacated, empty leases nevertheless retain an intrinsic value to the holding company because of the difficulty and complexity of obtaining new leases. Lease holders are therefore loathe to relinquish unused leases without a commensurate granting of a new lease in better waters.

The current statutory regime does not provide a mechanism to reduce the maximum leasable area in a marine farming zone. Lease holders therefore fear that relinquishing a lease—which would result in a zone’s leased area falling below the leasable cap—could see another operator being granted a lease within that zone, thereby undermining the purpose of relinquishment.

These risks and concerns could be mitigated by legislative change, to allow the regulator to:

- reduce the maximum leasable area of a marine farming zone after a lease relinquishment to permanently remove the relinquished area from being available again
- approve new leases through a simpler mechanism than is currently available when that new lease will be linked to the relinquishment of another.

5.3 Review of decisions

The existing decision review provisions of the governing legislation have been described in section 4.4.

In summary, the current situation is:

- Industry inputs to the Marine Farming Planning Review Panel processes are possible but there are no appeal provisions against the Minister’s final approval of a new marine farm development plan
- Industry can appeal to the Resource Management and Planning Appeals Tribunal against ministerial decisions on amendments to plans, including where existing farms could be adversely impacted
- The Minister can take advice from the Board of Advice and Reference (if it is extant) on the allocation of leases within marine farming zones, but the Board has been abolished
- There are no third-party appeals against the granting of leases; the applicant may only appeal against refusals or conditions (appeals go to the Tribunal)
- There are no third-party appeals against the granting of licences; only the applicant may appeal (appeals go to the Tribunal)
- The Minister can take advice from the Board of Advice and Reference (if it is extant) on any other matter but this additional power has never been exercised and the Board has been abolished.

It will not always be appropriate for unused leases to be relinquished, even if there is an associated granting of a new lease elsewhere. Unused leases retain value as back-up holding areas in the event of a disease outbreak that requires diseased fish to be temporarily relocated. These leases would effectively become ‘hospital leases’, and lease holders should be allowed to hold those leases empty indefinitely, provided that they are indeed suitable for disease management purposes—for example, an unused lease located close to active leases could not be considered to be a suitable lease for this purpose.

**FRAME 21:**
The statutory regime should be amended to allow unused leases to be relinquished in exchange for simplified approvals for new leases elsewhere, and for lease relinquishment to trigger a commensurate reduction in the maximum leasable area of the original zone to permanently remove the relinquished area from being available again.

**FRAME 22:**
The statutory regime should be amended to allow holders to designate suitably located leases to be hospital leases, and maintain them in an empty state indefinitely to be ready for the temporary relocation of diseased fish.

**FRAME 23:**
The statutory regime should be amended to allow new lease applications specifically for hospital leases.
These provisions go back to the original legislation and were not framed with biosecurity in mind. They therefore do not adequately provide for inputs, reviews or appeals by a company against decisions made in relation to another that may have biosecurity implications.

Because of the critical significance of biosecurity risks to industry, described in section 6.2, changes are necessary. The following suggestions seek to achieve those changes with minimal legislative amendment, as far as possible making use of existing provisions.

There are two key components to the proposed changes. The first, already discussed in section 4.3, is to bring fish farming and biosecurity expertise onto the Marine Farming Development Review Panel, so that marine farm development plans incorporate appropriate fish health and biosecurity considerations from the outset.

The second is to reinstate the Board of Advice and Reference, ensure that the fish farming expertise member has biosecurity expertise23, and expand its role to the provision of advice and review on all aspects of marine farm decision-making, from plan development through lease allocation to licence issue.

The proposed roles for the Board are shown in Figure 4. Appeals are currently available to applicants in certain situations but there is no explicit opportunity for the interests of other marine farmers to be protected at every stage. Under the proposals, the Board of Advice and Reference would ensure that the interests of other marine farmers are fully and properly considered when new plans are being developed, when new leases are being considered and when licences are being issued.

The marine farming decision-making process for plans, leases and licences should explicitly and comprehensively incorporate fish health and biosecurity advice and review by a body independent of the decision-maker.

Figure 4: Proposed advisory and review roles of the Board of Advice and Reference.

At the planning stage, existing marine farmers can currently each provide inputs to the Panel on new plans but only through the public consultation process and they cannot appeal against new plans. Under the proposals, the Board could provide a review role for new plans on behalf of the wider industry.

At the lease issue stage, appeals are currently possible by applicants against lease conditions but not against the issue of a new lease. The Board could provide a review role for new lease decisions to protect other lease holders.

At the licensing stage, applicants can currently appeal against conditions but other marine farmers cannot. The Board could provide a review role for licence decisions to protect other licence holders24.

The proposed changes can be implemented under existing legislation, simply by the Minister reinstating the Board of Advice and Reference and directing it under section 50 of the Marine Farming Planning Act 1995 to provide the advisory and review roles shown in Figure 4.

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23 Under section 49(2)(b) of the Act that member must have “experience and knowledge in marine farming and the seafood industry”, which is sufficiently broad to allow the Minister to require that experience and knowledge to include biosecurity

24 The EPA Director operates under the aegis of the EPA Board under the Environmental Management and Pollution Control Act 1994 but the EPA Board does not have the necessary industry expertise or focus for the marine farming industry
The Minister could simultaneously direct the Marine Farming Planning Review Panel under section 9 to refer plans to the Board and the Minister (or delegate) could administratively refer lease applications to the Board also.

As described in section 4.10, the government intends to transfer marine farm licensing to the EPA Director under the Environmental Management and Pollution Control Act 1994 (EMPCA), which will introduce RMPAT appeal provisions to marine farm licence decisions. However, the EMPCA is not a biosecurity statute and RMPAT will not have the necessary biosecurity expertise or mandate to take an industry-wide biosecurity perspective. The EPA Director (or proposed Finfish Aquaculture Regulator) could therefore administratively refer draft marine farm licence applications to the Board of Advice and Reference prior to making a decision.

5.4 Consolidation of Huon and Channel areas into one

The Huon and Channel areas are currently managed through separate marine farm development plans. This is a legacy of when the original plan areas were designated—areas were designated for geographic convenience rather than based on ecological processes and systems.

From an ecological and environmental perspective, the separation is entirely artificial. For example, the TPDNO (see section 4.5) for the Huon-Channel region is set on the basis of a biogeochemical model that models the entire area as a single system. This global TPDNO must then be administratively split between the Huon and Channel areas, even though there is no ecological or environmental split.

FRAME 25:
The Board of Advice and Reference should be reinstated and directed by the Minister to provide an independent advisory and review role for marine farm planning, leasing and licensing decisions.

FRAME 26:
To reflect the underlying ecological and environmental integrity of the natural system, the Huon and Channel areas should be managed under a consolidated single Marine Farm Development Plan, with a single TPDNO for the entire area.

This will require the Minister to redesignate the areas under section 19 of the Marine Farming Planning Act 1995 and for the plans to be merged. Rather than going through the normal plan development process, which would be a protracted and unnecessarily complicated process, this would be best achieved by special legislation.

5.5 Mandatory requirements for new leases

To avoid further exacerbating already high biosecurity risks, new leases should only be granted where strict prerequisites are met. Mandatory prerequisites should include:

- Separation distances between companies and between year classes and subclasses
- Access to a shore base
- Access to a hospital site
- Access to fresh water and ability to effectively treat amoebic gill disease
- Maximum water temperature limit
- Strong current flushing regime
- Use of an effective seal barrier.

FRAME 27:
New leases should only be approved if they meet mandatory requirements of: separation distances between companies and between year classes and subclasses; access to a shore base and hospital site; access to fresh water and ability to effectively treat amoebic gill disease; maximum water temperature limit; strong flushing regime; and use of an effective seal barrier.

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25 Or, if relevant, use the powers of section 52
26 Or, as proposed in section 5, the Salmonid Industry Regulator
The Marine Farming Planning Review Panel and the Board of Advice and Reference, enhanced with appropriate expertise as described above, should be directed to regularly review these mandatory prerequisites and amend or supplement them as may be necessary to ensure the highest levels of biosecurity protection for the industry.

**FRAME 28:**
The Marine Farming Planning Review Panel and the Board of Advice and Reference should regularly review the mandatory prerequisites for new leases to ensure the highest levels of biosecurity protection for the industry.

The application of minimum prerequisites will have ramifications for the future pattern of development of the industry. In south-eastern Tasmania, for example, the mandatory requirements could only be achieved in offshore areas (7 and 8), shown in Figure 5.

Figure 5: Areas (7 and 8) in south-eastern Tasmania to which new leases would be restricted by the mandatory requirements.
6 BIOSECURITY

6.1 Current biosecurity

Biosecurity is critical to the future of the industry. Industry’s concerns and requirements have been summarised in the TSGA’s submission to the Commonwealth government on its Biosecurity (Prohibited and Conditionally Non-prohibited Goods) Determination 2016.27

The number one priority for the industry is the maintenance of freedom from disease and pest status in Tasmania.

Many of the serious diseases and pests of concern are exotic to Australia and will potentially have major implications for aquaculture and fisheries across Australia. However, wherever the Commonwealth cannot justify quarantine measures on a national basis it is critical that formal recognition of Tasmania as a region of differentiation in relation to biosecurity and quarantine matters is enforced due to its special circumstances and geographic isolation.

In 2013, the salmonid industry engaged in discussions with DPIPWE to consider an integrated biosecurity program for the Tasmanian industry. The purpose of the integrated approach was to formalise biosecurity activities that are common to all industry operators, and to address the entire production life cycle and commercial activities of salmonid aquaculture.

FRAME 29:
Tasmania’s island status has provided a unique regional pest and disease status which must be recognised and maintained to ensure the ongoing viability of the industry.

Biosecurity Program

The initiative led to the publication of the Tasmanian Salmonid Growers Association (TSGA) Biosecurity Program28.

The aims of the Program are:

• Prevent the introduction and establishment of aquatic diseases in Tasmania
• Limit the spread of existing diseases that pose a threat to primary producers
• Inform industry and government representatives of potential threats early enough to take precautionary actions
• Manage existing diseases, and where possible reduce their impact through coordinated mitigation strategies
• Respond rapidly and effectively to new incursions of disease.

The objectives of the Program are:

• Establish a common understanding of industry compliance and regulatory obligations for finfish license conditions and plan area management controls, as per Tasmanian and federal legislation
• Gain industry and government agreement on the minimum biosecurity practices undertaken within the Tasmanian salmonid industry
• Document the biosecurity practices in a manner which clearly outlines responsibilities of all parties participating in the Tasmanian salmonid industry
• Identify biosecurity strategies that have been implemented to provide domestic and overseas markets with confidence in the high aquatic animal health standards of Tasmanian salmonids
• Establish a statewide biosecurity program that is effective in managing the threats of disease to the industry and
• Demonstrate transparent and consistent biosecurity decision-making and management practices consistent with state and national obligations.

Development of the Program was guided by the Biosecurity Strategy for Tasmania—Salmonid Industry Working Group, with input from industry companies and DPIPWE.

Guiding principles for the Program are:

- Aim to be a world-class leader in salmonid aquaculture biosecurity by developing and implementing best practice biosecurity measures, with the goal to work toward best practice in all aspects of enterprise operations
- Agree on the minimum industry-wide requirements for biosecurity, with clear expectations for operational requirements
- Develop biosecurity zonation and establish controls for movement of stock and equipment between zones
- Select locations for new facilities which are adequately separated from existing aquaculture operations, as well as other facilities which pose a biosecurity threat to salmonid aquaculture
- Select new vessels, equipment and transport systems which are designed and operated to prevent translocation of disease agents
- Determine protocols for identifying and communicating evidence of disease to industry companies and government authorities in a timely manner.

The Program addresses the aims of prevention, detection, control and response to disease through:

- Identification of regions and zones as a management tool for appropriate biosecurity requirements
- Management measures for pathways that may introduce or spread disease to any part of the salmonid lifecycle, including contracted services (personnel, road vehicles and vessels)
- Management measures for processors, waste and mortalities
- Detection of disease with surveillance and diagnostic capabilities
- Reporting and communication of disease incidents
- Emergency response arrangements; and
- Monitoring of compliance.

The TSGA also determined the need for:

- Identifying roles and responsibilities of key personnel involved in biosecurity decision-making;
- Implementation of the Program in enterprise biosecurity plans
- Identifying corrective action to continuously improve the Program
- Establishing review processes for the Program and managing change.

Biosecurity regions and zones

Three marine biosecurity zones and one terrestrial zone for salmonid aquaculture have been designated in the Tasmanian state region, in consultation with DPIPWE:

- Macquarie Harbour Marine Biosecurity Zone
- South East Marine Biosecurity Zone
- Tamar Marine Biosecurity Zone
- A single terrestrial zone for: hatcheries; fish processors; waste management facilities; and research and laboratory facilities.

Each of these zones is referenced for specific biosecurity management requirements in the Program.

The marine biosecurity zones encompass geographical areas within the Tasmanian region, and are not to be confused with Marine Farm Plan Areas prescribed by DPIPWE-EPA.

Disease pathways

Pathways that may enable the introduction of exotic diseases to salmonid farming activities, or cause the spread of endemic diseases between industry production sites include:

- Live fish movements, including the water in which they are transported. Live fish includes all life stages of salmonids (eggs, fry, smolt, broodstock and grow-out stocks)
- Infected fish products, post-harvest
- Contaminated feed
- Contaminated materials (eg. farm equipment including harvest and mortality bins, transport trucks, marine vessels)
- Staff, contractors and visitors (eg. vehicles, equipment, protective clothing)
- Wild aquatic organisms (eg. fish, crustaceans, zooplankton, algae), which may also be carrying diseases not previously introduced to farmed stock
- Wildlife interactions (eg. seals, birds)
- Biofouling of vessels and marine equipment, and ballast water discharges from vessels
- Recreational anglers and wild fishers (eg. contaminated tackle, vehicles, vessels, bait).

Specific internal pathway risks include:

- Movement of stock between hatcheries
- Movement of smolt from hatcheries to marine zones
- Movement of fish within marine zones
- Movement of harvest fish to processors
- Movement of broodstock, gametes or ova from production sites to hatcheries
- Removal and handling of mortalities
• Entry of contaminated feed
• Personnel access to facilities
• Plant and equipment movement between biosecurity zones.

Detailed biosecurity controls are described in the Tasmanian Salmonids Growers Association’s Biosecurity Program.

6.2 Critical biosecurity risks

Despite the very comprehensive biosecurity program described above, the Tasmanian salmonid industry remains at critical risk of biosecurity failures.

Some diseases are known to cause very high mortality. For example, infectious hematopoietic necrosis (IHN) can cause >70% mortality in small fish and >50% mortality in large fish; infectious pancreatic necrosis (IPN) can cause 100% mortality in hatcheries; and infectious salmon anaemia (ISA) can result in >90% cumulative mortality.

If any one of these diseases became established in Tasmania it could close the industry down. There could be huge job losses and financial losses, a crash from which industry may struggle to recover. This is not a theoretical scenario—there are many examples overseas of the devastating impact of disease on companies and communities.

The experience in the Faroe Islands has been mentioned earlier (section 3), Chile is another example. Figure 6 shows Chilean production trends over the last 20 years.

The introduction of ISA in Chile in 2007 resulted in Marine Harvest (just one company) having to close 27 production sites and two processing factories and make 1866 employees redundant. The devastating losses are reflected in Chile’s annual production figures. Like in the Faroes, the recovery from the crash occurred only after the introduction of strict new biosecurity controls, including safe minimum distances between companies and classes of fish.

In addition to the above overseas diseases, which have yet to become established in Tasmania, there are existing established diseases that can cause serious problems for industry.

Examples include gill amoeba, reovirus, salmonid rickettsial septicaemia (RLO), yersinia, tenacibaculum and (since May 2012) pilchard orthomyxovirus (POMV). There are also diseases specific to Macquarie Harbour, such as atypical Aeromonas salmonicida.

The progression of POMV in Tasmania illustrates the risks facing the Tasmanian industry, notwithstanding the industry’s biosecurity program.

Figure 6: Production trends in Chile

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29 There are also other diseases of great concern, including furunculosis, bacterial kidney diseases, cold water vibriosis, pancreas disease and viral haemorrhagic septicemia

30 Source Bakkafrost

POMV in Tasmania

POMV was an incidental finding in two fish in the Tamar River in 2005/2006 and then was not seen again until 2012. In May 2012, the first serious POMV infection occurred at a lease in the Huon Estuary, where it caused a cumulative mortality of more than 500,000 fish. Infection and mortality also occurred at another lease (> 20,000 fish). Later that year, a second serious infection occurred in smolt delivered to Dover, with more than 100,000 smolt dying.

In early May 2013, another serious infection started at a Tasman lease in newly transferred 13YC32 smolt. All 13YC pens at the site were affected. Mortality was up to 50% in an individual pen (ie. in order of 60–70,000 morts in a single pen).

POMV is now an established and very serious disease. In 2016, Huon Aquaculture and Tassal each lost 300,000 fish due to POMV. It has the potential to severely impact the viability of our industry if it starts to cause infection consistently in newly transferred smolt.

The current biosecurity program did not and cannot prevent these types of outbreaks, and the Tasmanian industry remains vulnerable to the catastrophic crashes that have occurred in other countries.

6.3 Future biosecurity

Further substantial biosecurity measures are urgently required. The recovery of the Faroe Islands industry from the devastating outbreak of ISA in 2003 stands out as an exemplar of best practice.

Mortalities there are now in the order of 5 to 10% compared with 20 to 25% prior to its introduction—the Tasmanian industry by comparison currently has a mortality in the order of 20%, up from around 7% 15 years ago.

A Faroe Islands type of approach must form the basis for future biosecurity in the Tasmanian salmonid industry.

The Faroe Islands’ recovery success is based on three key principles: strong regulation; a few companies only in each growing region; and physical separation of companies within growing regions.

Regulation

A regulatory regime known as the Faroese Veterinary Model (FVM) emerged from the 2003 crash and has allowed the industry to recover and prosper once again.

The FVM comprises:

• One generation farming
• Fallowing periods between each generation
• Immunisation and vaccination programs
• Movement restrictions on fish and equipment
• Imposition of density limits
• Brood stock to be held only on land
• Fish not to be held in open waiting pens at harvest stations
• Minimum distances between hatcheries
• Minimum distances between farms
• Rules to fight and control sea lice.

Companies per growing region

Prior to the 2003 crash, the Faroe Islands salmon industry comprised 27 companies, which were forced by the circumstances to consolidate down to only three following the crash. Clearly this situation does not apply in Tasmania, where there are currently only three (Huon Aquaculture, Tassal and Petuna) and it is unlikely that many more will emerge (although there were 18 companies at one stage). This is a fortunate situation for future biosecurity in Tasmania.

Intercompany separation

The separation between companies in the Faroes Islands is shown in Figure 733. Apart from some minor overlaps, essentially each company now has a fjord area to itself. In the overlap areas strict farming, fish health and fallowing regimes are mandated.

This separation was implemented after the 2003 crash. Prior to the crash, the 27 companies were intermingled throughout the various fjord areas.

The very marked contrast between the new Faroe Islands regime and the current Tasmanian situation is shown by comparing Figure 7 with Figure 8 and Figure 9, which show the distribution of established leases in the south-east (Huon-Channel-Storm Bay) and Macquarie Harbour areas. Figure 8 also shows how Huon Aquaculture uses its leases.

32 Year class 13
33 Bakkafrost presentation 2016
Figure 8 and Figure 9 highlight the close intermingling of leases in different ownership that characterises the Tasmanian industry.

This intermingling is exacerbated by each company using its leases within a different locality for different purposes. For example, one company’s smolt lease might be close to another company’s grow-out lease. Similarly, one company’s hospital lease might be close to another company’s production lease.

It is not just the proximity of leases that is of concern and risk. The intermingling also means that one company will need to tow fish pens past another company’s lease.

The intermingling of leases and transport routes is a high risk to the industry. It is fortunate that a catastrophic disease outbreak has not already spread through the industry. A physical separation of companies and fish classes is of the utmost importance to future biosecurity. If this cannot be achieved in existing areas, then sites should be managed as if they belong to one company, e.g. with same fish types next to each other. New areas should have adequate separation between companies and year classes.
Figure 9: Established leases in Macquarie Harbour

The existing situation of lease distribution and ownership has emerged over three decades and cannot easily be unravelled. In the Faroe Islands and Chile, it took a disaster to force change, and it was made somewhat easier there because of the natural physical separation of waters provided by the fjords.

In Tasmania, we must pre-empt disaster and make changes, recognising the geographical constraints and opportunities that we have. In the absence of fjords, separation can nevertheless be achieved through a combination of geography and good management and coordination.

**FRAME 31:**
A physical separation of companies and fish classes is of the utmost importance to the future biosecurity of the Tasmanian salmonid industry.

For the Huon-Channel-Storm Bay region, a rezoning of areas according to grow-out staging should be undertaken. Under this concept, the Huon Estuary and Port Esperance would become dedicated to smolt; the mid-channel would become dedicated to out of season smolt growout and more southern offshore areas could be dedicated to spring smolt growout. Storm Bay would be an entirely separate zone dedicated to pre-smolt transfer and growout.

There are two fundamental ways of achieving this, either:

- **Operational rezoning:** The existing arrangement of leases would largely be retained but companies would coordinate their farming practices so that on neighbouring leases all year classes and subclasses are put to sea and harvested at the same time. This would have the effect of the area being farmed as if it was by one company.

- **Geographical rezoning:** The existing arrangement of leases would be reconfigured to create a geographical separation between companies, so that within any given zone all leases are held by one company.

The actual reconfiguration mechanism would need to be worked out by the industry and government but the principle to achieve is critical—a physical separation of year classes and subclasses, whether that is by coordinating companies or separating companies.

**FRAME 32:**
Tasmania’s geography presents constraints to rigorous geographical intercompany separation but also opportunities for managed separation.

**FRAME 33:**
The south-eastern region should be reconfigured to achieve either an operational or a geographical separation of year classes and subclasses, respectively either by companies coordinating their management of neighbouring leases or by lease ownership being reallocated to create geographically separate company zones.
In Macquarie Harbour, geographical zoning would be problematic. However, operational zoning could be achieved by reconfiguring the arrangement of leases so all companies farmed different year classes at different ends of the Harbour, with each year class having to be harvested and all leases fallowed for three months prior to the next year class being stocked. Another option would be mandating to companies that only one, common year class can be held in the Harbour at any time, with compulsory whole-of-harbour annual fallowing. This would require the Harbour growout period to be restricted to 9 months to allow a three-month fallow period to occur.

The latter option would require significant changes to management practices, and would likely require companies to investigate the feasibility of growing first-year smolt in land-based facilities, something that is already under investigation in the south-east (see section 10).

Biosecurity management measures should be consolidated under a Tasmanian Veterinary Model (TVM) based on the following key principles:

1. **Strong regulation**
   While the TVM should as a matter of prudence and good husbandry be adopted voluntarily by industry, it should be reinforced by a strong and active regulatory effort by government.

2. **Separation of year classes and subclasses**
   Companies should coordinate their use of their leases so that nearby leases hold the same year class. This would lead to a consolidation of use of areas within growing regions. For example, inshore areas of the Huon–Channel region would best become dedicated to smolt leases for all companies, while offshore leases would be dedicated to grow-out for all companies. A further refinement of this would be for companies to coordinate their stocking and destocking of leases, so that the same year classes go in and come out together where leases are close together.

   Another important consideration, particularly in Macquarie Harbour, is the mixing of species (Atlantic Salmon and Ocean Trout) on a single lease. Whilst the potential for disease transfer is there, it is an order of magnitude lower in risk compared to risks associated with mixing of year classes. However, the industry and government need to determine if the residual risk is acceptable.

3. **Dedicated hospital leases**
   When fish get diseases, companies need to move them away from their own stock to another lease, to avoid the disease spreading throughout a lease. However, without coordination between companies, one company may move its diseased fish to a location that, while remote from its own stock, is close to another company’s stock. To avoid this situation, companies should dedicate an appropriately located lease in each geographical area to become a hospital lease, where they will take that area’s diseased fish until they recover. These leases should be identified in advance and should be remote from any lease held by another company.

   If the current availability and distribution of leases does not allow the dedication of appropriately located hospital leases, then the creation of new leases for that purpose must be a priority. This will require coordination by the industry with the support and facilitation of government.

4. **Restricted pen towing routes**
   Just as the close proximity of diseased fish on leases poses a great risk to uninfected fish on nearby leases, whether in the same or different ownership, the towing of fish past leases can cause disease to spread. Dedicated towing routes for diseased fish must be identified and agreed to by all companies, in advance of them being required. Towing should be progressively phased out.
5. Greater use of well-boats
Towing of pens, even if along dedicated routes, increases the potential for disease transfer. Over the next 3 to 5 years industry must move to a greater use of (closed-valve) well-boats, by which fish can be transferred safely inside the holds of the boats (with valve closed during transport).

6. Greater use of offshore leases
The current distribution of leases in the south-east means that many are intermediate between inshore and offshore. For example, inshore leases are those in the Huon Estuary, Port Esperance and close to Bruny Island; offshore leases are in Storm Bay; intermediate leases are in the centre of the Channel. As well as providing better growing conditions, and thereby being better leases in their own right, offshore leases have the great advantage of being further away from other, inshore, leases. If they are also managed as entirely separate zones, they will be less susceptible to disease transfer, whether that is from other leases to them or from them to other leases. Offshore leases provide better growing conditions for fish but were problematic to farm until advances in knowledge and technology made it practicable. The pattern that evolved during the early years of the industry was for inshore leases to be used for smolt and intermediate leases to be used for growout. The recent developments in offshore farming is allowing this to change.

7. Separation by tidal excursions
Evidence\(^\text{34}\) suggests that the minimum separation between companies should ideally be two tidal excursions, which is the longitudinal distance that water moves over two tidal cycles (10 km in Storm Bay, for example). The principle is that free-floating disease organisms cannot survive to be able to infect other fish over that separation distance and time. Following the same principle, companies should try to coordinate their stocking and harvesting of their leases to achieve a similar separation between fish year classes and smolt subclasses\(^\text{35}\).
The current arrangement of leases in both the south-east and Macquarie Harbour does not currently meet this minimum separation distance. However, it should become a determining factor for year class separation on current leases and for the approval of new leases by government.

8. Conservative fish stocking densities
Conservative limits should be set for fish stocking densities for pens and leases. These should be based on the safe carrying capacity of the particular growing waters, and will vary from region to region. For example, the safe stocking densities in Macquarie Harbour are much lower than they are in Storm Bay. The densities must be based on viable net volume, rather than simple physical net volume, to recognise that in sites like Macquarie Harbour the low oxygen levels at depth mean the deeper sections of nets can be unusable by fish. Conservative stocking densities that reflect the safe carrying capacity of the growing region should be implemented based on viable net volume.

9. Sanitary harvest systems
Ideally, fish would be harvested at their lease to minimise the risk of disease transfer. Transporting fish to a harvest station creates a potential disease transfer risk, particularly if the fish are held in open pens pending harvest. The regular and repeated concentration of fish being held in open pens at a harvest station creates disease risk hot-spots.

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\(^35\) Examples of smolt subclasses within the same smolt year class include spring smolt and out-of-season smolt
However, harvesting at exposed sites can be difficult due to sea conditions. Provided fish are healthy, they might be able to be moved to a dedicated lease or shore station for harvesting.

If a shore-based harvesting system is used and fish that are showing signs of disease need harvesting, then these fish can be brought back in a closed valve well-boat and pumped directly into the harvest system with all the water returning to the wells of the vessel and then flushed at a site a sufficient distance away from any farming activities. Another option being investigated in Norway is to bring fish back to closed pens or onshore tanks for harvesting. The feasibility of this should also be investigated by the Tasmanian industry.

10. Rigorous fallowing regimes

Fallowing must be undertaken for both disease control and environmental reasons.

After fish have been removed for harvesting or relocation, the seabed underneath pen-bays should routinely be left fallow for long enough to deplete any disease organisms that may be in the sediments. This minimises the risk of disease transfer to the restocked fish. Generally, this disease control fallowing will happen on an annual basis, in coordination with the annual harvesting cycle.

As well as entire lease fallowing that should occur annually, individual moorings within leases should be fallowed for longer periods to allow the seabed to return to baseline conditions. This will require more mooring positions within a lease than is used in any one year so pens can be moved between moorings as required. This will mean different requirements between inshore leases and offshore leases with offshore leases not requiring to do this as often as inshore leases.
PART B: GENERAL MATTERS
Traditional hatcheries use a flow-through design, where water is taken from the river, passed through the fish holding tanks and then discharged back into the river. Contemporary designs still take water from the river but recirculate almost all of it, with the small residual discharge usually being directed to land rather than back into the river.

Historically, flow-through hatchery discharges put nutrient-rich water back into the river, and this can have localised eutrophication impacts immediately downstream, typically in the form of increased benthic algae. The hatcheries are not the sole cause of this eutrophication because all rivers with hatcheries have significant nutrient inputs from other activities, but the hatcheries are contributing factors.

Facilities have evolved various nutrient and waste mitigation measures to deal with this. For example, the Lonnavale hatchery on the Russell River uses drum filters and settlement ponds on the outflow before it goes back into the river, and this is very effective. There is no evidence of any associated stress or detrimental impact on macroinvertebrates or fish at that hatchery36. Nevertheless, to minimise water use and impacts on rivers, industry is building new hatcheries to be recirculating rather than flow-through systems.

Recent state-of-the-art hatcheries built at Lonnavale and Judbury, for example, recirculate 95-99% of water, with the residual water being directed to land application, typically irrigation.

The greater control provided by recirculation hatcheries leads to more rapid fish growth and shorter growing periods. Smolt weights at transfer to sea have increased from around 130 g to around 200 g. The new developments of further on-land grow-out (see section 10) can further increase the transfer weight to around 600 g, which will allow full grow-out to harvest in under 12 months.

In the meantime, older flow-through systems will continue to play a vital role in supplying industry with smolt, trout and brood stock. Most flow-through systems have been upgraded in recent years to incorporate some form of nutrient capture and water reuse using basic recirculation technology components. Nutrient capture techniques include settlement ponds, reed beds, microstrainers, biodigesters and irrigation before the outflow enters the river system again.

**FRAME 38:**

When constructing new hatcheries, industry is preferentially evolving from older flow-through hatchery designs to contemporary recirculation designs, which use much less water and which have a lower environmental impact, while allowing faster fish growth and reduced growing periods.
8.1 Inshore versus offshore

For simplicity and convenience, lease locations can be described as inshore, offshore or intermediate between the two. For example, leases in the Huon Estuary might be considered to be inshore, leases in Storm Bay offshore and leases in the middle of the D’Entrecasteaux Channel intermediate.

These terms are not driven by proximity to shore, however. Huon Aquaculture’s Storm Bay leases are only about as far from land as our mid-Channel leases are. The driver is exposure to wind and sea conditions, and the consequential pen and anchoring designs that are needed and the size of vessels needed to service them.

Our ‘offshore’ Storm Bay leases are much more exposed than our ‘inshore’ Huon Estuary leases are. The mooring systems and equipment used on the Storm Bay leases must be much more substantial than they need to be on the Huon Aquaculture leases.

Macquarie Harbour leases can be subjected to rough sea conditions. However, the Harbour is considered to be an inshore region because much of it is relatively sheltered and because the bulk of its water volume has very low exchange rates, which is why dissolved oxygen levels and benthic health have become concerning for salmon farming.

Offshore sites tend to be deeper, with high wave-energy and stronger currents. They require substantial pen and anchoring systems and service vessels suited to these conditions. Due to the more exposed conditions, they are usually further from land and residential settlements and often remote. The environmental benefits of offshore leases are also considerable including greater oxygen availability and quicker flushing reducing any impacts on the sediment and water column.

Inshore sites tend to be in shallower, enclosed waters, away from high-energy waves. They may have strong currents, but often not. Pens can be smaller and anchoring systems can be less robust. Usually, these sites are more visible and closer to residential settlements.

Evolution of the industry

When the Tasmanian salmon industry was getting started in the 1980s, the ideal farming site was a relatively sheltered, semi-enclosed bay. As for inshore sites, early pen designs were much smaller and with shallow nets to accommodate the shallow water depth, with shelter the primary determining factor as long as there was adequate current movement for the fish.

The present distribution of marine leases largely reflects those early decisions. Under Tasmanian legislation, it is very difficult to relocate leases, so the original location and distribution of the early leases have become entrenched and subsequent leases have developed around that original arrangement.

The result is a configuration of leases that is far from ideal, and which would not be repeated if lease locations were being allocated today with the current technology that is available. Unfortunately, this has created a situation that presents a number of issues, including compromised fish health, increased environmental degradation and severe biosecurity risks, a subject addressed in section 6.

The recent industry response to these risks has been to start to develop offshore leases, well away from the original inshore leases.

8.2 Underwater lighting

Underwater lighting is used to prevent sexual maturation of fish in their first year at sea. This usually involves night-time subsurface lighting during winter and spring. The industry typically used to use a number of 400 to 1000 watt sub-surface metal halide lights in each pen. This lighting produced a distinct diffuse underwater glow that could be visible from above. The development and adoption of LED lighting that directs the light downwards in the pen has greatly reduced above water visibility and enhanced light efficacy.

8.3 Fish bathing

The most significant fish health issue for Tasmanian Atlantic salmon farms in the SE is the gill amoeba parasite. This is a naturally occurring parasite that can smother fish gills, causing mortality.

Fortunately, treatment of gill amoeba is very simple—it can be killed by bathing the fish in fresh water for 2 to 3 hours. This is due to the amoeba being unable to survive the change in salinity, whereas the salmon can.

Freshwater bathing was initially conducted by towing pens to a shore base that had a fresh water supply. This evolved to the use of a large liner slung inside an empty pen and filled with fresh water from another liner that was towed out to the lease. The fish would then be pumped across into the new pen containing the liner and after a 2-3 hour bath the liner would be removed. At this point, the fresh water would flush from the area and the fish would be in their new pen that

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37 The criterion was >2 cm/sec, which is very low by contemporary expectations
would then be moored back within the lease. More recently, underwater pipelines have been used to bring water out to some leases from the shore, reducing the number of liners being towed out to the leases.

Even more recently, the use of purpose-designed vessels, such as Huon Aquaculture’s Ronja Huon well-boat greatly reduces the need for liner towing and pen movements, as fish can be siphoned up into the hold of the vessel where they are bathed in fresh water, after which they can be released back into their source pen. New, larger vessels capable of producing their own fresh water on board will remove the need for towing liners altogether.

8.4 Fish transport

Fish have previously been transported from hatcheries to sea by boat in tankers and from smolt leases to grow-out leases by towing the pens, and from the grow-out leases back to the shore for harvest by towing pens.

The need for these transfers can be removed through the use of purpose-designed vessels such as Huon Aquaculture’s Ronja Huon, which can take multiple truckloads of smolt in one load and siphon up fish from a sea pen and transport them live to a new pen (usually in conjunction with a freshwater bath) or back to a shore base for harvesting.

8.5 Warming waters

The preferred temperature range for Atlantic salmon is 12–15°C. Post-smolt fish show signs of thermal stress at 17°C, and above that growth and development is impaired.

As the temperature of water increases, its oxygen content decreases and lowered oxygen availability can exacerbate the temperature stress. At fish temperatures above their optimal, immunosuppression can also occur, increasing fish susceptibility to infectious diseases (such as amoebic gill disease, reovirus, Rickettsia-like organism, Tenacibaculum and yersiniosis).

Temperature increases could also have indirect impacts on farmed fish, for example through increased density and new species of jellyfish blooms, which can cause toxic impacts and reduce oxygen availability, and through phytoplankton blooms, which can also diminish oxygen availability.

The Tasmanian Industry Selective Breeding Program selects for good performance at higher temperatures, as well as other factors including growth, but this alone may not be enough to keep up with the increased rate of change.

The warming waters already evident around Tasmania, together with future further warming due to climate change, create an imperative for industry to progressively move the focus of its operations from inshore to offshore sites where there is increased water flow and oxygen (but recognising that the southwards extension of the East Australia Current creates additional temperature constraints to salmon farming on the east coast, even offshore).

8.6 Climate change and associated warming waters will progressively reduce the suitability of shallow inshore leases and increase the need to move to more exposed offshore leases.

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**FRAME 39:**
Pen towing for fish bathing is being progressively reduced by the use of bathing barges and (closed-valve) well-boats for bathing.

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**FRAME 40:**
Pen towing for fish relocation should be phased out through the use of closed-valve well-boats for live fish transport.
8.6 Stocking densities

Low stocking densities are essential for the health and well-being of fish and for reducing the environmental impact of intensive fish farming.

In the early days of the industry, stocking densities around 20 kg/m$^3$ were common, but rates are now 10–12 kg/m$^3$ and Huon typically stocks at densities of around 8 kg/m$^3$ (approximately half the 15 kg/m$^3$ maximum recommended by the RSPCA). These low densities are most efficiently and practically achieved in large, offshore pens, which further points to this being the future direction of the industry.

These densities should be calculated by reference to viable net volume, which recognises that dissolved oxygen can be lower at depth, particularly in the highly stratified conditions in Macquarie Harbour where dissolved oxygen can be so low 10 m down that salmon could not survive there. Including the volume of net below this depth in density calculations would be wrong.

8.7 Fish feeding

The Tasmanian industry currently uses fish feed manufactured by three suppliers: Ridley Aquafeeds (based in Narangba, Queensland), Biomar (based in Grangemouth, Scotland) and Skretting (Cambridge, Tasmania). Feeds are specifically formulated for Atlantic salmon farmed in Tasmanian conditions.

A typical biological feed conversion ratio (FCR) for the full grow-out cycle is 1.35, which means that 1.35 tonnes of feed is used to produce 1 tonne of fish. Feed manufacturers are continually working to reduce the amount of wild caught fish required in salmon feed. As noted by the Australian Marine Conservation Society’s Sustainable Food Guide, “It is likely that the companies producing salmon in Tasmania will achieve the goal of being net [fish] protein producers in coming years, meaning they should produce more weight of farmed fish than is contained in the fish feed.”

Industry feeds to appetite, following the principle of giving every fish every opportunity to eat when it wants to while minimising feed wastage to the seabed. Wasted food causes greater impacts on the seabed underneath pens and is also a direct financial loss for farmers.

Feeding typically uses video camera systems that assess the appetite and ingestion rate of the fish to feed to satiation without waste. This minimises food wastage and also pellets reaching the sea floor.

Additional monitoring of the sea floor is undertaken in accordance with licence requirements. This is usually by video cameras deployed on ROVs.

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Fish feeding is becoming more automated, with pellet-recognition video software able to detect pellets falling to the bottom sections of pens. While these pellets are still eaten by fish, they indicate that the rate of consumption is slowing and feeding can then cease.

Feeding is also becoming increasingly centralised, with feed located within a central, moored feed barge that supplies feed to multiple pens through a network of floating pipes. Initially, this has been controlled by operators on the barges but with the move to offshore sites, and associated safety considerations, this local operation is being phased out and replaced with remote operation from land-based offices.

**8.8 Mortality collection**

The collection of dead fish from pens was a task that used to be undertaken by divers, but like fish-feeding is being automated through a network of pipes that collect dead fish from where they fall to the base of each pen and send them back to a central barge for ensiling. Again, this will progressively come to be remotely operated. Rapid and automated recovery of dead fish reduces disease risk and removes a potential attractant to predators.

**8.9 Net cleaning**

Like anything in the sea, nets can be subject to biofouling by organisms such as algae, mussels and sea squirts. Biofouling blocks the flow of water through the net and can act as a disease organism reservoir.

Clean nets allow for better water flow through the pen, which means more oxygen reaches the fish, making them more comfortable and healthier.

In the early industry, biofouling was minimised by using copper-based anti-fouling paint on the nets. By design, these materials are toxic to marine organisms. Unfortunately, the anti-foulants can break-off from the nets and fall to the sea floor, and when nets are brought to shore for cleaning the removed waste is also contaminated.

The use of anti-fouling on nets is no longer considered appropriate and has been phased out with in situ net cleaners being used instead.

In peak fouling times during summer and in parts of spring, nets may need to be cleaned as often as once a week. This reduces to every two to three weeks in winter.

A further benefit of in situ net cleaning is that it removes the need to take nets back to a shore base for cleaning.

In situ net washing leads to washed-off material and organisms falling to the sea floor. However, regular washing prevents organisms taking hold and growing on the net, greatly reducing the accumulated biomass.

A two-year industry study supported by a Caring for our Country grant described the nature of this fallout and demonstrated that the levels of solids derived from net cleaning was less than 3% of either organic carbon, organic nitrogen or the total solids of any overall emission of the fish themselves. The study also found that of those net cleaning solids, 90% would be deposited within 100 m of the pen in low flow conditions and 200 m of the pen under high flow conditions.

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8.10 Use of antibiotics

The following table summarises endemic diseases and their treatment methods. The table shows that antibiotics are rarely used and that the main treatments for diseases are freshwater bathing and vaccination.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Distribution (zones)</th>
<th>Potential impacts</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ameobic Gill Disease (AGD).</td>
<td>Tamar and South East Marine Zones, but causative agent found in all zones.</td>
<td>Localised gill inflammation and hyperplasia.</td>
<td>Freshwater bathing.</td>
</tr>
<tr>
<td>Pilchard orthomyxovirus (POMV)</td>
<td>All zones.</td>
<td>Serious morbidity and mortality.</td>
<td>No effective treatment. Vaccine being developed with the FHU Laboratory.</td>
</tr>
<tr>
<td>Yersiniosis (Yersinia ruckeri – serotype O1b)</td>
<td>Freshwater Zone hatcheries and associated with smolt transfer to marine zones.</td>
<td>Septicaemia.</td>
<td>Yersinivac-B vaccine, or antibiotics in infected populations (rarely used).</td>
</tr>
<tr>
<td>Vibriosis (Vibrio anguillarum serotype O1)</td>
<td>Macquarie Harbour Marine Zone, but causative agent found in all zones.</td>
<td>Systemic bacterial infection with high mortality rate.</td>
<td>AnguiMonas vaccine.</td>
</tr>
<tr>
<td>Skin infections (Tenacibaculum maritimum and marine Flavobacterium spp.)</td>
<td>All zones.</td>
<td>Skin lesions/ulcers associated with primary trauma (predation, net damage).</td>
<td>Antibiotics in infected populations (occasionally used).</td>
</tr>
<tr>
<td>Tasmania Aquareovirus</td>
<td>South East Marine Zone and Freshwater Zone.</td>
<td>Not associated with clinical disease, but often detected in association with disease caused by other agents.</td>
<td>Preventive measures to promote fish health. Vaccine is under development with the FHU Laboratory.</td>
</tr>
<tr>
<td>Tasmanian Rickettsia-Like Organism (RLO) – three serotypes recognised in each of the three marine zones.</td>
<td>South East Marine Zone, where the South-East serotype is associated with clinical disease. The other serotypes have not been observed to be a cause of disease.</td>
<td>Low level mortality.</td>
<td>Antibiotics in infected population (rarely used). Corrovac vaccine for the South-East serotype in field trial.</td>
</tr>
<tr>
<td>Tasmanian Aquabirnavirus</td>
<td>Macquarie Harbour Marine Zone.</td>
<td>Systemic viraemia in post-transfer smolt, with low level mortality.</td>
<td>Vaccine is under development with the FHU Laboratory.</td>
</tr>
</tbody>
</table>

Antibiotics are only ever be used to treat bacterial infections because they are ineffective against viruses. When they are used, it is always under veterinarian supervision and there is always a withdrawal period before harvesting.

\(^{41}\) Table 6.1 of TSGA (September 2014) Tasmanian Salmonid Growers Association Biosecurity Program.
8.11 Monitoring and modelling

The Tasmanian salmonid farming industry collects a very wide range of data relating to waterway health. For example, the Broadscale Environmental Monitoring Program (BEMP) has collected over 75,000 individual data points from more than 120 full days of sampling over the past 8 years in the Huon-Channel region, and the current Macquarie Harbour Environmental Monitoring Program (MHEMP) involves monthly sampling from 17 sites and 60 depths covering 30 parameters.

The data collected by these programs goes well beyond meeting basic compliance needs and provides a transparent environment from which regulators, scientists, environmental groups and the general public can assess the industry’s actions. These datasets are robust, independently sourced, longitudinal, peer reviewed and audited, and interpreted summaries are often publicly available.

The TPDNO (section 4.5), BEMP, MHEMP and future Storm Bay program are supported by broadscale and local impact modelling.

Broadscale modelling

In the Huon-Channel region, a sophisticated three-dimensional biogeochemical model has been established by CSIRO and IMAS. The model was initially validated against 2002 water quality observations and reproduced concentrations of key parameters well.

The model has subsequently been used to predict water quality behaviour under a variety of scenarios to examine the potential impacts of fish farming on water quality.

Previous studies found that annual nitrogen fluxes through the Huon Estuary were dominated by oceanic inputs of nitrate during winter. Because of low light intensities and low temperature, this nitrate was mostly unutilised by phytoplankton, but during summer and autumn intense phytoplankton blooms occur. In these seasons, marine nitrate inputs are naturally low and fish farm nutrients can make a significant contribution to overall system production\(^{42}\).

The study also concluded that the Huon Estuary and the D’Entrecasteaux Channel were tightly coupled and that these two components needed to be studied and modelled as a single system. The biogeochemical model was developed on this basis.

In Macquarie Harbour, the Aquafin CRC has developed a harbour-wide numerical hydraulic model based on a similar approach and ultimately it too will include full three-dimensional hydrodynamic and biogeochemical components.

Local scale modelling

At the individual farm level, models such as DEPOMOD\(^{43}\) are routinely used. DEPOMOD predicts the solids deposition on the seabed arising from fish farm operations. It has a structure made up of several core processing components including grid generation, particle tracking, re-suspension and benthic response modules (Figure 10).

Figure 10: DEPOMOD components

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\(^{43}\) Scottish Environment Protection Agency
The grid generation module converts field derived data into a grid containing information on depth, pen and sampling station positions for the area of interest. The particle tracking module takes information on wastage rates of fish food and faeces and hydrodynamics of the area and calculates the initial deposition of particles on the seabed. The re-suspension module then redistributes particles according to near-bed current flow fields to predict the net solids accumulated on the seabed within the grid area.

Data availability

The region-wide BEMP and MHEMP initiatives, together with lease monitoring undertaken by individual companies, have built a comprehensive dataset of benthic and water quality in marine farming regions. There are also numerous detailed reports from IMAS, UTAS, CSIRO and Aquenal that are publicly available.

The data is provided to DPIPWE-EPA and expert scientific organisations such as IMAS for analysis and interpretation, and key reports are publicly available.

While there have been expressions of interest from community groups for the public release of the raw data itself, this is not considered to be appropriate because of the difficulties of correctly interpreting data without appropriate context or expertise. This view was supported by the recent Senate inquiry. The Senate Committee did, however, recommend that annual reports for each aquaculture zone should be published and that there should be some online reporting of interpreted data.

These initiatives are supported.

8.12 Navigation

Tasmania has the highest level of recreational boat ownership in Australia, with one boat for every 17 Tasmanians.

The Huon-Channel area is frequently used by recreational boaters (both yachting and motor boats) originating from the Huon area and visiting from other regions.

Macquarie Harbour is also a regular boating waterway.

The presence of marine farms can affect shipping lanes, transit lines, anchorages and safe navigation at night (lighting/marking issues).

Marine farmers mark their farms to minimise interference with and risks to boating.

Concerns from the boating community about marine farms include:

• The need for clear navigational channels with good sight lines, even in adverse weather
• The perceived lack of clarity for recreational boaters of navigation marking, particularly with the large number of leases in the Huon-Channel region.

Yacht clubs have suggested the use of coloured lights or possibly lasers to clearly delineate lease areas.

Marine and Safety Tasmania (MAST) is the responsible authority in Tasmania for navigation and boating safety, and also for approving navigational markings on marine farms.

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FRAME 48:

Industry supports the online publishing of interpreted datasets from the BEMP and MHEMP initiatives.
9 SOCIAL ENGAGEMENT

9.1 Community support and concerns

The salmonid industry is now a major employer in rural Tasmania, and has brought optimism and vigour to local communities that would otherwise be struggling. It is not enough, however, to passively assume that support for the industry will automatically follow unabated. Each company should have its own community engagement plan, and industry as a whole should have an overarching strategy. Industry must continually engage openly and transparently with its stakeholders.

Stakeholders include:
- Local and wider communities, including the Aboriginal community
- Local and State government, and in Macquarie Harbour the Commonwealth Government
- Non-governmental fishing, boating and environmental organisations
- Tourism operators.

Independent surveys commissioned by the salmonid industry highlight the broad support there is for the industry but also identify the concerns that some people have.

In a 2013 survey, for example, Huon Aquaculture found that:
- 89% of respondents viewed the salmonid industry as important to Tasmania with almost two-thirds (65%) classifying it as "very important"
- Of that 89%, 27% said that they believe the industry gives Tasmania a good reputation and promotes the state; 24% viewed the industry as important because it produces premium, high quality products; and 23% mentioned the benefits of jobs and employment derived from the salmonid industry in Tasmania
- Almost two-thirds (63%) of all respondents surveyed viewed the salmonid industry as important to their local region and community, with the predominant factor being the creation and availability of jobs and employment opportunities
- Community concerns about industry were reflected in findings that:
  - 6% were concerned about damage to seabed and rivers
  - 3% were concerned about treatment of marine animals.

While these concerns are held by a relatively low percentage of people, they are real and important, and industry must work hard to address the underlying causes.

The recent Senate inquiry into the industry identified more specific community concerns, including:
- Night-time disturbances from bright lights used on leases
- Noise from the operation of special purpose vessels and equipment associated with fish farms, such as barges, service boats, feed supply and support vessels, and trucks entering and leaving shore-based facilities
- Noise from venturation, a process of raising dissolved oxygen (DO) levels in the water for fish health management purposes during the warmer summer months, potentially 24 hours per day
- Noise from air lift, the process of recovering dead fish from the pens using compressed air lift systems,
- Noise from fish feeding, where pellets from the feed barge are blown by a compressor along high density polyethylene (HDPE) pipes that run to individual pens
- Lights from pen lighting powered by generators on the farm barge located within the lease, which may be required to operate 24 hours per day depending on environmental conditions
- Shore facilities and marine traffic associated with leases.

Industry must actively work to minimise these problems to all practical extents, recognising, however, that marine farming is a machinery-intensive primary industry just as land-based farming is.

Like any farming industry, marine farming has the potential to impact adversely on the amenity of nearby residents, and the industry must take all reasonable and practical steps to minimise those impacts, for example by locating new leases offshore and by using well-boats to reduce vessel movements.

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45 Senate Environment and Communications References Committee (August 2015) Report on the regulation of the finfish aquaculture industry in Tasmania
9.2 Communication

A wide variety of community communication methods are used by the industry:

- Email and telephone contact – making and maintaining personal contact with key stakeholders through the engagement process
- One-on-one meetings – having meetings with key stakeholders through the engagement process to resolve important issues
- Targeted briefings and presentations – providing presentations to key stakeholders
- Open days to inform people about the activities of companies and describe the planned changes
- Websites – information on planned changes
- Sustainability Dashboards – an online information resource to provide current information on environmental performance and compliance as well as other indicators
- Flyers – distributed to stakeholders via direct mail, meetings, briefings and open days
- Direct mail – letters, community information brochures and flyers direct mailed to residents and businesses
- Posters – standalone information posters, for display at open days and other events
- Media and editorials – use of local and state media to communicate changes.

Sustainability dashboards

Sustainability dashboards capitalise on the interest that the community has for real-time information and the ability of the industry to make that information available through online websites.

Dashboards (eg. Figure 11) can provide interactive, real-time sustainability reporting, including environmental monitoring data.

Figure 11: Huon’s online dashboard

Frame 51:

Online industry dashboards provide the best opportunity and greatest capability for communicating performance data to the community in real time.
9.3 Third-party accreditation

In addition to compliance requirements, the industry invests significant resources annually in third-party sustainability certifications. The aim of these standards is to:

- credibly offer measurable, performance-based requirements that minimize or eliminate the key negative environmental and social impacts of salmonid farming, while permitting the industry to remain economically viable

Producers seeking relevant certification are required to comply with numerous standards that cover environmental impacts, fish health and disease management, sustainability of feed ingredients, wildlife management, employee safety and working conditions, transgenic animals, escapes, energy efficiency and biosecurity, as well as the mandatory regulations required by the government.

These voluntary standards often have higher requirements than legislated regulations, but the extra compliance costs involved may be offset by increased production through the reduction of mortality from disease and stress, and increased growth under better environmental conditions.

Certified products also have greater market access and can obtain a higher market price.

The industry has been involved in the evolution of aquaculture accreditation programs since their genesis and continues to support their development provided that the certification criteria are rigorous and transparent.

Voluntary third-party certification is not a substitute for strong regulation, however. Simply meeting certification criteria does not necessarily mean that all environmental and fish health requirements are met. For example, Macquarie Harbour’s unique dissolved oxygen characteristics and problems are not addressed by certification schemes.

**FRAME 52:**

Third-party accreditation schemes provide industry with community and market recognition and with confidence benefits, but they cannot substitute for strong environmental, fish health and biosecurity regulation by government.

Criteria must consider environmental outcomes, not just processes—simply having an environmental management plan will not be sufficient to satisfy the requirements. Industry participants must demonstrate that the plan has been successfully implemented, is responsive, and is achieving sustainability outcomes.

**Tasmanian salmonid industry participation**

Tasmanian industry currently participates in several voluntary accreditation schemes:

- **Best Aquaculture Practices (BAP)** (Tassal and Petuna)
  Best Aquaculture Practices (BAP) is an international, third-party certification system that verifies the environmentally and socially responsible processes under which finfish are produced. BAP certification standards contain the key elements of responsible aquaculture, such as environmental responsibility, social responsibility, food safety, animal health and welfare, and traceability.

- **Global G.A.P.** (Huon Aquaculture)
  The Global G.A.P. Integrated Farm Assurance Standard—Aquaculture Version 4—is a pre-farm gate standard that covers the whole production process of the certified product from the hatchery until the point of harvest and packing.

- **Global Salmonid Initiative (GSI)** (Huon Aquaculture)
  The Global Salmonid Initiative (GSI) is a global leadership initiative founded and led by salmonid producers dedicated to determining the best measures by which our sector can grow sustainably. Salmonid aquaculture is the world’s fastest growing food production system.

- **Aquaculture Stewardship Council (ASC)** (Huon Aquaculture, Tassal and Petuna)
  The ASC program promotes industry best practice to minimise the environmental and social footprint of commercial aquaculture. Through its consumer label, the ASC promotes certified responsibly farmed products in the marketplace.

- **Global Reporting Initiative (GRI)** (Tassal)
  GRI promotes the use of sustainability reporting as a way for organisations to become more sustainable and contribute to sustainable development. GRI’s Sustainability Reporting Framework is a reporting system that enables all companies and organisations to measure, understand and communicate this information. GRI’s mission is to make sustainability reporting standard practice, one which helps to promote and manage change towards a sustainable global economy.

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48 Tasmanian Salmonid Growers Association (June 2015) Submission to the Senate Standing Committee on Environment and Communications with respect to the regulation of the finfish aquaculture industry in Tasmania.
49 http://bap.gaalliance.org/
50 http://www.globalgap.org/
51 http://www.globalsalmoninitiative.org/
52 http://www.asc-aqua.org/
53 https://www.globalreporting.org/
Onshore farming of Atlantic salmon in a recirculating aquaculture system (RAS) has superficial attractions. It offers:

- Close control of the rearing environment
- The potential for largely disease-free production (ability to sterilise incoming water)
- The potential to be located close to markets
- The potential to reduce environmental impacts.

Tasmania has not ignored the potential for land-based farming — a facility was contemplated near Safety Cove on the Tasman Peninsula as early as the late 1980s, right at the beginning of our salmonid industry.

However, even with recirculation, land-based farming for full growout needs to be located close to the sea and close to sea level to minimise pumping energy and costs, and finding a suitable site that also does not conflict with other community interests is problematic. The very large-scale facility that would be required for a full grow-out operation is likely be of great concern to the community, particularly in a coastal location.

Internationally, there have been a number of pilot and commercial plants constructed in recent years. While these have shown that it is technically feasible to grow Atlantic salmon through to market size in land tanks, there are still significant problems to overcome, including:

- Precocious or early maturing males. Females are mostly grown in RAS systems, particularly in Tasmania, but when males are grown, up to 30% of them mature early, when the fish are around 1.5 to 2 kg. They then stop growing (despite being fed), lose their silvery colour and their flesh quality becomes inferior, making them unmarketable.

- Off flavours. An identified risk for salmon grown to market size in RAS systems has been the occurrence of “off flavours” in the final product. This requires the fish to be depurated in a separate clean system where they are not fed pre-harvest for 1–2 weeks.

- Stocking densities. The high stocking densities necessary to make operations cost-effective could introduce fish welfare concerns.

- Waste disposal. The technology exists to remove nutrients and dewater the waste solids produced. However, this has high running costs. Also, the waste stream generated from a saltwater recirculation facility poses disposal issues. Whereas the treated wastewater and solids from a freshwater facility can be irrigated and spread onto land, this can damage crops and soil if the waste stream contains salt. If salmon are grown in fresh water only, they must be held through a smoltification and desmoltification period that can be very stressful to the fish, even causing mortalities.

- Capital costs. The capital costs of RAS systems remain high, at approximately 2.5 times that of marine pens (and other studies suggest 3 times\(^5\) or even 5 times\(^6\)).

- Operating costs. RAS systems are very energy intensive, due to the need to pump recirculating water. While marine pens have no pumping costs, studies have shown that a RAS system requires in the order of 23,000 kWh per tonne of fish produced\(^7\). If a nominal commercial charge of 15c/kWh is assumed\(^8\), this equates to about $3,500 per tonne of fish, a production cost increase in the order of 30%.

These problems mean that the superficial attractions of RAS need to be reality-checked against its significant disadvantages:

- Infrastructure and operating costs greatly increase the cost of production, beyond what is financially viable.
- While tanks and disinfection of incoming water allow separation of fish stocks, which can minimise disease transfer between stocks, if a pathogen does become established in a tank, the high stocking rates mean that the pathogen transmits through the population very quickly and the only way to eradicate it is through the complete removal of the stock from the tanks to allow disinfection of tanks and filters.
- Precocious maturation and sulphide production mean that growth is inhibited and product quality is diminished by off flavours.
- For financial viability, stocking densities in land tanks must be much higher, raising animal welfare concerns and...
introducing health risks. Conventional pen farming stocks at around 10-12 kg/m³, whereas tank farming must stock at 50 to 80 kg/m³ or higher (even up to 100 kg/m³) to be profitable.

- Site location requirements (close to the sea and close to sea level to reduce energy costs) mean that a commercial full grow-out (therefore needing sea water) land-based farm is likely to be highly intrusive, in areas where the potential for conflict with other community interests and values is high. An example is the 1980s consideration of a site near Safety Cove on the Tasman Peninsula, which was identified after a comprehensive search based on site imperatives. It is unlikely that a large tank farm in such a location would receive community support.

Huon Aquaculture will continue to monitor the feasibility of land-based farming but at present does not consider it to be a viable alternative for full grow-out.

Despite these problems and shortcomings, Huon Aquaculture does consider land-based farming feasible for a salmon nursery, to provide partial grow-out. Indeed, Huon is establishing a land-based facility for this purpose, at Whale Point, Port Huon. Smolt will be grown to approximately 500-600 g in the nursery before they are transferred into sea pens. Currently, smolt are transferred to sea at 200 g. With smolt transfer to sea at around 500 g rather than 200 g, it is possible to grow fish out to harvest size in under 12 months, compared with 18 months for the smaller smolt. This could enable up to a 30% increase in production from marine leases. The potential shortening of the grow-out cycle is shown in Figure 12.

The time fish spend in sea water will be reduced by 6 months, meaning they will spend more time on land than in the sea. The shorter cycle will enable production to be increased by up to 30%, with reduced mortality and disease risk and opportunities for longer fallowing of marine leases.

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**FRAME 53:**
Onshore farming in Recirculated Aquaculture Systems (RAS) is currently not economic for full grow-out of fish and is unlikely to be in the foreseeable future, but initiatives have already begun for partial grow-out of smolt in onshore nurseries, and the success or otherwise of these will be a guide to the potential for more extended grow-out in the future.

**FRAME 54:**
Irrespective of the potential for full grow-out in onshore facilities, the use of onshore facilities to grow smolt to around 500 g will allow grow-out to harvest size in under 12 months, allowing an increase in production of about 30% and providing greater opportunities for longer fallowing of marine leases.

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Figure 12: Shortening of grow-out cycle achievable by land-based smolt on-growing

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Bakkafrost presentation 2016
11 HARVESTED FISH TRANSPORT

Tasmanian salmonid producers have processing facilities at various distances from their marine farming areas. In some cases, such as some in the Huon-Channel region, processing facilities are relatively close to local farms. Others are located in more centralised locations to service all growing regions and may be several hours away from any particular farm.

For remote processing facilities, low temperature transport is required. Transport is undertaken by contractors who service multiple producers, so the transport systems are similar across the industry.

Typically, after harvesting at a farm, fish are transferred into purpose-built 30 kL road tankers directly from the harvest line. The tankers contain approximately 10 kL of salt-ice slurry water to keep the fish below the required 5°C during transport to the processing facility. The slurry is manufactured on site. The tankers have an automatic control system in place that maintains the water temperature below 5°C during transport, which may be a period of 4 to 6 hours.

Salt-ice slurry transport has proven successful for transporting fish in optimum condition for processing, but there are environmental consequences that must be managed. In particular, the slurry results in high salinity water being discharged to the processing facilities’ wastewater systems, which can then carry through to discharges. This can be problematic for effluent reuse schemes, which irrigate treated waste water onto pasture or crops. The high salinity can cause pasture or crop die-off and soil decline.

Fish are bled at harvest and if bloodwater is also carried with the ice slurry, this can add high organic loading (and further salinity) to the wastewater stream, which creates additional treatment and discharge impacts.

Unless they have appropriately designed salinity management systems, salt-ice slurry and bloodwater transport to processing facilities should be phased out. Huon Aquaculture is investigating the replacement of salt-ice slurry with a freshwater ice slurry followed by rapid chilling at the factory prior to processing. Huon Aquaculture is also investigating refrigerated truck transport, but that would require a major refit by transport contractors.

FRAME 55:
Salt-ice slurry transport of harvested fish to processing facilities should not be used unless those facilities have wastewater management systems that can adequately deal with saline water.

FRAME 56:
Blood water should not be transported to processing facilities unless those facilities have wastewater management systems that can adequately deal with high organic loadings.
12 FISH-FEED PRODUCTION

Feed must meet fish needs for development, metabolism and growth if we are to produce healthy fish, farm sustainably and deliver a high quality product.

While fish meal and fish oil remain important ingredients for salmonid feed, over the last 20 years a huge amount of research has delivered safe, sustainable, alternative ingredients that reduce the reliance on marine-derived ingredients. For example, omega-3 oil can now be produced by marine algae cultures.

As noted earlier (section 8.6), the Australian Marine Conservation Society’s Sustainable Food Guide considers that Tasmania is on track to being net [fish] protein producers in the coming years, meaning we should produce more weight of farmed fish than is contained in the fish feed.

FRAMEx 57:
Fish farming companies will continue to progressively reduce reliance on wild fish in fish feed to the extent feasible without diminishing fish health, production efficiency or product quality.

Fish welfare is a primary requisite for delivering a quality product to market. A failure to maximise the welfare of the fish harms not only the fish but also the efficiency and profitability of the companies that grow them.

Farmed salmonids are not a cheap commodity but rather a fish targeted at the premium end of the market. The look, texture, taste and presentation of salmon are paramount to market success, and diminishing any one of these through poor welfare management diminishes the industry.

Fish farmers should not need to be told to look after their fish—they should do it as a matter of course.

For example, in collaboration with a local supplier, Huon Aquaculture researched and developed a stun-and-bleed harvest system that is now exported around the world and recognised as the gold standard. It received an award from the RSPCA UK for welfare and humane harvesting.

Tasmania’s salmonid producers continually seek to improve their harvesting performance and product quality, and they conduct trials and experiments to refine methods and systems to delay rigor onset.

Delivering rigorous allows gutting, filleting and smoking to be undertaken pre-rigor, which improves fish quality by reducing gaping, texture loss and blood spotting.

Although maintaining and enhancing fish welfare is an inherent focus of the Tasmanian industry, there is value in also having strong, independent fish welfare guidelines to reference.

The RSPCA UK has issued welfare standards for farmed Atlantic salmon, covering both land-based and sea-based farming. The standards recognise that scientific evidence confirms that it is highly likely that fish feel pain and stress, similar to mammals. The standards are based on the Five Freedoms defined by the Farm Animal Welfare Committee:

1. *Freedom from thirst, hunger and malnutrition* – by access to an appropriate high quality diet and an environment in which fluid and electrolyte balance can be maintained.
2. *Freedom from discomfort* – by maintaining water and environment at an appropriate temperature, flow rate and chemical composition and providing well designed enclosures and tanks, with shading if necessary.
3. *Freedom from pain, injury or disease* – by avoiding situations which are likely to cause pain, injury or disease, by rapid diagnosis and treatment of disease and humane transport and harvesting.
4. *Freedom to express normal behaviour* – by providing the appropriate space and environment for the species.
5. *Freedom from fear and distress* – by minimising stressful situations such as poor handling or predator attack as far as possible, by making gradual changes to husbandry and water quality, and by humane transport and slaughter.

The standards present husbandry practices for:
- Slaughter
- Medicinal products
- Handling
- Stocking densities
- Grading
- Well-boats
- Pen towings
- Predator protection
- Genetic selection/modification
- Food content
- Feeding
- Transport

The standards also cover equipment, environmental quality and environmental impact (including fallowing).

RSPCA Australia has also released guidance notes for farmed Atlantic salmon under its Approved Farming Scheme series. The Approved Farming Scheme works to establish welfare standards that go beyond mere regulatory compliance, assist market differentiation for producers, and offer consumers a higher welfare choice. These standards also adopt the Five Freedoms as their founding principles.

Frame 58:
Fish welfare is of the utmost importance to a successful industry and the RSPCA guidelines reflect, consolidate and, in some cases, extend industry best practice.
Marine farming is not the only marine industry responsible for debris, which also comes from recreational and commercial fishing and boating, for example.

The seafood industry undertakes regular clean-ups, and community groups also have clean-up days.

The Tasmanian Seafood Industry Council has formalised its clean-up efforts through the Adopt-a-Shoreline Initiative. Huon Aquaculture and Tassal are both active participants in this (see Figure 13).

Prevention is better than clean-up, however, and industry must increase its efforts to minimise the loss or equipment. Huon Aquaculture’s fortress pens have dramatically reduced marine debris due to the more substantial rigging methods used for tensioning the nets.

Additional incentives for improved performance and more rapid recovery of large items could include:

- Companies using uniquely colour-coded rope and other equipment to allow ready identification of the source of rope debris
- Companies deploying GPS transmitters on large items that could potentially break free in storms
- A cooperative debris response team, funded jointly by operators in a given region
- Minimum response times for the retrieval of significant reported debris
- Industry support funding to community groups for clean-up days
- Coordination of clean-up activities with other sectors of the marine industry, such as commercial fishers.

Debris from fish farms that is in the water and/or washing up on foreshores is unsightly and a danger to wildlife, particularly birds, through ingestion and entanglement.

Marine Debris Surveys were conducted along Channel and Huon coastal waters and marine debris hot spots were identified. To address these hot spots an ‘Adopt a Shoreline’ initiative has been developed with local marine farmers nominating shorelines for which they will have the primary responsibility for monitoring and removing marine debris.

These adopted shores are highlighted on this map and are colour coded to show if they have been adopted by Huon Aquaculture Company (HAC), Tassal or the Bruny Island Shellfish Growers Association. These three organisations will conduct regular marine debris clean ups and offer assistance for clean-up activities initiated by community groups.

In addition to regular clean-ups and disposal of marine debris, HAC, Tassal and the Bruny Island Shellfish Growers Association are committed to annual monitoring of shorelines and encourage the public to contact them if marine debris becomes an issue.

This project demonstrates what great work can be accomplished when the seafood sector collaborates with the local community and the commitment of marine farmers to take stewardship of the environment they work in.

This project is supported by the Tasmanian Seafood Industry Council through funding from the Australian Government’s Caring for our Country.

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Figure 13: The Adopt-a-Shoreline Initiative

PART C: SUMMARY OF FRAMEWORK
Wildlife interactions

Frame 8: To avoid physical interactions between farming and wildlife, seals and birds are being kept away from farmed fish by specifically designed underwater and over-pen netting.

Frame 9: Pens should be provided with double-net seal barriers, unless operators can demonstrate that their single-net system will be equally as effective at preventing seal attacks.

Frame 10: With the introduction of mandatory double netting for seal exclusion, seal capture and relocation should be phased out.

Frame 11: The Wildlife Management Branch of DPIPWE should work with the marine farming industry to undertake a comprehensive review of wildlife interactions and associated issues, with a view to developing a comprehensive set of protocols and research priorities.

Monitoring

Frame 12: Environmental monitoring by the Tasmanian salmonid industry must be consistent with world’s best practice.

Adaptive management

Frame 13: Adaptive management is the most appropriate management regime for the industry and it is both a scientific and social process.

Frame 14: Adaptive management by industry must be accompanied by adaptive regulation by government, with regulators responding early and precautionarily to environmental monitoring data.

Frame 15: Industry and regulators must be prepared to take severe precautionary action to head off potential catastrophic failures.

Frame 16: The Macquarie Harbour experience highlights the critical importance of adaptive management being implemented in deed not just in name, with unequivocal indicators of progressive environmental decline there (dissolved oxygen and benthic condition) not being matched by appropriate industry or regulator responses.
Proposed regulatory changes by government

Frame 17: Transferring regulatory authority for salmonid farming to the EPA will strengthen the industry and increase community confidence in its long-term sustainability, but the EPA Director must be supported by industry, and by fish health and biosecurity expertise and advice.

Additional regulatory changes sought

Frame 18: The transfer of regulatory responsibility for the salmonid industry to the EPA must be accompanied by a commensurate allocation of additional resources and expertise.

Frame 19: The transfer of environmental regulatory responsibility for the salmonid industry to the EPA Director could be further enhanced by the creation of a specific position of Aquaculture Industry Regulator, dedicated to ensuring the long-term sustainability of the industry.

Frame 20: The Aquaculture Industry Regulator should be given regulatory powers for all regulatory aspects of the salmonid industry, including environmental, biosecurity, hatcheries and land-based smolt grow-out, either explicitly or by statutory delegation under relevant Acts.

Frame 21: The statutory regime should be amended to allow unused leases to be relinquished in exchange for simplified approvals for new leases elsewhere, and for lease relinquishment to trigger a commensurate reduction in the maximum leasable area of the original zone to permanently remove the relinquished area from being available again.

Hospital leases

Frame 22: The statutory regime should be amended to allow holders to designate suitably located leases to be hospital leases, and maintain them in an empty state indefinitely to be ready for the temporary relocation of diseased fish.

Frame 23: The statutory regime should be amended to allow new lease applications specifically for hospital leases.

Review of decisions

Frame 24: The marine farming decision-making process for plans, leases and licences should explicitly and comprehensively incorporate fish health and biosecurity advice and review by a body independent of the decision-maker.

Frame 25: The Board of Advice and Reference should be reinstated and directed by the Minister to provide an independent advisory and review role for marine farm planning, leasing and licensing decisions.

Frame 26: To reflect the underlying ecological and environmental integrity of the natural system, the Huon and Channel areas should be managed under a consolidated single Marine Farm Development Plan, with a single TPDNO for the entire area.

Frame 27: New leases should only be approved if they meet mandatory requirements of: separation distances between companies and between year classes and subclasses; access to a shore base and hospital site; access to fresh water and ability to effectively treat amoebic gill disease; maximum water temperature limit; strong flushing regime; and use of a double-net seal barrier.

Frame 28: The Marine Farming Planning Review Panel and the Board of Advice and Reference should regularly review the mandatory prerequisites for new leases to ensure the highest levels of biosecurity protection for the industry.

Biosecurity

Island status

Frame 29: Tasmania’s island status has provided a unique regional pest and disease status which must be recognised and maintained to ensure the ongoing viability of the industry.

Existing controls

Frame 30: All controls and measures of the TSGA Biosecurity Program must be implemented, and supplemented with the additional measures identified in this paper and subjected to regular review.

Future controls required

Frame 31: A physical separation of companies and fish classes is of the utmost importance to the future biosecurity of the Tasmanian salmonid industry.

Frame 32: Tasmania’s geography presents constraints to rigorous geographical intercompany separation but also opportunities for managed separation.
Frame 33: The south-eastern region should be reconfigured to achieve either an operational or a geographical separation of year classes and subclasses, respectively either by companies coordinating their management of neighbouring leases or by lease ownership being reallocated to create geographically separate company zones.

Frame 34: Macquarie Harbour salmon farming should be restricted to year classes being separated or only one, common year class being held in the Harbour at any time, with compulsory whole-of-harbour annual falling.

As well as entire lease falling that should occur annually individual moorings within leases should be fallowed for longer periods to allow the seabed to return to baseline conditions. This will need more mooring positions within a lease than is used in any one year so pens can be moved between moorings as required. This will have different requirements between inshore leases and off shore leases with off shore leases not requiring to do this as often as inshore leases.

Frame 35: The future biosecurity of the industry should be based on a Tasmanian Veterinary Model (TVM), with intents and principles similar to the Faroe Islands Veterinary Model.

Frame 36: The TVM should function to separate year classes and separate diseased and non-diseased fish in space and time, which will require close coordination and cooperation by industry, reinforced by strong government regulation.

Frame 37: The TVM should include designated hospital leases, designated tow routes and progressive phasing out of towing, greater use of (closed-valve) well-boats, a transition to offshore farming, tidal excursion lease separation, sanitary harvest systems and rigorous falling regimes.

Hatcheries

Flow through hatcheries

Frame 38: When constructing new hatcheries, industry is preferentially evolving from older flow-through hatchery designs to contemporary recirculation designs, which use much less water and which have a lower environmental impact, while allowing faster fish growth and reduced growing periods.

Marine farms

Fish bathing

Frame 39: Pen towing for fish bathing is being progressively reduced by the use of bathing barges and (closed-valve) well-boats for bathing.

Fish transport at sea

Frame 40: Pen towing for fish relocation should be phased out through the use of closed-valve well-boats for live fish transport.

Warming waters

Frame 41: Climate change and associated warming waters will progressively reduce the suitability of shallow inshore leases and increase the need to move to more exposed offshore leases.

Frame 42: The move away from inshore leases also addresses community concerns and is becoming progressively more viable with steady advances in technology, leading to improvements in fish husbandry and fish performance.

Frame 43: For the welfare of fish, and to minimise seabed impacts and maximise the quality of product, industry should move towards stocking densities of less than 12 kg/m³ of viable net volume, best achieved in offshore leases.

Fish feeding

Frame 44: Fish are fed to appetite, on the principle of allowing them to eat as much as they want to while minimising the loss of food to the seabed underneath the pens.

Frame 45: Feeding is increasingly becoming centralised, with feed sent from centralised feed barges through a network of pipes to individual pens using a remotely operated system.

Dead fish collection

Frame 46: Dead fish collection is increasingly becoming centralised, with these fish pumped from the base of individual pens to centralised barges through a network of pipes using a remotely operated system.

Net cleaning

Frame 47: The use of anti-fouling has been phased out and replaced by in situ net cleaners.

Monitoring

Data availability

Frame 48: Industry supports the online publishing of interpreted datasets from the BEMP and MHEMP initiatives.
Navigation

Navigational marking

Frame 49: Industry will cooperate with Marine and Safety Tasmania, other authorities and the boating public to implement whatever navigational markers are appropriate, including innovative systems suggested by boating organisations.

Social engagement

Amenity values

Frame 50: Like any farming industry, marine farming has the potential to impact adversely on the amenity of nearby residents, and the industry must take all reasonable and practical steps to minimise those impacts, for example by locating new leases offshore and by using well-boats to reduce vessel movements.

Real-time communication

Frame 51: Online industry dashboards provide the best opportunity and greatest capability for communicating performance data to the community in real time.

Third-party accreditation

Frame 52: Third-party accreditation schemes provide industry with community and market recognition and with confidence benefits but they cannot substitute for strong environmental, fish health and biosecurity regulation by government.

Onshore farming

Recirculated aquaculture systems

Frame 53: Onshore farming in Recirculated Aquaculture Systems (RAS) is currently not economic for full grow-out of fish and is unlikely to be in the foreseeable future, but initiatives have already commenced for partial grow-out of smolt in onshore nurseries, and the success or otherwise of these will be a guide to the potential for more extended grow-out in the future.

Smolt ongrowing

Frame 54: Irrespective of the potential for full grow-out in onshore facilities, the use of onshore facilities to grow smolt to around 500 g will allow grow-out to harvest size in under 12 months, allowing an increase in production of about 30% and providing greater opportunities for longer fallowing of marine leases.

Transport to processing

Harvested fish transport

Frame 55: Salt-ice slurry transport of harvested fish to processing facilities should not be used unless those facilities have wastewater management systems that can adequately deal with saline water.

Frame 56: Blood water should not be transported to processing facilities unless those facilities have wastewater management systems that can adequately deal with high organic loadings.

Fish feed

Fish feed production

Frame 57: Fish farming companies will continue to progressively reduce reliance on wild fish in fish feed to the extent feasible without diminishing fish health, production efficiency or product quality.

Fish welfare

RSPCA standards

Frame 58: Fish welfare is of the utmost importance to a successful industry and the RSPCA guidelines reflect, consolidate and, in some cases, extend industry best practice.

Marine debris

Marine debris prevention and clean-up

Frame 59: The industry will continue to conduct regular marine debris clean-ups and to support community clean-up days.

Frame 60: The industry should adopt uniquely colour-coded rope and other equipment to allow rapid identification of the source of marine debris.

Frame 61: The industry should install GPS transmitters on large pieces of equipment to alert operators to loss and allow rapid retrieval.