



In December 2019, WWF-Australia commissioned Seafood Advisory, an independent seafood consultancy, to prepare a report to examine the circumstances surrounding the ecological impacts of expanded aquaculture operations in Macquarie Harbour in Tasmania. We were concerned at how cumulative impacts of multiple farming operations in enclosed waterways, such as Macquarie Harbour, could be detected.

We wanted to know more about how and why these impacts occurred, and if changes in certification schemes could have helped to prevent the adverse ecological outcomes. We also wanted to ensure that any lessons could inform decision-making so that these negative environmental impacts are not repeated elsewhere, and to inform the discussion on restoring the health of Macquarie Harbour.

Seafood Advisory interviewed multiple stakeholders about the issues around aquaculture in Macquarie Harbour, and this input helped to frame the findings and recommendations in this report.

WWF, in Australia and around the world, works with 3rd party independent certification systems, such as the Aquaculture Stewardship Council (ASC), to ensure that certification standards are robust, transparent, and based on the best available science.

As this report confirms, there are ways in which aquaculture certification can and should be reformed, particularly to account for cumulative impacts of multiple farms in a given ecosystem. It also found some impacts of aquaculture in Macquarie Harbour are beyond the scope of certification and need to be addressed through government regulatory reform.

These findings reinforce WWF-Australia's [submission](#) and recommendations to the Tasmanian Upper House Enquiry on Fin Fish Farming in 2019.

WWF will use this new independent report to continue to advocate for transformation in the aquaculture industry. This will include working towards a stronger environmental regulatory framework, reforms to marine spatial planning, science-based biomass limits and enhanced biosecurity measures and environmental scrutiny, including through the transparency of data collection. We will also advocate for the development of new solutions and consideration of land-based opportunities, which may be appropriate in certain contexts, and work to ensure animal welfare remains paramount in all aspects of the industry. The Tasmanian Government must play the central role in addressing these issues.

WWF-Australia believes that all stakeholders must work together to ensure that planning and management of the Tasmanian aquaculture industry operates in harmony with nature and with the many other users of Tasmania's unique coast and marine environment.

WWF-Australia is grateful to everyone who contributed to this report. As the report's findings consolidate information previously available in the public domain, particularly related to the cumulative impacts of aquaculture operations, it was most efficient to complete the report and share with stakeholders to reaffirm key insights.

This remains an independent report. WWF-Australia has not edited this report, with the exception of explaining acronyms.

A handwritten signature in black ink, appearing to read 'Krista Singleton-Cambage'.

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1 September 2021

Review of Eco-labelling Standards in Relation to Salmon Farming in Macquarie Harbour



Prepared by
Seafood Advisory Ltd.



Commissioned by WWF-Australia

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1 SUMMARY

This review was commissioned by WWF-Australia to examine the circumstances surrounding the events in Macquarie Harbour, and their relevance to voluntary standards and certification of salmon farming. Macquarie Harbour (MH) is a 276km² shallow, poorly flushed, and highly stratified natural body of water, with approximately one third of the area located within the Tasmanian Wilderness World Heritage Area to the South. Two rivers regulated by hydroelectric dams contribute dark tannin rich freshwater leading to sediments naturally depauperate of fauna. Ecosystem health of the harbour is also affected by heavy metal contamination from past deposition of mining tailings as well as acid drainage in river catchment areas.

Two expansions of aquaculture production in 2012 and 2015 lead to widespread concern among stakeholders, such as decreasing levels of dissolved oxygen (DO), the potential impact of low levels of DO on the endangered Maugean Skate, increase in the presence of *Beggiatoa* bacterial mats, as well as other concerns. Stakeholders are divided over the type and level of concerns, as well as the extent to which observed changes in the harbour can be attributed to causes from aquaculture, damming and loading from freshwater inputs, or natural processes.

The reviewers visited MH as well as a salmon farm in the harbour, engaged in extensive discussions with stakeholders and reviewed publicly available reports received, although a full literature or regulatory review was not part of this project. The aim was to review the following questions and contribute to discussions for voluntary standards and NGOs:

Why did Eco-labelling not prevent the Adverse Impacts observed in MH?

The ASC standard functioned successfully in MH in the sense that certification was lost as a result of the detection of an adverse situation. The review also found that the ASC standard has not been set up to “prevent” adverse situations occurring in the first place, and the outcome-focused metrics are not flanked by requirements for mechanisms to address identified potential impacts before they “become established”. Recommendations are made around the intention to prevent or require improvement, as well as to review some technical details of indicators as well as process, which likely contributed to delayed action to tackle/reverse the adverse situation.

It is not known how BAP is managing the adverse situation as audit reports, or summaries thereof, are not disclosed and stakeholders have not been engaged in the audit process in MH.

Given the special conditions in MH, what are appropriate ‘indicators’ to protect local biodiversity & ecosystem function?

The site chosen for an aquaculture farm is one of the most significant factors in the farm’s ability to meet a voluntary standard’s objectives. The process from spatial planning to responsible farming is discussed as well as where voluntary standards fit into the decision-making process. The Environmental Impact Assessment (EIA) plays a central role and it is discussed how voluntary standards could benefit from additional steps and requirements to ensure that monitoring programs are correlated to farming activity and the carrying capacity of the environment, based on the outcome of the EIA, and are effective not only in identifying impacts, but also in triggering an immediate management response and a review of the EIA, when needed. While improving the system as a whole, such “enhanced EIAs” could be one of the few mechanisms voluntary standards have to capture special conditions of the local environment. Especially for risky sites, where there is a lack of long-term data, inconclusive data, known issues or

foreseeable unknowns (e.g., climate change), ensuring frequent analysis of monitoring data and rapid response where needed (adaptive management), could be part of the suggested “enhanced EIA”. The process of an enhanced EIA should be combined with an area approach, as adverse impacts and special conditions in Macquarie Harbour demonstrate that good management practices or responsible farming thresholds in relation to the immediate vicinity of the farm and irrespective of the carrying capacity of the system is not sufficient to protect biodiversity and ecosystem function. Reviewing the use of an enhanced EIA process with area approach, combined with an effective management system, is recommended.

Does reliance of eco-labelling on government regulation create a gap?

Requiring compliance with local law and regulation is not enough to ensure claims made by a voluntary standard on responsible/sustainable farming or continuous improvement, and must be ensured by indicators within the standard itself. The main reason for this is that the current indicators in written standards do not sufficiently address how to handle a lack of enforcement of regulation (ASC & BAP), or how to safeguard against local and national law having a lower environmental quality objective than the voluntary standard (BAP).

Would requirements on cumulative impacts have prevented certification or driven additional management?

Including more requirements on cumulative impacts in voluntary standards at the time would not have made a big difference regarding certification for the following reasons: 1) cumulative impacts were largely addressed only in relation to biosecurity, 2) indicators would have relied on existing regulatory requirements which were not fully enforced, and 3) efforts between the voluntary schemes operational in MH would not have been coordinated. Recommendations include mechanism to identify Environmental Quality Objectives (EQOs) in need of a spatial approach as well as efforts for GSSI recognized aquaculture schemes to work together.

How should eco-labelling be adjusted more generically to address similar impacts occurring in other locations?

The recommendations made in response to the topics above seem sufficient to address similar impacts occurring in other locations. In addition, the value of a more inclusive and more meaningful stakeholder process is addressed and recommendations are made to consider adding more clarification on the intention for seeking stakeholder engagement, developing more clarification in order to better align stakeholder and voluntary standard expectation, as well as developing more guidance for CABs to manage stakeholder engagement. It is also recommended to conduct further research into the value of stakeholder engagement and transparency.

2 INTRODUCTION

This review was commissioned by WWF-Australia to examine the circumstances surrounding the events in Macquarie Harbour (MH), and their relevance to voluntary certification of salmon farming.

Chapter one summarises the main findings of this review. Chapter three provides some background information on MH and chapter four outlines the method used for this review. The core part of this report are the review findings which are discussed in chapter five, where possible focussing on beneficial recommendations for voluntary certification schemes and stakeholders working with certification schemes. Recommendations are only spelled out for ASC and not for other voluntary standards such as BAP.

The scope of this review is limited to MH. While there are other jurisdictions facing similar difficulties, the focus on a specific case study is deliberate.

This review predominantly focuses on the voluntary standard Aquaculture Stewardship Council (ASC) and, to a lesser extent, on the standard Best Aquaculture Practices (BAP). Although three farms in MH have been certified against the GlobalG.A.P standards for a number of years, it is not the aim of this report to compare voluntary standards amongst each other or to include all certification schemes existing in MH. For this reason, GlobalG.A.P is only mentioned in some sections of the report.

This review focuses mainly on the time period 2012 – 2018, covering a period of significant increase in marine farming/biomass production in MH, as well as the period of ASC certification. Requirements from voluntary standards and from local and national law and regulation have since changed, as have production practices, as well as knowledge gained from additional scientific assessments. This review did not begin until January 2020, in order to avoid conflict with earlier and related court proceedings. Therefore, some of the findings of this review may be most valuable and applicable to other farming areas going through a similar process, while other findings are still relevant to the situation in MH today.

Despite the reviewer's best efforts to assimilate the key information and only use information which is factually correct, it may be the case that due to the complexity of this project, some information has been missed or has been incorrectly put into context.

During this review a large amount of information was collected, leading to valuable insights where voluntary standards work and where they do not. We regret that not all topics raised by stakeholders could be addressed here; these topics could be discussed and addressed in future projects.

3 BACKGROUND

Macquarie Harbour (MH) is situated in the West of Tasmania (Annex IV Information and charts on leases in MH). MH is a 276km² large natural harbour, approximately 33km long and 9km wide (EIS, 2011). The water body is 50m deep at the deepest point with a single <5m shallow entrance sill restricting exchange with the ocean, and a tidal range of less than 1m. The harbour is poorly flushed and highly stratified (Ross J & MacLeod C. 2017) with a fresh, marine and intermediate layer. The rivers Gordon and King,

both regulated by hydroelectric dams, contribute significant amounts of fresh water to the harbour. The dark tannin rich freshwater layer limits light penetration and as a consequence productivity is low; the sediments are naturally depauperate of fauna (Ross J & MacLeod C. 2017). Ecosystem health of the harbour is also affected by heavy metal contamination from past deposition of mining tailings as well as acid drainage from the century-old upstream copper mining activities in the King River catchment area.

The harbour is mostly surrounded by wilderness, with approximately one third of the area of located within the boundary of the Tasmanian Wilderness World Heritage Area (TWWHA) to the South (Figure 10), and supports tourism activities, port operations, aquaculture and hydroelectric power generation.

Marine farming commenced in MH around 1987 as small family businesses with an annual production estimated to be well below 1'000 tonnes (see Annex II Summary Sequence of Events in MH). The speed and level of increase in production during two significant expansions of aquaculture production in 2012 and 2015 lead to widespread concern among all stakeholders, including the marine farming industry. Stakeholders are divided over the type and level of concerns, as well as the extent to which observed changes in the harbour can be attributed to causes such as aquaculture, damming and loading from freshwater inputs, or natural processes. Environmental concerns raised included; decreasing levels of DO, the potential impact of low levels of DO on the endangered¹ Maugean Skate *Zearaja maugeana*, increase in the presence of *Beggiatoa* bacterial mats and increase in abundance and distribution of opportunistic polychaetes including within the TWWHA (EPA, 2017), spontaneous gas bubbling, mass fish kills, as well as the ability to manage further unknown. In addition to the environmental aspect, the ongoing debate also includes economic and social aspects. This review does not attempt to judge the validity of these concerns but rather focuses on how voluntary standards can handle such situations. For this reason, this chapter is kept short and further information can be found in the listed references in chapter 8 and in other documentation and publications, where a variety of stakeholders have published their understanding of the history of events, concerns, negative impacts and potential causes.

4 REVIEW METHOD

This review was carried out primarily through consultation with stakeholders including an on-site farm visit.

All stakeholders were contacted by WWF and invited to submit written comments by the end of January 2020. In addition, a short description of the project was published on the WWF website including a request for comments to be submitted. No submissions were received.

WWF-Australia provided a list of key stakeholders, who were all contacted by the reviewers seeking an in-person meeting. All contacted stakeholders responded, and all except ASC agreed to a meeting. ASC preferred this review to be conducted independently but indicated they would consider the outcomes as part of their process of continuous review and revision of the ASC Standards.

¹ listed as endangered under the Environment Protection and Biodiversity Conservation Act 1999

Meetings were also carried out with additional stakeholders who reached out to the reviewers during the course of the review. The names and the sector affiliations of stakeholders with whom meetings were arranged are listed at the end of this report (see Annex I List of Stakeholders consulted).

Due to the confidential nature of some of the information received and the tense relationships between stakeholders, the reviewers decided not to report directly on information and opinions provided by stakeholders. Instead, the review method was adapted and evidence was sought to confirm insights gained from the meetings. Additional reports, publicly available information on regulation and the enforcement of regulation, published literature provided by stakeholders, as well as select submissions to the legislative finfish farming inquiry, were included in this review. However, the scope of the review did not allow a comprehensive independent literature review.

Information received and reviewed was assessed by the reviewers in relation to MH and eco-labelling standards, and with the aim of answering the following key questions:

- 1. Why and how the ASC standard and certification process did not avoid or prevent the adverse impacts observed at Macquarie Harbour farming sites?*
- 2. Given the special environmental conditions of Macquarie Harbour, what would be the appropriate 'indicators' and 'requirements' for voluntary production standards to protect local biodiversity and ecosystem function? In the case that parts of this cannot yet be defined, clearly indicate what is needed, for example which area of research, in order to develop appropriate indicators and requirements.*
- 3. Does the reliance of voluntary standards, including both ASC and BAP, on operators being in compliance with local and national laws, without requiring a minimum standard for those laws, create a gap in expectations about the meaning of 'environmentally responsible'?*
- 4. Would explicit criteria, which require potential cumulative impacts from multiple leases to be assessed and managed, have prevented the certification of sites in Macquarie Harbour and/or driven additional management and production decisions to prevent these impacts?*
- 5. How should voluntary salmon production standards be adjusted more generically to address the issues identified above, in order to prevent similar impacts occurring in other locations?*

The nature of these questions taken from the TOR have three implications on the scope of this review: 1) information on salmon farming in other countries and regions outside of MH is not included in this review, 2) this report describes the outcome of an independent review rather than reflecting stakeholder opinion, and 3) this report should not be considered a judgement on industry or on regulatory action and performance, but rather a reflection on how voluntary standards and contributing NGOs can or cannot address situations such as that observed in the special case of MH.

Originally, it was planned to present a preliminary outcome of this review to all participating stakeholders, including the eco-labelling scheme owners, attending SEG (Seafood Expo Global) in Brussels. However, after multiple postponements of the SEG originally planned for April 2020 and the eventual cancellation of SEG and all other seafood expos in 2020 due to the covid-19 pandemic, the most meaningful mechanism to use the outcome of this review is still to be determined.

5 FINDINGS

5.1 WHY DID ECO-LABELLING NOT PREVENT THE ADVERSE IMPACTS OBSERVED IN MH?

Original question in full: Why and how the ASC standard and certification process did not avoid or prevent the adverse impacts observed at Macquarie Harbour farming sites?

Common to all leases and most relevant for this review was the difficulty of complying with indicators 2.1.1 (benthic effects) and 2.2.1 (water quality), although also other non-conformities (NCs) were raised. The certification history of the various leases in Macquarie Harbour (MH) is summarised in Annex II Summary Sequence of Events in MH. In total, 6 leases were ASC certified in MH over the period 2014-18. During 2018, all 5 current leases and an additional lease that was part-way through the certification process either withdrew voluntarily or had their certification withdrawn (table 1 and 2).

Water column and benthic health is primarily addressed by ASC in indicators in 2.1 and 2.2. According to these indicators, using the example of water column health², an adverse situation can be understood to be weekly averages dropping below 70% saturation of dissolved oxygen (DO) (ASC 2.2.1), or >5% weekly averages dropping below 2mg/L DO (ASC 2.2.2). The identification of adverse conditions and the handling of these in ASC audit outcomes is discussed below, using water column and benthic health as examples.

ASC indicator 2.1.1 (benthic effects)

Indicator 2.1.1 requires sediment monitoring both inside and outside of the farm's identified Allowable Zone of Effect (AZE). Farms must follow the sampling methodology outlined in the ASC Standard and meet the set threshold value for either redox potential or sulphide concentration.

An approved variance request (VR) was in place for indicator 2.1.1, allowing the farms to continue to use their current method of visual monitoring to assess benthic impacts, rather than the sediment sampling methods usually required by the ASC Standard. The VR was approved in 2014 for a group of leases during the first ASC audit in Macquarie Harbour, and was subsequently applied to all ASC certified leases in Macquarie Harbour. More detail on the reasons for the VR application and its approval can be found in Annex IV.

Visual surveys picked up impacts at several leases in 2017, resulting in a non-conformity being identified by the CAB during an ASC audit in 2017. The NC was closed after corrective actions were taken and accepted by the CAB. The corrective actions as described in the audit report included the removal of stock, implementation of preventative actions, and submitting results of surveys showing signs of recovery. However, the same issues were observed at other leases in MH during 2017 and during the following season. In 2018, all leases in the harbour were affected by significant major non-conformities relating to benthic impacts.

Certificate validity	Farm lease						
	MF214	MF219	MF266	MF217	MF215	MF133	MF213
2014	Certified. No NC						
2015	Certified. No NC						

² See also Annex III and the discussion on the intention of DO indicators.

2016	Certified. No NC		Certified. No NC	
2017	Major NC. Closed after CAs implemented.	De-stocked. Certificate expired.	Major NC. Open. Certification withdrawn (report/decision delayed until 8/2018)	Audit did not identify an NC but site withdrawn from process prior to certification.
2018	Major NC. Open. Certification withdrawn (December 2018)		Certification withdrawn (August 2018)	

Table 1. Summary of audit results for indicator 2.1.1 benthic effects.

ASC indicator 2.2.1 (percent saturation of dissolved oxygen)

Indicator 2.2.1 requires farms to monitor water quality within and near to the farm site and record levels of the measured on-farm percent saturation of dissolved oxygen (DO). Weekly average DO values must be at least 70%, or consistent with a reference site in the same water body.

In 2015, for MF214 & 219, a minor NC was identified at some leases due to DO levels dropping below the allowed threshold value on a single occasion since the previous audit. The NC was reviewed at the following audit in 2016 and closed after reported values were shown to be compliant. In 2017, the CAB identified the same issue, resulting in a major NC, after reported DO values were again too low on occasion. Corrective actions were implemented (described in the report as including a commitment to more effective monitoring, risk mitigation measures, monthly reporting of DO to the CAB) and the NC was closed. However, during a 2018 audit it was found that the issue had still not been effectively resolved and certification was withdrawn.

The cluster M217, MF215 and MF133 had similar difficulties, with a small number of weekly averages below the threshold in 2016 resulting in a minor NC. The situation remained unchanged during the following year leading to a major NC and eventual withdrawal of certification in 2018.

Certificate validity	Farm lease						
	MF214	MF219	MF266	MF217	MF215	MF133	MF213
2014	Certified. No NC						
2015	Minor NC. Open. To be reviewed during next audit.						
2016	Certified. No NC			Minor NC. Open. To be reviewed during next audit.			
2017	Major NC. Closed after CAs implemented.	De-stocked. Certificate expired.		Major NC. Open. Certification withdrawn (report/decision delayed until 8/2018)			Minor NC identified but site withdrawn from process prior to certification.

2018	Major NC. Open. Certification withdrawn		Certification withdrawn (August 2018)	
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Table 2. Summary of audit results for indicator 2.2.1 % saturation of dissolved oxygen.

Despite the final decertification of sites, this review does seem to suggest that the ASC program did play an important role in improving environmental management, mainly through the requirements for data monitoring and analysis, as well as through non-conformities and required action plans.

Conclusion - Why did Eco-labelling not prevent the Adverse Impacts observed in MH?

The ASC standard functioned successfully in MH in the sense that certification was lost as a result of the detection of an adverse situation according to ASC indicators. However, the review also found that the ASC standard has not been set up to “avoid” or “prevent” adverse situations occurring in the first place. In these examples, the predominantly outcome-focused metric approach of the ASC standard focuses on determining an adverse condition rather than preventing it. Outcome-focused metrics are not flanked by requirements for mechanisms to address identified potential impacts before they “become established”.

Recommendations

- 1) Voluntary standards and NGOs: Prevention
Review the intention of voluntary standards; should auditing identify an adverse situation after it has become established, or should additional requirements lead to the identification and addressing of potential impacts before they have become established?
- 2) Voluntary standards and NGOs: Improvement
Review the intention of voluntary standards; should the setting of non-conformities include an active mechanism to drive (necessary) improvement?
- 3) Voluntary standards - additional points for further review:
The intention of the requirements for DO monitoring, the timelines for closing major non-conformities, the process for approving and evaluating the suitability/effectiveness of ASC variances, as well as the option to exclude initial phases of grow-out from the auditing/certification process, most likely contributed to delayed action to tackle/reverse the adverse situation. Some of these points are addressed for further review in Annex III.

5.2 GIVEN THE SPECIAL CONDITIONS IN MH, WHAT ARE APPROPRIATE ‘INDICATORS’ TO PROTECT LOCAL BIODIVERSITY & ECOSYSTEM FUNCTION?

Original question in full: Given the special environmental conditions of Macquarie Harbour, what would be the appropriate ‘indicators’ and ‘requirements’ for voluntary production standards to protect local biodiversity and ecosystem function? In the case that parts of this cannot yet be defined, clearly indicate what is needed, for example which area of research, in order to develop appropriate indicators and requirements.

The location or site chosen for an aquaculture farm is one of the most significant factors in the farm's ability to meet a voluntary standard's objectives relating to ecosystem function and local biodiversity. It is extremely important that site selection is carefully considered prior to beginning or expanding farming in an area, as the consequences of poor site selection cannot normally be sufficiently compensated for by good management practices. Therefore, before reading the discussion in this chapter, we urge the reader to review the process needed to ensure appropriate spatial planning and site selection, the basis of sustainable aquaculture production in Annex V, Part I. Broadly speaking, the steps from initial spatial planning to initial farming can be summarised as follows: broad scoping followed by zoning, site selection, design of aquaculture management areas, elaboration of corresponding management plans. These steps may occur in a different sequence or be carried out by different entities or organisations, however, the main steps are all necessary to ensure sustainable production.

The role of voluntary standards in scoping, zoning, and site selection

As discussed in Annex V, Part I, scoping and zoning decisions are guided by a country's or region's strategy and economic development plans, which are outside of the scope of voluntary standards. Site selection however, while also affected by these factors, may be considered as part of a voluntary standard's scope. The success of an aquaculture project relies heavily on an appropriate location, and the consequences of site selection can greatly affect a farms' future ability to comply with voluntary standards for responsible and sustainable aquaculture. The reviewers are not suggesting voluntary standards should include requirements for the zoning and site selection process, although non-binding guidance on an effective zoning and site selection process with a view to promoting future compliance with voluntary standards, might be worth exploring by voluntary standards.

Although site selection is critical to sustainable aquaculture production, this process is often completed before farms begin to work with voluntary standards. For established sites, particularly those with special environmental conditions such as Macquarie Harbour, it can be a difficult question for voluntary standards how to design indicators to ensure local biodiversity and ecosystem functions are protected.

This question has two aspects that need to be considered; 1) how can indicators be designed to ensure special conditions specific to a local environment are taken into account, and 2) how can indicators be designed to protect biodiversity and ecosystem function, both parameters which we now understand cannot be managed at the individual farm-level but need to be addressed at wider spatial scales.

Conditions specific to the local environment could be addressed by voluntary standards (with an otherwise global geographical range) in several ways, although each option comes with some challenges and has both advantages and disadvantages. Examples are,

- a. Industry self-regulation: for conditions specific to a local environment a voluntary standard could move away from setting actual requirements and rely on industry self-regulation and self-reporting. This is not advised, as one of the main purposes of voluntary standards is to provide third-party verification of an eco-label's quality objectives.
- b. Local law and regulation: for conditions specific to a local environment a voluntary standard could move away from setting actual requirements and rely on local law and regulation. This is not advised, as a voluntary standard is understood to provide added value by going beyond local law and regulation, as well as for other reasons discussed in 5.3.

- c. Local interpretations of generic and globally applicable voluntary standards: for conditions specific to a local environment a voluntary standard could develop local interpretations of the global standard. This approach has significant challenges, including ensuring consistency in both developing and applying the local interpretations, as well as avoiding a potential marketing advantage of some regions over others. In addition, a local interpretation is likely to be at a jurisdictional level and would not capture the specifics of an area or ecosystem at a much smaller scale such as MH.
- d. Variations from generic and globally applicable voluntary standards: for conditions specific to a local environment a voluntary standard could allow variations from the standard to better fit the local context. This is what is currently happening through the VR (variation request) process used by ASC. Disadvantages include questions around consistency in rigour for the process of approving variations as well as for the monitoring of effectiveness of variations, as well as the potential marketing advantage of some regions over others. More information on VRs can be found in Annex III/IV.
- e. EIA: a voluntary standard could include requirements for additional process steps, in order to more effectively assess and manage the risks of aquaculture production in a local environment. An environmental impact assessment (EIA) is by default a reflection of local / specific environmental conditions. The requirement for an EIA, as partially addressed by some voluntary standards, could be enhanced in order to achieve the following:
- Assessment of the level of risk in terms of defined/assessed acceptable levels of impact,
 - improved monitoring and management responses to identified risks,
 - protection against anticipated future unknowns, and
 - Identification of all risks related to the voluntary standard's near field and far field (wider spatial scales) quality objectives.
- An EIA including the wider ecosystem would allow assessing potential impacts on parameters such as biodiversity and ecosystem function.

The importance and effectiveness of EIAs with a spatial or area approach in addressing cumulative impacts is well recognised and documented, as illustrated by the following extracts from a FAO report (FAO 2017):

- Common problems arising from the lack of spatial planning and management of aquaculture can be categorized as: (i) fish disease; (ii) environmental issues; (iii) production issues; (iv) social conflict; (v) post-harvest and marketing issues; (vi) risk financing; and (vii) lack of resilience to climatic variability, climate change and other external threats and disasters.
- Although many of the social and environmental concerns surrounding impacts derived from aquaculture may be addressed at the individual farm level, most impacts are cumulative. Impacts may be insignificant when an individual farm is considered, but potentially highly significant when multiple farms are located in the same area, or when the entire sector is taken as a whole.
- Aquaculture should be developed in the context of ecosystem functions and services (including biodiversity) with no degradation of these beyond their resilience.

The ecological carrying capacity, or assimilative capacity, sets an upper limit for the number of farms and their intensity of production that retains impacts at manageable and/or acceptable levels (FAO 2017). The risks identified, assessed, and managed through the EIA process should be expanded to include an area approach, handling all topics for which management implemented at farm-level fail to be effective in minimizing impacts at the area level.

In this chapter, we explore and discuss the option of an “enhanced EIA with an area approach” in more detail. It must be noted that the carrying capacity is not limited to biodiversity and ecosystem function and equally has social components (see chapter 5.4). However, in order to explore how an “enhanced EIA with area approach” could work for voluntary standards within a system such as Macquarie Harbour, and how it fits with other levels of management and decision-making, the discussion below focuses on the environmental aspect as an example.

An “enhanced EIA with an area approach” for voluntary standards

Following site selection and in order to finalize management plans prior to farming, or prior to changes to farming practices, a detailed site-specific EIA should be required. Since ecolabels have their own vision and EQOs which typically will deviate between standards and be different from those of local law and regulation, the EIA must include a voluntary standard’s indicators and acceptable level of impact (derived from the voluntary standard’s EQOs) in order to inform management plans and establish compliance with voluntary standards. In other words, the EIA is the first stage in the process which must be part of the voluntary standard’s scope and from where onwards voluntary standard indicators must be addressed.

Voluntary standards’ current approaches to EIAs

The concept of an EIA is already included in the ASC standard. Indicator 2.4.1 requires farms to have “*an assessment of the farm’s potential impacts on biodiversity and nearby ecosystems*” (Figure 1). The requirements of the assessment are detailed in an Annex of the ASC standard and include the identification of sensitive habitats and species as well as potential impacts the farm might have on biodiversity. It also requires a description of “*strategies to eliminate or minimise any identified impacts and monitoring of their outcomes.*”

Criterion 2.4 Interaction with critical or sensitive habitats and species

INDICATOR	REQUIREMENT
2.4.1 Evidence of an assessment of the farm's potential impacts on biodiversity and nearby ecosystems that contains at a minimum the components outlined in Appendix I-3	Yes

Appendix I-3. Biodiversity-focused impact assessment

Requirement 2.4.1 requires the farm to demonstrate that a biodiversity-focused environmental impact assessment has been undertaken for the farm.

The assessment shall include habitats and species that could reasonably be impacted by the farm. For example, cold-water corals near the farm could be impacted by nutrients, or whale populations in the region could be impacted by acoustic deterrent devices.

The assessment shall incorporate:

1. Identification of proximity to critical, sensitive or protected habitats and species:
 - a. This includes key wild species within the marine environment around the farm
 - b. Particular attention to be paid to species listed on International Union for the Conservation of Nature (IUCN) or national threatened/endangered lists and on any areas that have been identified as HCVAs, areas important for conservation/biodiversity or the equivalent
 - c. Sensitive species may include non-threatened species of high economic value in the area that may be affected by the salmon farm (e.g. lobsters)
2. Identification and description of the potential impacts the farm might have on biodiversity, with a focus on those habitats or species
3. Description of strategies and current and future program(s) underway on the farm to eliminate or minimise any identified impacts the farm may have, and for the monitoring of outcomes of said programs and strategies
4. Where damage of sensitive habitats has been caused by the farm (as defined in the impact assessment) previously and where restoration is possible and effective; restoration efforts will or have resulted in a meaningful amount of restored habitat; either through direct on-farm restoration or by an off-farm offsetting approach. Grandfathering of historical losses is allowed.

Figure 1. ASC indicator, and corresponding Annex, requiring, and setting out the topics to be included in an EIA. ASC Salmon Standard Version 1.3.

The current ASC indicators, particularly 2.4.1, do not explicitly require a review of the EIA if unexpected impacts are observed, which means that auditors are not required to request an immediate revision of mitigation strategies or the EIA itself. In MH, auditor concerns about effectiveness of the EIA resulted in two recommendations, and a minor NC, which was later closed after action was taken to improve the implementation of mitigation plans (the establishment of a committee to oversee the status of key sustainability targets). None of these examples resulted in revision of the EIA, strategies, or an immediate implementation of mitigation measures being required to maintain certification.

When comparing ASC indicator 2.4.1 to the function of an “enhanced EIA” as described in Annex V Part I, the ASC indicator could be improved by adding the following additional steps:

- In order to reflect the voluntary standards’ EQO in full, other parameters, beyond biodiversity relating to sensitive and endangered species and habitats, are needed.
- More detail within the indicator to ensure outcomes of continuous monitoring and evaluation are acted upon. In other words, clear requirements on management responses.
- More detail within the indicator to ensure a feedback mechanism correlating the outcome of continuous monitoring with the validity of the EIA and Aquaculture Management Areas (AMA).
- Prior to starting production and prior to undergoing changes in production such as a major increase in biomass, each farming site should be subject to a enhanced EIA

- Moving some of the outline in the ASC annex to the indicator level would add specificity and act as a clear set of requirements against which non-conformities can more easily be raised when required.
- Some of the same requirements as outlined within the farm's vicinity are needed at the area level in order to cover objectives such as those on biodiversity and ecosystem function.
- A wider view and more detail are needed to fully incorporate the concept of risky systems and the handling of unknowns.
- Finally, any exceptions to metric thresholds required in the standards, or in ASC's terminology any variations, should only be approved if the EIA can predict acceptable impact with reasonable confidence, and management plans include specific indicators and thresholds, continuous monitoring and evaluation leading to immediate and targeted management measures, should warning or trigger levels nevertheless be breached.

BAP does not include a specific reference to an EIA in the salmon standard, but does require independent assessment of some topics that are components of an EIA. For example, new farms must provide an independent study of the area's hydrographic and benthic characteristics and analysis of the farms' ability to meet sediment and water quality criteria, and an expert assessment of the risk to wildlife, both of which are components of an EIA (Figure 2).

4.3: For newly established farms, or farms that have expanded and do not yet have enough monitoring data, the applicant shall provide an independent study that characterizes the hydrographic and benthic characteristics of the area and provides a consultant's opinion (without liability) that the farm can meet or exceed sediment and water quality criteria if operated correctly. This opinion shall be verified by reference to sampling results at the next audit.

7.2. Local rules notwithstanding, the applicant shall demonstrate that the farm meets the BAP procedural, performance, documentation and reporting requirements for a written Wildlife Interaction Plan, as described in the implementation requirements above, which shall include a list of local species of concern, expert wildlife interaction risk assessment, procedures to respond to risks and a description of the farm's passive deterrence measures and inspection procedures.

Figure 2. Selected BAP standards requiring independent monitoring or assessment of environmental impacts. BAP Salmon Farm Standard – issue 2 – Revision 3 October 2016.

The independent assessments required by BAP in indicators 4.3 (hydrographic and benthic characteristics of the area) and 7.2 (wildlife interaction) are similar to individual components of an EIA but do not fulfil the full intention or need for an "enhanced EIA". Unfortunately, as audit reports or summaries thereof are not publicly available, it is not known whether any EIAs were reviewed during audits as evidence or supporting information.

Macquarie Harbour

Prior to the expansion of farming in Macquarie Harbour, local government regulations required an EIA (referred to as EIS, Environmental Impact Study) to be submitted. The EIS was reviewed during ASC audits and found to be compliant with the ASC indicator 2.4.1. With the benefit of hindsight, it is apparent that an "enhanced EIA" requirement would have helped to better manage adverse conditions observed in the next few years. Here, we attempt to give an overview of key topics where more effective EIA requirements from voluntary standards would have changed the course of action, illustrating the potential benefits of this approach.

The EIS for Macquarie Harbour that was submitted in 2011 and updated in 2012 was prepared for all three salmon producers operating in the harbour. The EIS included an assessment of the risks to

biodiversity and ecosystem function, and used modelling to determine a sustainable carrying capacity of the harbour. It identified parameters for modelling and a suggested monitoring programme. The report explained the adaptive management process and the theory behind using monitoring results to determine future monitoring requirements and if necessary, to adapt management practices.

In response to the submitted EIS, regulators approved the industry request for an increase in allowed biomass, although regulators limited the increase to a precautionary 52.5% of the modelled sustainable biomass. They also issued a document listing some specific management requirements called "conditions for expansion". These conditions included required benthic and water quality monitoring, suggestions of what substantial benthic impact may be, defined limits for water quality parameters (ammonia, nitrate, oxygen) and included targeted management responses which could be directed by the Secretary if needed (reduction in biomass, reduction in nitrogen output, redistribution of biomass).

The approach required by regulators through the "conditions for expansion" and "licence conditions" in MH included many of the elements recommended above from spatial planning, through site selection to farm licencing. It was based on an EIS, included an allowable zone of effect, an estimated maximum biomass, as well as targeted management responses with timelines.

An enhanced EIA with area approach, combined with an effective AMA, would have addressed several of the issues identified in Macquarie Harbour. Both local and spatial issues could have been better addressed. Initially, an enhanced EIA would have identified Macquarie Harbour as an inherently "risky" system, requiring a precautionary approach to any expansion of production. Once the expansion occurred, an effective management mechanism such as an AMA that focussed on other spatial and cumulative issues in addition to biosecurity, would have required a management response to issues identified in correlation with farming practices (e.g., production changes) and trigger levels set.

Discussion

Current indicators in voluntary standards do go some way towards addressing the potential effects of aquaculture on biodiversity and ecosystem function. The indicators, however, do not ensure that all process steps are followed i.e., that a robust EIA leads to the designation of an AMA, informs the design of a monitoring program to verify the outcomes predicted by the EIA and verify the effectiveness of any mitigation measures, or initiate action defined in the AMA, should warning or trigger levels be breached. The reviewers conclude that the EIA requirements in voluntary standards could benefit from additional steps and requirements to ensure that monitoring programs are effective, not only in identifying impacts according to the voluntary standard's EQO, but also in triggering an immediate management response. Especially for risky sites, where there is a lack of long-term data, inconclusive data, known issues or foreseeable unknowns (e.g., climate change), ensuring frequent analysis of monitoring data and rapid response where needed (adaptive management), is key.

An alternative or additional approach to building the requirement for an enhanced EIA into voluntary standards would be to add a requirement for effective management. Auditors would be required to review the adequacy of an operator's management system and more specifically, its ability to assess risks, manage risks and monitor for compliance.

One difficulty for voluntary standards is to ensure that the EIA is scientifically robust in the first place. On the one hand, ample guidance and requirements to follow due process can be described by voluntary standards. On the other hand, a system of peer review, or a system where the EIA is produced by an acknowledged scientific institution, may be approaches to ensure the adequacy of the EIA. This could be required for all sites or for sites of higher risk for reasons mentioned above. Putting the above into the context of MH, MH would have been classified as a risky site leading to slower and precautionary steps of expansion, with immediate management responses to e.g., declining DO, substantially poor benthic health, as well as benthos not recovering.

Another difficulty for voluntary standards is the question of attribution, which can require years of research, as well as monitoring a form of correlation between for example water quality / benthic health and changes in production biomass. Where attribution remains somewhat unclear, the EIA can nevertheless work with initial precautionary estimates, coupled with a monitoring program and data analysis to ensure an effective and rapid adaptive management response. Such response mechanisms may not lead to much change if the cause-effect relationship is weak, which arguably is not of great concern from an environmental point of view as in that case the farming is not significantly driving the negative trend.

Response mechanisms, when needed, will usually have an economic impact on producers. Potential management measures in an AMA must be determined prior to starting production, so that industry has the possibility to work with a level of risk suitable for their business model. This is especially important when farming species such as salmon, where the long grow-out period adds to the challenge of rapid adaptive management.

The need to include an area-approach in voluntary standards has been previously recognised (FAO) and has even been on voluntary standard's agendas for some time. To date, no standard has yet implemented the approach, although there are some first attempts for voluntary implementation and partial requirements. The most obvious challenge is how to integrate area-related indicators into a farm-level verification system. Some may also argue that an individual farm cannot be responsible for or may not have the possibility to influence factors in the wider area beyond the farm. This is for sure a difficulty and probably the main reason why voluntary standards have been struggling to embrace a mechanism for area approaches. There is also the question whether a voluntary standard is trying to ensure responsible farming, sustainability, or both. However, the scientific community is more likely to argue that farming in a system that is beyond the system's carrying capacity, no matter what level of impact is attributed to certified aquaculture, is not responsible or sustainable. Precedent for this is the approach by some fishery standards, where harvest control rules are determined by the health of the fish population, rather than regulated by fishing mortality attributable to the fishing company in question or by contribution of the fishery to overall mortality.

A final difficulty for voluntary standards is the reliance and use of suitable reference sites. Arguably, for systems like Macquarie Harbour, there are no reference sites for water quality monitoring requirements, and it is the determined carrying capacity of the system which indicates whether or not water quality is adequate. The reference site within the harbour can be equally affected by far-field impacts or affected differently due to cumulative impacts. In other system such as the open ocean, where reference sites are more likely to extend beyond the area of significant impact, the use of reference sites would be more

meaningful. In the example of ASC and DO, the reference site is the compliance threshold and can falsely confirm compliance, if the health of the ecosystem is declining.

Conclusion

In summary, the adverse impacts and special conditions in Macquarie Harbour demonstrate that good management practices or responsible farming thresholds in relation to the immediate vicinity of the farm and irrespective of the carrying capacity of the system is not sufficient to protect biodiversity and ecosystem function. An enhanced EIA with area approach, combined with an effective management system, would ensure that both local and ecosystem impacts are minimised and when they occur, are detected and can be remedied immediately.

Recommendations

- 1) Voluntary standard's EQOs could be better defined in order to inform the expectations for an enhanced EIA, with requirements outlined in indicators to ensure a particular outcome is met, in line with the EQO.
- 2) EQO should distinguish between objectives which can be assessed within the lease area and objectives which are more large-scale such as biodiversity and ecosystem function, and cannot be assessed, monitored or managed within the lease area or immediate vicinity of a farm.
- 3) EIA process requirements by voluntary standards could benefit from additional steps³ to ensure that monitoring programs are correlated to farming activity and the carrying capacity of the environment, based on the outcome of the EIA, and are effective not only in identifying impacts, but also in triggering an immediate management response and a review of the EIA, when needed. While improving the system as a whole, such "enhanced EIAs" could be one of the few mechanisms voluntary standards have to capture special conditions of the local environment.
- 4) Further research: the process steps for an "enhanced EIA with an area approach" are likely to greatly improve a voluntary standard's handling of special conditions in the local environment as well as ensuring responsible farming within the ecological carrying capacity of the system; for this, a list of specific questions to assess and a process blueprint which every enhanced EIA and management plan can follow, would be useful.

5.3 DOES RELIANCE OF ECO-LABELLING ON GOVERNMENT REGULATION CREATE A GAP?

Original question in full: Does the reliance of voluntary standards, including both ASC and BAP, on operators being in compliance with local and national laws, without requiring a minimum standard for those laws, create a gap in expectations about the meaning of 'environmentally responsible'?

In this chapter, the term law is used to describe rules that are established by the federal, state, or local government and set out broad legal/policy principles (also called legislation or Act). In contrast, regulations are created by an executive government agency to actually implement and ensure uniform

³ See suggested list in section "Voluntary standards' current approaches to EIAs", above

application of the law and dictate how the provisions of the law are applied (also called subsidiary legislation).

There are two aspects to the question asked: 1) is there a gap in situations where there is a lack of enforcement of environmental quality objectives required by law, and 2) is there a gap in situations where local and national law has a lower environmental quality objective than the voluntary standards. These two aspects are elaborated in more detail below:

Aspect 1: Enforcement of regulation. Typically, voluntary standards require compliance with local and national laws and regulations as a baseline for certification. This is likely included to avoid any conflict with applicable laws and regulations as well as to ensure a certified operator is not engaged in illegal practices. While this sounds straightforward, difficulties arise where the law applies but local regulation is not effectively enforced. Examples include situations where there is a lack of compliance monitoring, a lack of analysis of compliance monitoring, a lack of taking action based on the outcome of the analysis of compliance monitoring, or a lack of enforcing sanctions for infringements of applicable regulation. The two questions this raises for voluntary standards are the following: 1) is a producer compliant with voluntary standard's own requirement to comply with local and national laws and regulations in situations where there is a lack of enforcement and regulatory compliance goes unevaluated by regulators, and 2) is a producer compliant with voluntary standard's own requirement to comply with local and national laws and regulations in situations where infringements are accepted by local regulators?

Aspect 2: Minimum standards achieved. Local and national law and regulations typically address a range of environmental aspects, leading to overlap between regulation and voluntary standards. An example for this could be the use of antifoulants; regulation may allow the use of copper treated nets together with strict conditions on net washing, whereas the voluntary standard may prohibit the use of treated nets for certified fish. In this example, there is overlap of the coverage of "the use of treated nets", with the regulation having a different EQO to the voluntary standard. In other words, local and national law and regulation can be inadequate to meet the scheme's intention and claim, or in other cases even conflict with it.

What holds true in all cases is that a voluntary standard either aims to improve enforcement (aspect 1) or increases the minimum compliance standard (aspect 2) in relation to local and national law and regulation; alternatively, there is hardly any value in the voluntary standard existing.

International good practice guidance

The ISEAL Code of Good Practice for Setting Social and Environmental Standards (ISEAL, 2014), which was developed by ISEAL as a means to "*evaluate and strengthen the process for setting sustainability standards*", can give some further guidance on the question asked in this chapter.

ISEAL expects voluntary standards to set requirements at a level that will result in significant positive impacts. Depending on the current local situation, this may be achieved either by meeting or exceeding existing regulations. As explained in the ISEAL guidance document, in some cases, a positive impact may be achieved simply by ensuring current regulations are enforced, where they may not otherwise be. In cases where regulations are already enforced, but are not consistent with international best practice, it is expected that the standards' requirements should exceed local regulations. However, if local

regulations are enforced and meet international good practice, then standards' requirements that meet the regulations are considered sufficient (ISEAL, 2014).

ASC approach

ASC's principle 1 requires that farms comply with all applicable laws and regulations. The rationale for the principle, as stated in the standard, is: *"Salmon aquaculture operations must, as a baseline, adhere to the national and local laws of the regions where production is taking place. Farm operations that, intentionally or unintentionally, break the law violate a fundamental benchmark of performance for certified farms. It is important that aquaculture operations demonstrate a pattern of legal and responsible behaviour, including the implementation of corrective actions for any legal violations."*

This requirement is covered by four indicators requiring compliance specific to local law and regulation:

Criterion 1.1 Compliance with all applicable local and national legal requirements and regulations

INDICATOR	REQUIREMENT
1.1.1 Presence of documents demonstrating compliance with local and national regulations and requirements on land and water use	Yes
1.1.2 Presence of documents demonstrating compliance with all tax laws	Yes
1.1.3 Presence of documents demonstrating compliance with all relevant national and local labour laws and regulations	Yes
1.1.4 Presence of documents demonstrating compliance with regulations and permits concerning water quality impacts	Yes

Figure 3. ASC indicators requiring compliance specific to local law and regulation. ASC Salmon Standard Version 1.3.

During ASC audits in MH, breaches in licence conditions, such as spontaneous gas bubbling and extensive mats of *Beggiatoa* were linked to 1.1.1. of the ASC standard. In these examples, a lack of enforcement of the regulation was addressed in the audit report and in a non-conformity. It is unclear what the final consequence of this would have been in terms of certification status, as certification was withdrawn for non-conformities raised against other indicators.

None of the other ASC principles and their indicators rely on local and national law and regulation, instead, there is an attempt to focus on metric compliance thresholds, thereby setting the minimum standard a farm must achieve to receive and maintain certification. The thresholds are meant to apply in all cases, requiring farms to meet ASC's own requirements, i.e., ASC's own EQO. This approach has the advantage of ensuring a minimum standard and consistency across certified farms, regardless of jurisdiction. However, it also has the disadvantage that requirements are less flexible in adapting to unique local conditions.

In principle 2, which is the most relevant for this review, ASC lists for example the following indicators for DO and benthic health:

Criterion 2.1 Benthic biodiversity and benthic effects⁴

INDICATOR	REQUIREMENT
2.1.1 Redox potential or ⁵ sulphide levels in sediment outside of the Allowable Zone of Effect (AZE), ⁶ following the sampling methodology outlined in Appendix I-1	Redox potential > 0 mV, or, Sulphide ≤ 1,500 µMol /L
2.1.2 Faunal index score indicating good ⁷ to high ecological quality in sediment outside the AZE, following the sampling methodology outlined in Appendix I-1	AZTI Marine Biotic Index (AMBI ⁸) score ≤ 3.3, or, Shannon-Wiener Index score > 3, or, Benthic Quality Index (BQI) score ≥ 15, or, Infaunal Trophic Index (ITI) score ≥ 25
2.1.3 Number of macrofaunal taxa in the sediment within the AZE, following the sampling methodology outlined in Appendix I-1	≥ 2 highly abundant ⁹ taxa that are not pollution indicator species
2.1.4 Definition of a site-specific AZE based on a robust and credible ¹⁰ modelling system ¹¹	Yes

Figure 4. ASC indicators requiring compliance with ASC specific benthic indicators. ASC Salmon Standard Version 1.3.

Criterion 2.2 Water quality in and near the site of operation¹⁵

INDICATOR	REQUIREMENT
2.2.1 Weekly average percent saturation ¹⁶ of dissolved oxygen (DO) ¹⁷ on farm, calculated following methodology in Appendix I-4	≥ 70% ¹⁸
2.2.2 Maximum percentage of weekly samples from 2.2.1 that fall under 2 mg/L DO	5%
2.2.3 For jurisdictions that have national or regional coastal water quality targets ¹⁹ , demonstration through third-party analysis that the farm is in an area recently ²⁰ classified as having “good” or “very good” water quality ²¹	Yes ²²
2.2.4 For jurisdictions without national or regional coastal water quality targets, evidence of monitoring of nitrogen and phosphorous ²³ levels on farm and at a reference site, following methodology in Appendix I-5	Consistency with reference site

Figure 5. ASC indicators requiring compliance with ASC specific DO (and other water quality) indicators. ASC Salmon Standard Version 1.3.

These indicators typically set metric compliance thresholds, independent of local and national law and regulation, ensuring a minimum standard and consistent approach among different jurisdictions. It should be mentioned that a variation request (VR) was accepted by ASC to deviate from indicators 2.1.1, 2.1.2, and 2.1.3, as well as 2.2.3 and 2.2.4 in order to take into account local conditions. What this meant for the situation in MH and how the VR process works, is referred to in chapter 5.1 and Annex III/IV.

BAP approach

BAP states in the introduction to the Salmon standard that *“BAP standards demand compliance with local regulations as the first step toward certification. However, not all regulations are equally rigorous in all aspects. For this reason, BAP standards set out requirements for documentation and procedures that must be in farm management plans, whether they are prescribed by local regulations or not. By so doing, they seek, where possible, to impose consistency in performance among facilities in different producing regions and to engage the industry as a whole in a process of continuous improvement.”*

Section 1 of the BAP salmon standard requires that farms *“comply with local and national laws and environmental regulations, and provide current documentation that demonstrates legal rights for land use, water use, construction, operation and waste disposal”*.

This requirement is covered by six indicators requiring compliance specific to local law and regulation:

Standards

- 1.1: Current documents shall be available to prove legal land and water use by the applicant.
- 1.2: Current documents shall be available to prove all business and operating licenses have been acquired.
- 1.3: Current documents shall be available to prove compliance with applicable environmental and other regulations for construction and operation.
- 1.4: Where applicable, current documents shall be available to prove compliance with Area Management Agreements or other local agreements to which the farm has committed. (See also Standard 2.7.)
- 1.5: Where applicable, current documents shall be available to prove compliance with laws protecting the resources of indigenous peoples and/or independent agreements the applicant may have made with them.
- 1.6: Where applicable, current documents shall be available to show compliance with the farm's own industry codes of practice.

Figure 6. BAP requirements for compliance with local and national laws. BAP Salmon Farm Standard – issue 2 – Revision 3 October 2016.

Based on the written standard, the indicators do not seem sufficient to pick up on a lack of enforcement of regulation, but it is unknown how these indicators were actually applied in MH as BAP audit reports are not made publicly available and were not shared on request for this review.

A number of other sections and their indicators rely on local and national law and regulation. Where local and national law and regulation are not available, BAP typically require best management practices and compliance with the farm's own written farm management documents, rather than requiring metric compliance thresholds to be met. The aim of this approach is to allow continuous improvement, rather than achieving a minimum standard. An advantage is the flexibility to adjust to unique local conditions, while the disadvantage is that no minimum standard or consistency across certified farms is ensured.

In section 4. Environment, Sediment and Water Quality, which is the most relevant for this review, BAP lists the following indicators:

Standards

- 4.1: The applicant shall provide documents that describe local standards for benthic impacts under salmon farms, which shall include the benthic indicator "trigger level" above which the farm would not be in full compliance with the local standard, where this is clearly defined, or with its intent where it is not clearly defined.
- 4.2: For established farms, the applicant shall provide three years of monitoring data to show that the farm meets or exceeds sediment and water quality criteria specified in 4.1, its operating permits and/or its own monitoring plan at current operating levels.
- 4.3: For newly established farms, or farms that have expanded and do not yet have enough monitoring data, the applicant shall provide an independent study that characterizes the hydrographic and benthic characteristics of the area and provides a consultant's opinion (without liability) that the farm can meet or exceed sediment and water quality criteria if operated correctly. This opinion shall be verified by reference to sampling results at the next audit.
- 4.4: For farms in countries where sediment monitoring is not required and/or a sediment impact zone is not defined as a condition of the farms' operating permits, the applicant shall write and implement a monitoring plan consistent with the provisions under Implementation above.
- 4.5: Monitoring of sediment conditions shall be undertaken at the time of peak feeding during the production cycle and shall be conducted according to the requirements of the farm's operating permits or its own plan in countries or regions where sediment monitoring is not required, and as specified in the implementation requirements.
- 4.6: Sediment sampling and analysis performed as part of the monitoring program shall be conducted according to methods generally accepted for such use in the region in which production is occurring.
- 4.7: The results of sediment monitoring shall be reported to and approved by the appropriate regulators. Where regulatory approval is conditional upon implementing a program of remedial action, this shall have been implemented and completed to show compliance with 4.1.
- 4.8: Data that will enable the farm's feed-based carbon and nitrogen discharges to be calculated shall be collected and recorded, and may be required to be submitted to the BAP database for future use in BAP-sponsored research. (See Introduction.)
- 4.9: Production cycles, fallowing and nutrient monitoring shall be coordinated with the other neighboring BAP applicants or certified farms, or with members of an established AMA. (See Section 2.)

Figure 7. BAP requirements for sediments and water quality. BAP Salmon Farm Standard – issue 2 – Revision 3 October 2016.

The indicators require the auditor to review a number of processes based on local and national law and regulation (4.1, 4.2, 4.5, 4.7). Where relevant regulation is absent, the operator must write and implement a monitoring plan following the guidance in the BAP standard. While 4.4 outlines an extensive process, this does not apply where local regulation already requires sediment monitoring, i.e., does not apply to MH or probably any other salmon producing jurisdiction (as all have regulation around sediment monitoring). While allowing for flexibility for local conditions, the disadvantage of this approach is that a minimum standard is not ensured, as local law and regulations will have varying EQOs and effectiveness in different jurisdictions, and any lack of enforcement is not addressed. How continuous improvement was addressed through the BAP standard is not known, as there didn't seem to be a BAP specific monitoring plan in place, however, due to the lack of transparency on BAP certified sites and BAP audit reports, it is not clear if aspect 1, aspect 2, or none of these, is ensured by the indicators in the standard.

Discussion and conclusions

The different approaches used by voluntary standards nicely demonstrate the two aspects of this chapter's topic. While both voluntary standards reviewed require compliance with national and local law and regulation, BAP relies on national and local law and regulation to set an acceptable minimum standard, whereas ASC sets its own monitoring and compliance thresholds in many cases.

Aspect 1: Enforcement of regulation.

Both standards have requirements for operators to comply with national and local law and regulation. The difficulty lies in the practical application of this requirement. The reviewers have audited several hundred operators in all regions of the world over the last 15 years and while it is uncommon for an

operator to be unlicensed, it is common to see a lack of enforcement of regulation. There are a number of reasons for this, from insufficient capacity, funding and expertise, to inadequate monitoring programs, and possibly even a lack of management responding to monitoring outcomes due to economic consequences. This creates a great opportunity for voluntary standards to drive significant positive change and in many cases accelerate regulatory enforcement. For voluntary standards, additional sub-indicators and guidance are suggested to clarify how an operator not subject to effective local regulation or enforcement can be certified as compliant with the voluntary standard. While this approach may raise concerns for a young industry, typically older industries tend to see the benefit, as it creates a level playing field for all operators and is more likely to ensure a long-term and sustainable production.

Aspect 2: minimum standard achieved

The second approach is more straightforward. One way to look at this is that buyers and consumers have an expectation that a product carrying an ecolabel is not simply equal to other products produced in that region. Another way to look at this is that a voluntary standard and governance around the standard must fulfil the standard's claim. Therefore, if a voluntary standard makes claims around ensuring a minimum standard or environmental quality objective (EQO), then, as demonstrated above, the standard's indicators cannot rely on local and national law and regulation to fulfil that objective. If a voluntary standard makes claims around ensuring continuous improvement or ensuring a minimum DO threshold, then again, the standard's indicators cannot rely on local and national law and regulation to fulfil that objective.

In summary, compliance with local law and regulation is not enough to ensure environmental responsibility. Any claims made by a voluntary standard on responsible operation, environmental quality objectives, or continuous improvement, must be ensured by indicators within the standard itself. If there was a common global understanding of acceptable levels of impact, and adequate laws and regulations ensuring achievement of that acceptable level of impact, there would arguably be no need for voluntary standards. It is plausible, however, for a voluntary standard to benchmark national and local laws and regulation (including effective enforcement) against its own EQO or theory of change. Where these are found to be (continuously) equivalent, relying on local and national law and regulation does not create a gap in expectations; however, for both standards such a benchmark has not been performed.

Recommendations

- 1) Voluntary Standards: it is recommended to add sub-indicators or guidance, to clarify how operators not subject to effective local regulation or enforcement can be certified by the voluntary standard as compliant with national and local laws and regulation. The intention of this recommendation is to tackle the common situation where national and local laws and regulation exists but may not (yet) be fully enforced, as well as to speed up regulatory enforcement and contribute to significant positive change as suggested by ISEAL. It is also likely to lead to a more consistent level playing field between different CABs and jurisdictions.
- 2) ASC: consider including the following in a formalized VR process for variations relying on national and local laws and regulation: include scientific benchmark of the variation in terms of the ASC EQO, and include a review of national and local laws and regulation in terms of effective enforcement.

5.4 WOULD REQUIREMENTS ON CUMULATIVE IMPACTS HAVE PREVENTED CERTIFICATION OR DRIVEN ADDITIONAL MANAGEMENT?

Original question in full: Would explicit criteria, which require potential cumulative impacts from multiple leases to be assessed and managed, have prevented the certification of sites in Macquarie Harbour and/or driven additional management and production decisions to prevent these impacts?

At the time of the expansion, regulation and the industry's EIS and AMA already took a harbour-wide approach; monitoring was being carried out throughout the harbour, collecting information on potential cumulative impacts.

Area management in MH – voluntary standards

ASC requires all farms to participate in Area-Based Management (ABM) schemes to coordinate measures relating to the management of fish health and biosecurity. These measures include: coordinating stocking, fallowing, the application and rotation of treatments, and the monitoring of disease and resistance. Farms in areas without an ABM scheme need to show leadership in working with neighbouring farms to establish one.

BAP states in the salmon standard that they strongly support the concept of Area Management Agreements (AMAs). Where AMAs already exist, BAP requires farms to participate and coordinate production cycles, fallowing and nutrient monitoring as well as to cooperate on measures for fish health and biosecurity. If there is no AMA, but other BAP-certified farms are located in the area, the certified farms are required to work together as if in an AMA.⁴

Area management in MH – regulators

As discussed in more detail in chapter 5.2, the limit levels (triggers) for oxygen for example, only required targeted management responses when impact could be attributed to the marine farming operation. This means that unless the source of an impact could be clearly established, it would not be required to lead to a management response.

Area management in MH – industry

In 2012, an Area Management Agreement (AMA) was developed by the three salmon producers in MH. The agreement was comprehensive and included measures for fish health and biosecurity, as well as an environmental monitoring plan, which detailed monitoring to be carried out for both harbour-wide and farm scale impacts, based on recommendations in the EIA. The AMA also set an agreed carrying capacity level, which was also reflected in the farms' respective marine farming licence conditions. The agreement explained the theory behind the groups' stated adaptive management approach,

This coordinated management approach is compliant with the indicators of both voluntary standards reviewed. Auditor comments in initial ASC audit reports suggested the coordinated efforts for monitoring and health were working well, but the relationship between the parties later broke down, resulting in an ineffective AMA. It is not clear if the status today is the same, as BAP audit reports or summaries thereof, are not made publicly available. Nevertheless, this illustrates that, although

⁴ A recently published version of the revised BAP Farm Standard, released in July 2020 for public comment, includes some additional implementation guidance regarding the importance of AMAs in addressing cumulative benthic impacts and stresses the need for cooperation with neighbouring farms, whether those farms are certified or not.

monitoring of cumulative impacts has been underway for some time, achieving a consistent coordinated management response has proven difficult.

Cumulative Impacts

At the time of the expansion, it was common to view cumulative impacts solely from the point of view of biosecurity and it is likely that even if cumulative impact requirements had been included in voluntary standards, additional indicators would not have addressed the environmental concerns “biodiversity” and “ecosystem function”. Sustainable Fisheries Partnership (SFP) has produced a report in partnership with Conservation International, and the University of California Santa Barbara’s Sustainable Fisheries Group on ways to address cumulative impacts, based on the ecosystem approach to aquaculture (EAA) developed by the Food and Agriculture Organization (FAO) (SFP, 2018, FAO, 2010). They focus on three main challenges facing the aquaculture industry relating to cumulative impacts:

- 1) Spatial conflicts with other resources users – e.g., access rights, impacts of habitat conversion on other users.
- 2) Exceeding carrying capacity of a waterbody – leading to negative environmental effects e.g., benthic impacts, loss of water quality
- 3) Disease amplification and transmission – this can affect both aquaculture species and wild stocks.

Such reports strongly suggest moving away from a purely biosecurity focused view, to include carrying capacity of waterbodies and spatial conflicts, two topics which cannot be managed at a farm-scale.

Despite the view that additional criteria on cumulative impacts alone would not have made a big difference, mainly due to a lack of structure for the accompanying management response mechanisms, it is possible that the following additions in ASC and BAP would have driven additional management:

- Incorporation of carrying capacity of the waterbody into Area Management Agreements, as suggested by FAO above
- Clearer requirement for industry to take joint targeted management response based on monitoring values and warning and trigger levels pre-defined in the AMA

For the second point, there has not been much guidance from the scientific community on how such AMAs/ABMs need to be governed, in order to be effective in a potentially competitive environment both for producer as well as for voluntary standards/ecolabels.

In conclusion, and for the three reasons described, 1) at the time cumulative impacts were regarded as only relating to biosecurity, 2) indicators would have relied on existing regulatory requirements which were not fully enforced/acted upon (see 5.3), and 3) non-coordinated efforts between the voluntary schemes operational in MH, the reviewers are of the opinion that despite the existence of AMAs early on in MH, additional criteria at the time on cumulative impacts from multiple leases would not have altered the situation regarding certification.

Recommendations

- 1) Voluntary standards:

Review the feasibility of including all topics which cannot be resolved at farm-scale, such as the carrying capacity of a waterbody into the AMA/ABM requirement.

2) Voluntary standards:

Evaluate the possibility of entering a MOU with other GSSI recognized aquaculture schemes, to enable and enforce a mandatory requirement that all certified producers must participate in area agreements. The agreements would need to include monitoring programs and defined responses to indicators exceeding pre-defined trigger levels. Explore the option of allowing a precautionary approach (modified monitoring/trigger values), in situations where non-certified producers decline to participate in the AMA/ABM.

3) Research Community:

More guidance from the scientific community would be very welcome on how AMAs/ABMs need to be designed and governed, in order to be effective in a potentially competitive environment both for producers as well as for voluntary standards/ecolabels.

5.5 HOW SHOULD ECO-LABELLING BE ADJUSTED MORE GENERICALLY TO ADDRESS SIMILAR IMPACTS OCCURRING IN OTHER LOCATIONS?

Original question in full: How should voluntary salmon production standards be adjusted more generically to address the issues identified above, in order to prevent similar impacts occurring in other locations?

The discussions and recommendations made in chapter 5.2 and throughout this report are sufficiently generic to be applied to all locations. Chapter 5.1 discusses the issue of preventing impacts, 5.2 discusses how to capture local specificities for any location, and 5.3 discusses how a voluntary standard can maintain its claim independent of the level of enforcement and effectiveness of local and national law and regulation. The recommendations suggested in the above chapters are considered likely to prevent similar impacts occurring in other locations if implemented, as well as minimising some of the potentially negative impacts on stakeholders (including industry). In addition to the topics already discussed in previous chapters, improved structuring of the stakeholder engagement process would also help to address the issues discussed, as stakeholders are an important source of information, especially regarding lessons learnt in other locations which auditors may not be familiar with. For this reason, this chapter discusses stakeholder engagement in more detail.

For voluntary standards, engaging stakeholders can enhance the verification process by enabling the auditor or CAB to cross-check or obtain additional information, particularly that specific to the local area. Stakeholders can also be a source of sector- and producer-specific knowledge, can educate about the local context, some of which cannot be seen or learned during an on-site visit by an auditor. For example, stakeholders may have experience of historic risks in a specific area, have valuable knowledge of existing scientific advice, or be able to share similar issues or successful strategies seen in other locations. Other reasons for seeking their engagement may be to allow compromise where there is strong opposition (e.g., differing impacts on different users), to make community interviewing requirements more

meaningful, to provide a mechanism to enable stakeholders to raise concerns about the auditing and certification process, or to increase participation and foster acceptance of certification decision outcomes. Nevertheless, despite the listed potential benefits, stakeholder processes can also pose a challenge; in some situations, stakeholder engagement and input can be motivated by reasons other than looking to ensure responsible production and minimise impacts on the environment and society.

During meetings with stakeholders it was evident that repetition of the same issues seen in MH in other locations within Tasmania was of great concern. Other environmental, economic and social issues, not all of which have been discussed in this report, were also raised. There was concern that stakeholder input, including scientific advice and knowledge of lessons learned in MH, would not be actively sought or integrated in the processes discussed in chapter 5.2. There is supportive literature on the importance of including stakeholder input at all levels of spatial planning (Aguilar-Manjarrez et. al, 2017, Sanchez-Jerez et. al, 2016) and ensuring an effective and sustainable process. Very recently, a legislative enquiry into Finfish Farming in Tasmania was launched, receiving 224 submissions. At the time of this review the extent to which the inquiry may lead to changes in process or legislation and regulation remained unclear. As this review focuses on the role of voluntary standards, stakeholder inclusion from a regulatory point of view will not be discussed in further detail but is mentioned here to emphasise the importance and value of an inclusive, balanced process; alternatively, it is possible that the single most important factor impeding growth of the industry could be missing stakeholder support.

It was also noted that stakeholder expectations of the voluntary standard's auditing and certification process and the outcome of their involvement was not always met. In some instances, the understanding of the roles of an auditor or certification body differed significantly from the ISO guidelines (ISO/IEC 17065) according to which most voluntary standards operate. Such differences primarily related to the expectation that auditors would have the role or capacity to collect baseline data and perform scientific reviews, or have the flexibility to raise non-conformities to reflect the local situation even where a corresponding indicator within the voluntary standard is missing. Such topics more likely fit into the role of stakeholders (including industry), both during the audit and certification process, as well as during the standard revision process.

For ASC, producers are required to show evidence of regular and meaningful consultation and engagement with community representatives and organizations (indicator 7.1.1) and stakeholders are actively invited to give input before and during the certification process (ASC CAR 17.8). Stakeholder input is reviewed by the auditors as part of the auditing and certification process and documented in the public audit report. MH stakeholders were familiar with community and stakeholder events held as part of the ASC certification process and many had attended such events at some point in time. The ability to participate in the process was generally welcomed but in some cases the outcome was not clear to all stakeholders or was not as they had expected. The reviewers did not find ASC specific guidance or clarification in publicly available documents on ensuring meaningful stakeholder engagement, the role of stakeholders in the audit process, the intention for seeking their engagement, or what the expected outcomes are.

The BAP salmon standard states that during the auditing process, an auditor may include farm neighbours and community stakeholders as a source of information. However, they do not actively seek stakeholder input, and as the audits are not publicly announced, and audit reports outcomes are not

available to the public, stakeholder engagement is likely to be minimal. Few, if any, of the MH stakeholders, other than industry and auditing/certification representatives, were aware that sites are BAP certified and it seems no stakeholder engagement has taken place.

An improved process to inform stakeholders and manage their expectations would help to increase participation, leading to increased support and trust, and encouraging stakeholders to continue to engage in the future. On the flipside, further clarification of the intentions for involving stakeholders would allow stakeholders to better understand their role and give more targeted and meaningful input to the auditing and certification process. Guidance on mechanisms to ensure meaningful stakeholder engagement would support CABs and the industry, and help to strengthen and standardise the process, presumably adding to an improved global level playing field.

Recommendations

1) Voluntary standards – ASC:

Consider adding more clarification on the intention for seeking stakeholder engagement:

- Does the intention include stakeholders obtaining information on ASC, on the role of auditors and CABs, as well as the process and status of the certification process? If not, do outreach staff need to improve in this role?
- Does the intention include improving the verification process by requesting or allowing stakeholders to provide auditors with additional information and to fact-check information used by the CAB?
- Does the intention include finding an acceptable compromise between potentially opposing stakeholder views?
- Does the intention include avoiding certification where there is strong stakeholder opposition or where certification is not supported by society?

Consider adding more clarification in order to better align stakeholder expectation:

- What is the role of stakeholders in the auditing and certification process?
- What is the scope i.e., what kind of stakeholder input can be considered in the certification process?
- What outcome can a stakeholder expect from input given?
- Is there a requirement to consult stakeholders when exceptions to the standard (e.g., VRs) are being considered by ASC for a particular site?
- What is the difference between stakeholder input to the certification process and submitting a complaint to the CAB or voluntary standard? What outcome/feedback can a stakeholder expect from a complaint submission?

Consider adding guidance for CABs:

- how to ensure a meaningful stakeholder engagement process.
- how to manage stakeholder engagement and input motivated by reasons other than ensuring responsible production and reasons other than minimising impacts on the environment and society.

- 2) Further research or review of existing research, from a social science perspective, on the following topics:
- What is the value of, or need for, stakeholder engagement in voluntary standard certification?
 - How can stakeholder input be managed to give representatives of society and other organisations and industry a voice, so that stakeholder information can successfully feed into a certification process, while avoiding the possibility that certification is delayed or opposed for reasons other than ensuring responsible production and positive or acceptable impacts on the environment and society?
 - What is the value of transparency?

6 ACKNOWLEDGMENTS

We wish to thank all stakeholders for their time to meet and discuss with the reviewers, their preparedness to share invaluable information, their patience to revisit questions around events of the past, and their engagement in exploring ideas for potential future improvements.

7 ABBREVIATIONS AND EXPLANATIONS

ASC	Aquaculture Stewardship Council https://www.asc-aqua.org/
ABM	Area-based management
AMA	Aquaculture Management Agreement, or Aquaculture Management Area
Area Management Plan	A plan for the management of a defined area for aquaculture where the farmers undertake aquaculture in accordance with agreed strategies, management practices and codes of conduct, and manage production in order to reduce and manage risks posed by disease and parasites, including cumulative environmental impacts and social conflict (FAO, 2017).
BAP	Best Aquaculture Practices https://www.bapcertification.org/
Bio-inspecta	BIO.INSPECTA PTY LTD https://www.bio-inspecta.ch/en/aquaculture-and-fisheries.html
Carrying capacity	Carrying capacity is the amount of a given activity that can be accommodated within the environmental capacity of a defined area. In aquaculture, it is usually considered to be the maximum quantity of fish that any particular body of water can support over a long period without negative effects to the fish and to the environment (FAO, 2009; Ross et al., 2013).
CSIRO	Commonwealth Scientific and Industrial Research Organisation https://www.csiro.au/en https://www.csiro.au/en/About/Our-impact/Our-impact-in-action/Agriculture-and-fisheries/Salmon
DPIPWE	Department of Primary Industries, Parks, Water and Environment https://dPIPWE.tas.gov.au/ Responsible for Marine Farming Development Plans, Marine Leases and Marine Farm licences https://dPIPWE.tas.gov.au/sea-fishing-aquaculture/marine-farming-aquaculture
EDO	Environmental Defenders Office http://www.edotas.org.au/?s=salmon https://www.edo.org.au/
EPA	Tasmanian Environment Protection Authority Responsible for Environmental Licences https://epa.tas.gov.au/regulation/salmon-aquaculture
ET	Environment Tasmania https://www.et.org.au/
FAO	The Food and Agriculture Organization (FAO) is a specialized agency of the United Nations that leads international efforts to defeat hunger. http://www.fao.org/aquaculture/en/

	<p>FAO recognizes the fast-growing contribution aquaculture is making to food security, providing technical assistance through the implementation of the Code of Conduct for Responsible Fisheries, which:</p> <ul style="list-style-type: none"> • promotes sustainable aquaculture development, especially in developing countries, through better environmental performance of the sector, through health management and biosecurity • provides regular analysis and reporting of aquaculture development status and trends at global and regional levels, sharing knowledge and information • develops and implements efficient policies and legal frameworks which promote sustainable and equitable aquaculture development with improved socio-economic benefits <p>The Sub-Committee of Aquaculture provides a forum for consultation and discussion on aquaculture.</p> <p>It also advises the Committee on Fisheries (COFI) on technical and policy matters related to aquaculture and the work to be performed by the Organization.</p> <p>FAO provides a wealth of information and tools on aquaculture development, issues and opportunities worldwide.</p>
Global G.A.P.	https://www.globalgap.org
Huon	Huon Aquaculture Pty Ltd. Atlantic salmon producer in Tasmania https://www.huonaqua.com.au/
IMAS	University of Tasmania, the Institute of Marine and Antarctic Studies https://www.imas.utas.edu.au/ http://imas.utas.edu.au/research/fisheries-and-aquaculture/aquaculture/atlantic-salmon-aquaculture-research
ISEAL	ISEAL Alliance is a membership association for sustainability standards. They publish guidance tools to define and communicating what good practice looks like for sustainability standards. www.isealalliance.org ASC is a full member of ISEAL alliance. BAP and GlobalG.A.P are not members, although Global G.A.P is listed as a subscriber on the ISEAL website.
Management Area	Management areas are defined areas (geographical waterbody areas) where all the operators in the management area agree (coordinate and cooperate) to certain management practices or codes of conduct (FAO, 2017).
MH	Macquarie Harbour
NC	Non-conformity
NOFF	Neighbours of Fish Farming https://neighboursoffishfarming.org.au/
Petuna	Petuna Pty Ltd.

	Atlantic salmon producer in Tasmania https://www.petuna.com.au/
SeaChoice	Living Oceans https://livingoceans.org/ https://www.seachoice.org/
SEG	Seafood Expo Global https://www.seafoodexpo.com/global/
Tassal	Tassal Pty Ltd. Atlantic salmon producer in Tasmania http://www.tassal.com.au/
TAMP	Tasmanian Alliance of Marine Protection https://www.tamp.org.au/
TOR	Terms of Reference (for this review)
TSGA	Tasmanian Salmon Growers Association https://www.salmonfacts.com.au/
TCT	Tasmanian Conservation Trust http://www.tasconservation.org.au/
TWWHA	Tasmanian Wilderness World Heritage Area

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FAO. 2010. Aquaculture development. 4. Ecosystem approach to aquaculture. FAO Technical Guidelines for Responsible Fisheries No. 5, Suppl. 4. Rome. 53 pp.

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Knight B, Forrest B, Johnston C 2015. Macquarie Harbour Environmental and Fish Health Monitoring Review. Prepared for Department of Primary Industries, Parks, Water and Environment Tasmania. Cawthron Report No.2729. 93 p. plus appendices.

Bottema MJM. Institutionalizing area-level risk management: Limitations faced by the private sector in aquaculture improvement projects. 2019. Aquaculture 512

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

Ross J & MacLeod C. 2017. Environmental Research in Macquarie Harbour, Interim Synopsis of Benthic and Water Column Conditions, University of Tasmania & IMAS.

Sanchez-Jerez, P. & Karakassis, Ioannis & Massa, Fabio & Fezzardi, Davide & Aguilar-Manjarrez, Jose & Soto, D. & Chapela, Rosa & Avila, P. & Rivero, José Carlos & Tomassetti, Paolo & Marino, Giovanna & Borg, Joseph A & Franicevic, V. & Yucel-Gier, Guzel & Fleming, Ian & Biao, X. & Nhhala, Hassan & H.A., Hamza & Forcada, Aitor & Dempster, Tim. 2016. Aquaculture's struggle for space: The need for coastal spatial planning and the potential benefits of Allocated Zones for Aquaculture (AZAs) to avoid conflict and promote sustainability. Aquaculture Environment Interactions. Volume 8. 41-54.

Telfer T, H Atkin, R Corner. 2009. Environmental impact assessment and monitoring in aquaculture: Requirements, practices, effectiveness and improvements, Edition: FAO Fisheries and Aquaculture Technical Paper 527.

Links to government information sources

Map of farm leases and monitoring sites:

<https://salmonfarming.dpipwe.tas.gov.au/macquarie-harbour>

Licences: <https://maps.thelist.tas.gov.au/listmap/app/list/map>

Operational data from 2017 onwards : <https://salmonfarming.dpipwe.tas.gov.au/macquarie-harbour>

2020 Legislative Council Government Administration A - Fin Fish Farming in Tasmania Inquiry http://www.parliament.tas.gov.au/ctee/Council/GovAdminA_Fin.htm

Marine Farming Planning Act 1995:

<https://www.legislation.tas.gov.au/view/whole/html/inforce/current/act-1995-031>

2015 Macquarie Harbour Status Report: <https://stors.tas.gov.au/1450300>

2015 DPIPWE response to Macquarie Harbour Status Report and recommendations:
<https://stors.tas.gov.au/1450296>

Links to information available from voluntary standards

ASC:

Standards: <https://www.asc-aqua.org/what-we-do/our-standards/farm-standards/the-salmon-standard/>

ASC information and reports for currently certified farms <https://www.asc-aqua.org/find-a-farm/>

ASC granted variations in 2014 (benthic sampling and water quality testing) and 2015 (single year-class stocking):

- <https://asc-portal.force.com/interpret/s/article/VR-22-Benthic-biodiversity-and-water-quality>
- <https://asc-portal.force.com/interpret/s/article/VR116-Salmon-V1-0-5-4-1>

BAP:

Standards: <https://www.bapcertification.org/Standards>

Currently certified farms: <https://www.bapcertification.org/Producers>

Links to NGO reports

Australian Marine Conservation Society (AMCS) rating for Tasmanian farmed salmon
<https://www.marineconservation.org.au/red-rating-for-tasmanian-farmed-atlantic-salmon-industry-pushing-environment-too-far-too-fast/>

SeaChoice reviews

<https://www.seachoice.org/wp-content/uploads/2018/10/ASC-Global-Review-AU-Regional-Summary.pdf>

<https://www.seachoice.org/wp-content/uploads/2018/10/SeaChoice-ASC-Salmon-Standard-Global-Review-Oct-15-Online.pdf>

<https://www.seachoice.org/meaningful-stakeholder-engagement-in-seafood-eco-certifications/>

Links to salmon producer's dashboards

Huon Aquaculture Group Ltd. <https://dashboard.huonaqua.com.au/>

Tassal: <https://dashboard.tassalgroup.com.au/>

9 ANNEX I LIST OF STAKEHOLDERS CONSULTED

	Stakeholder	Sector affiliation
1.	DPIPWE	Regulators
2.	EPA	Regulators
3.	IMAS	Science
4.	CSIRO	Science
5.	Cawthron Institute	Science
6.	Tassal	Industry
7.	Petuna	Industry
8.	TSGA	Industry
9.	TCT	ENGOS/Community
10.	ET	ENGOS/Community
11.	NOFF	ENGOS/Community
12.	TAMP	ENGOS/Community
13.	EDO	ENGOS/Community
14.	SeaChoice	ENGOS/Community
15.	Bio-inspecta Australia	Certification
16.	BAP/ASC auditor	Certification
17.	BAP/ASC auditor	Certification
18.	Anonymous	Certification
19.	Anonymous	Science
20.	Anonymous	Confidential

Tab 3. This table lists the stakeholders consulted for this review. The stakeholders are identified as organisations and companies, together with their sector affiliation. The names of individuals consulted remain confidential. Meetings included a visit to Macquarie Harbour as well as an on-site visit to one of the salmon farming sites.

10 ANNEX II SUMMARY SEQUENCE OF EVENTS IN MH

The following table includes some of the most relevant events and shall support the reader in understanding some of the sequence of events. However, this table is by no means complete and may contain some errors, and shall therefore be used with caution.

Reports (mainly scientific reviews of MH relating to DO, but also other evaluations), Regulator action (relating to DO/biomass restrictions), and Operational events reported to relate to DO situation in MH	Biomass cap for MH (MT)	timescale	ASC certified leases	BAP certified leases	GlobalG.A.P certified leases	Other leases
EPA monitoring water quality and copper levels across the harbour since 1993, spatial coverage and frequency of this monitoring program has reduced significantly over time		1987				1 st farming in MH
<u>Regulator action</u> Marine Farming Planning Act (Tas) 1995 Living Marine Resources Management Act (Tas) 1995 → associated marine farming lease conditions → management controls and license conditions Environment Protection and Biodiversity Conservation Act 1999 Marine Farming Development Plan 2005 Adaptive Management Framework (AMF) <u>Operational activities</u> Gradual increase in biomass 2010: Industry submits proposal for expansion to the Marine Farming Planning Review Panel for assessment						MF 219 (T) MF 214 (T) MF 266 (T) MF 217 (P) MF 133 (P) MF 215 (P) MF 213 (P) MF 216 (H) MF 220 (H) MF 267 (H)
<u>Reports</u> <u>Regulator action</u> <u>Operational activities</u> data collected through the industry monitoring program Production said to be around 9 MT		2011				
<u>Reports</u>	15,437	2012				

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<p>Submission of EIS addendum and appendices by industry for the application of increased biomass, based on DHI model.</p> <p>AMA, Area Management Agreement between the three salmon producers: health surveillance and biosecurity plan.</p> <p><u>Regulator action</u></p> <p>Approval of amendment No.1 to the Macquarie Harbour Marine Farming Development Plan October 2005</p> <p>➔ Approval for expansion to 29.5 MT (condition: cap at 15,437 MT until review in 2013)</p> <p>Notification of Referral Decision – Marine Farming Expansion:</p> <ul style="list-style-type: none"> - Conditions to ensure no significant impacts on the Maugean Skate as a result of changes to the benthic environment - Conditions to ensure no significant impacts on the Tasmanian Wilderness World Heritage Area and Maugean Skate as a result of water quality changes - Conditions to ensure no significant impacts on the Tasmanian Wilderness World Heritage Area as a result of changes to viewfields - Potential management measures: <ul style="list-style-type: none"> o Reduction in biomass o Reduction in nitrogen output o Redistribution of biomass <p><u>Reports on any major farming operation events</u></p> <p>-</p>						
<p><u>Reports</u></p> <p>-</p> <p><u>Regulator action</u></p> <p>Biomass cap at 15,437 MT lapsed</p> <p><u>Reports on any major farming operation events</u></p>	15,437	2013			MF 216 (H) MF 220 (H) MF 267 (H)	MF 219 (T) MF 214 (T) MF 266 (T) MF 217 (P) MF 133 (P) MF 215 (P) MF 213 (P)
<p><u>Reports</u></p>	15,437	2014	MF 219 (T) MF 214 (T)	(T) all sites in harbour?	MF 216 (H) MF 220 (H)	MF 266 (T) MF 217 (P)

<p>Industry report - Dissolved Oxygen Working Group:</p> <ul style="list-style-type: none"> - There is a clear downward trend in the dissolved oxygen (DO) levels of the deep-waters (> 15m) of Macquarie Harbour over the period 2009-present. - DO levels less than 2 mg/l are now very common below 20 m and occasionally come to within 12 m of the surface. - There have been a number of significant changes over the period from 2009-present. River flow was historically low between 2009-12 and historically high in 2013. This period also coincides with a major expansion of salmon aquaculture. <p>EPA Dissolved Oxygen and Salinity Data Summary:</p> <ul style="list-style-type: none"> - <u>5-10m</u>: The DO levels generally are within the long-term range. The variation in DO is however within the recorded range for maintaining ecosystem protection. - <u>20-25m</u>: The DO post 2010 however has declined considerably and is outside of the long-term range for MH. The DO has changed significantly in the middle to lower depths in MH and from the continuous DO monitoring at a site on the boundary of the WHA near Station 27, which would be representative of many other sites in MH, the DO at 25m has not returned to a normal range at levels at or less than 2mg/L or 15%sat DO over 2014 - <u>40-45m</u>: The DO post 2009 has declined and is outside of the long-term range for MH from 2012. <p>The DO has changed significantly in the middle to lower depths in MH and from the continuous DO monitoring at a site on the boundary of the WHA, the DO at 25m has not returned to a normal range at levels at or less than 2mg/L or 15% sat DO over 2014.</p> <p><u>Regulator action</u> Regulator informs that biomass cap at 15.5 MT has lapsed</p> <p><u>Reports on any major farming operation events</u> MH Dissolved Oxygen Working Group was established 'to look at the science behind the oxygen levels in Macquarie Harbour'. The Working Group comprises the industry (Huon Aquaculture, Tassal and Petuna), Hydro Tasmania, CSIRO, IMAS and DPIPWE</p>					<p>MF 267 (H)</p>	<p>MF 133 (P) MF 215 (P) MF 213 (P)</p>
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<p><u>Reports</u> Research - MH Environmental and Fish Health Monitoring Review (Cawthron Institute):</p> <ul style="list-style-type: none"> - Conclusion: <ul style="list-style-type: none"> o Steady production increase since 2012, accompanied by monitoring of benthic (seabed) health indicators, water quality parameters, and fish health status o Recent monitoring results have revealed changes in key indicators that appear to be inconsistent with anticipated environmental effects. o seabed video surveys show changes in benthic indicators that are symptomatic of increased organic enrichment o water quality monitoring indicates a harbour-wide decline in dissolved oxygen o apparent increases in surface (2m) concentrations of ammonium and nitrate o concerns that fish health status in MH is indicating a biological system under stress. - Recommendations: <ul style="list-style-type: none"> o Undertake a comprehensive synthesis of MH monitoring results and related data o Several recommendations around benthic monitoring: indicators, physico-chemical and water quality variables o Several recommendations around water quality monitoring: real-time data, pelagic processing of wastes and DO, new water tracers o Several recommendations around fish health monitoring: standardization of production parameters, <p>Regulator - DPIPWE response to Cawthron recommendations:</p> <ul style="list-style-type: none"> - This document outlines the DPIPWE's planned management response in relation to key recommendations of the Cawthron Report <p>MH Status report: Industry - MH Dissolved Oxygen Working Group, update report:</p> <p><u>Regulator action</u></p> <ul style="list-style-type: none"> - DPIPWE commissions Cawthron review to assess the data presented, and provide advice on the nature and adequacy of the 	20,150	2015	MF 219 (T) MF 214 (T) MF 266 (T)		MF 216 (H) MF 220 (H) MF 267 (H)	MF 266 (T) MF 217 (P) MF 133 (P) MF 215 (P) MF 213 (P)
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<p>monitoring and future research associated with benthic and water quality monitoring and fish health performance.</p> <p>- Biomass cap increased to 20,150 MT</p> <p><u>Reports on any major farming operation events</u> Around 85,000 Fish kill said to be due to low DO Production said to be around <u>20,000 MT</u></p>						
<p><u>Reports</u> MH Status report update & addendum</p> <p><u>Regulator action</u> Biomass cap increased to <u>21,500 MT</u> the EPA takes over as regulator of salmon farming operations from DPIPWE on July 1, 2016</p> <p><u>Reports on any major farming operation events</u> -</p>	21,500	2016	MF 219 (T) MF 214 (T) MF 266 (T) MF 217 (P) MF 133 (P) MF 215 (P) MF 213 (P)	(P) couple first certifications?	MF 216 (H) MF 220 (H) MF 267 (H)	MF 213 (P)?
<p><u>Reports</u> IMAS report: Environmental Research in Macquarie Harbour Interim Synopsis of Benthic and Water Column Conditions</p> <p><u>Regulator action</u> IMAS research commissioned? Biomass cap for MH lowered to 14,000 MT for Feb-April 2017 Biomass cap for MH lowered to 12,000 MT for next year</p> <p><u>Reports on any major farming operation events</u> Tassal has requested approval to grow their 2016 year class fish through to market size, resulting in around 4,000 tonnes of additional salmon being in the Harbour in January 2018. Mr Ford directed Tassal to destock the lease in November 2016, and this was completed by April 2017. Tassal: waste capture system</p>	14,000 12,000	2017	MF 219 (T) MF 214 (T) MF 266 (T) MF 217 (P)* MF 133 (P)* MF 215 (P)* MF 213 (P)*	(P) All except new sites?	MF 216 (H) MF 220 (H) MF 267 (H)	
<p><u>Reports</u></p> <p><u>Regulator action</u></p>	9,500	2018	MF 219 (T)* MF 214 (T)* (P)?	MF 217 (P) MF 133 (P) MF 215 (P)	MF 216 (H) MF 220 (H) MF 267 (H)	

Review of Eco-Standards for Salmon Farming in Macquarie Harbour

<p>Biomass cap for MH lowered to 9,500 MT for next two years</p> <p><u>Reports on any major farming operation events</u> Around 1.35 million farmed fish died over the 2017/18 summer in Macquarie Harbour from disease exacerbated by environmental stress including low oxygen levels in the harbour. Joint Venture (Tassal and Petuna) reporting that this will allow increased flexibility in terms of improved separation of salmonid year classes and longer lease following periods. Major fish escapes have also occurred in 2018 following storm events.</p>				MF 213 (P)		
<p><u>Reports</u></p> <p><u>Regulator action</u> Biomass cap for MH remains at 9,500 MT</p> <p><u>Reports on any major farming operation events</u> Not sure when: industry initiative to destock some leases to allow for fallowing, and a JV to allow for single year classes per lease. Production said to be around 9,000 MT</p>	9,500	2019		MF 217 (P) MF 133 (P) MF 215 (P) MF 213 (P) MF 219 (T) MF 214 (T)	MF 216 (H) MF 220 (H) MF 267 (H)	MF 266 (T/P?)
<p><u>Regulator action</u> Biomass cap for MH remains at 9.5 MT for next 2years Producer specific caps valid issued to Join Venture (Tassal & Petuna) and Huon:</p> <ul style="list-style-type: none"> - 15 kg/m3 - weekly notification of biomass calculation and projection once biomass comes close to cap per hectare 	9,500	2020		MF 217 (P) MF 133 (P) MF 215 (P) MF 213 (P) MF 219 (T) MF 214 (T)	MF 216 (H) MF 220 (H) MF 267 (H)	

11 ANNEX III ADDITIONAL POINTS FOR FURTHER REVIEW

1) *The intention and rationale for DO monitoring*

The rationale given in the standard emphasises how critical DO is for the survival and good performance of farmed fish: *One component of water quality, dissolved oxygen (DO), is particularly critical for the survival and good performance of farmed salmon.... Salmon ideally need a level of dissolved oxygen over 5 mg/L to avoid any possible stress, although they are able to live under lower oxygen concentrations, particularly if only for short periods.* However, footnote 18⁵ allows for an exception when farms can demonstrate consistency with a reference site in the same water body. The rationale for this exception is as follows according to the ASC standard: *This will ensure that if the percent saturation is lower than ideal, it is the result of natural conditions in the water body and not due to nutrient release from the salmon farm.* This insinuates that the primary intention of this indicator relates to adverse impact on the environment rather than welfare and health of the farmed stock. In addition, ASC 2.2.1 and 2.2.2. are embedded in principle 2, which intends to *address potential impacts from salmon farms on natural habitat, local biodiversity and ecosystem function.*

If these indicators intend to safeguard against negative impact on the environment, then it is not clear why the DO monitoring is limited to a depth of 5m below the surface instead of monitoring throughout the water column or, monitoring according to the specifics of the water body (see chapters 5.4 and 5.5), e.g., at 1/5/15/25/35m in MH. Continuous real-time DO monitoring at several depths in the water column has become common practice in salmon farming and could be feasible to include as a requirement.

If these indicators intend to safeguard the welfare of the farmed fish, then 1) the role and potential implications of DO levels at reference sites within the same water body should be reviewed and, presumably 2) the behaviour of caged salmon and monitoring at additional levels above the current 5m should be reviewed.

It is clear that the standard is attempting to triangulate the complexity of metric requirements, minimal thresholds for compliance, some flexibility for one-off failed monitoring results, and allowing for particular local conditions. Nevertheless, increasing the clarity of the intention or intended outcome of these requirements would improve the correct determination of NCs and approvals of corrective action plans by auditors.

2) *Variance Request process*

VR 22 was approved by ASC in order to take into account local conditions. This meant that producers could deviate from indicators 2.1.1, 2.1.2, and 2.1.3, as well as 2.2.3 and 2.2.4 and follow existing regulatory requirements. The approval process, however, did not seem to include input from the research entities involved in research on MH and the specifics of the local conditions, nor the authorities

⁵ Although footnote 18 refers to 2.2.1 and not to 2.2.2, the rationale for and applicability of these two indicators seems linked.

setting the regulatory requirements, nor stakeholders on the enforcement of regulatory requirements (for reliance on government regulation, see also 5.3). On the one hand, having a process to take into account local conditions and provide a certain level of flexibility is important for voluntary standards, on the other hand, exceptions should be equally robust as the original indicators in the standard. How technical VRs could be approved to capture local conditions, or in situations where there are unknowns, is discussed in chapter 5.2.

The monitoring results, based on methods imposed/agreed by the VR were evaluated during surveillance audits, but the appropriateness/effectiveness of the VR itself was not. It should be reviewed if the monitoring of VRs as part of the auditing and certification process, especially where conditions are set by ASC as part of the approval, is adequate. Similarly, the appropriateness/effectiveness of approved VRs should be monitored and evaluated; where VRs have not been shown to be effective, approved VRs could be reversed and where VRs have proven to be effective, the exception could be included as part of the next ASC standard update.

VR 116 too, was approved mainly on the grounds of taking into account local conditions and the difference to the Northern hemisphere. As for VR 22, this review indicates that the process for the VR approval was not adequately based on scientific knowledge and stakeholder input, and the variance request was driven primarily by economic pressure. It was widely acknowledged at the time that separation of year classes in salmon production is necessary to avoid the proliferation of disease and parasites, whether these have already become established in an area or not.

The VR process has since changed and is briefly described in Annex IV.

12 ANNEX IV VARIANCE REQUESTS

VR 22

With VR 22 an exemption from the ASC Standard's monitoring requirements for benthic health and water quality was requested, resulting in the farm continuing to follow and report on their current monitoring program instead. The rationale as explained in the VR application was that alternative monitoring systems were already in place, as required by local regulations, and the monitoring required by ASC would be less applicable to the local environmental conditions.

For sediment monitoring (2.1.1) the proposed method was to require visual monitoring rather than chemical sampling of redox potential or sulphide levels. The VR application stated that historical data shows no leases have exceeded the metric limits set by ASC and therefore they wished to continue their current monitoring programme, based on visual surveys.

Regarding benthic diversity (2.1.2 and 2.1.3), the VR application stated that Macquarie Harbour is a naturally depauperate environment and that the faunal indices required by the ASC Standard may give misleading scores. They proposed to analyse and report benthic biodiversity using methods allowed under the current regulatory processes (Bray-Curtis Similarity Index and multidimensional scaling (MDS)), rather than those usually required by the ASC Standard.

For water quality (2.2.3 and 2.2.4), the VR requested that the current government-mandated classification system, requiring monthly water monitoring with set trigger levels, be compared to the EU water Quality Framework Directive. The VR application stated that although there is no trigger level

set for phosphorus in the current methodology, this is not considered a limiting nutrient and therefore need not be included in the monitoring programme.

The VR was accepted. The ASC decision referred to guidance in the Standard that “some degree of flexibility with regard to sampling location and methodology shall be considered acceptable during audits as long as the basic rigour of the standard isn’t jeopardised”.

The VR was implemented and was also applied during audits at other farm sites, resulting in all farm sites in Macquarie Harbour using the alternative visual survey monitoring methods. During subsequent surveillance audits, the visual survey results showed evidence of benthic impacts, which resulted in non-conformities and ultimately the loss of certification.

VR 116

With VR 116 an exemption to the requirement for all salmon on a site to be from a single year class was requested. The rationale for the request was that the requirements for fallowing and single year class stocking in the ASC Standard are more relevant for northern hemisphere farms to control endemic disease, especially sea lice. The farm had staff responsible for fish health, an internal disease management and biosecurity protocol and a fish health management plan in place. The VR application stated that these measures would facilitate a coordinated, well-informed and timely response to biosecurity risks. In the VR application it was stated that when two year-classes are stocked on a single farming lease, they are kept at a distance of 200-300m from each other. The application also states that the State of Tasmania has implemented biosecurity zones, but it is not explained how these zones are managed.

The VR was approved. In the ASC Interpretation text, ASC stated that the internal procedures of the farm, with support of state government agencies, satisfies the aim and intent of the ASC Standard, which is to ensure that farms do not harm the health of wild populations by amplifying or spreading disease. ASC also stated that due to differing environmental conditions, a different protocol may have to be used in the Southern Hemisphere to achieve the aim of the Standard.

ASC VR process

The ASC has developed a new procedure for VRs, which becomes effective in December 2020. VRs are now published, along with any supporting evidence, on the ASC website as soon as they are submitted. Registered stakeholders are notified and given the opportunity to submit feedback before the VR is considered by a technical committee. Any VR decisions relating to; adaptation of a required metric, deferring to legal requirements rather than adhering to the standard, or where stakeholder feedback or other information suggests it is necessary, will require a ‘targeted technical consultation’, including consultation with stakeholders, before the VR is approved.

In addition, stakeholders can now submit comments on a VR to ASC at any time, and if deemed appropriate, ASC may decide to reconsider a VR on the basis of comments received.

13 ANNEX V STEPS FROM SPATIAL PLANNING TO FIRST FARMING AND IMPLICATIONS OF AN “ENHANCED EIA”

Part I Theoretical Steps from spatial planning to first farming

Scoping and Zoning

National and/or regional legislation provide the basis for Environmental Quality Objectives (EQOs), reflecting the country or jurisdiction’s own acceptable levels of impact.

As a first step of spatial planning, scoping includes the collection of baseline information to identify general issues and opportunities including, potential culture species and farming systems, the identification of stakeholders for consultation, and a review of applicable local law and regulation (Figure 8). Taking into account parameters such as EQOs and economic development goals, regulators define zones where aquaculture production will be allowed or encouraged (AZA, Allocated Zone for Aquaculture). Such zones are assessed for their biophysical (and socio-economical) suitability for aquaculture; this typically includes an evaluation of issues and risks, broad carrying capacity estimations and biosecurity strategies for the zone. Only within such zones can aquaculture sites be established.

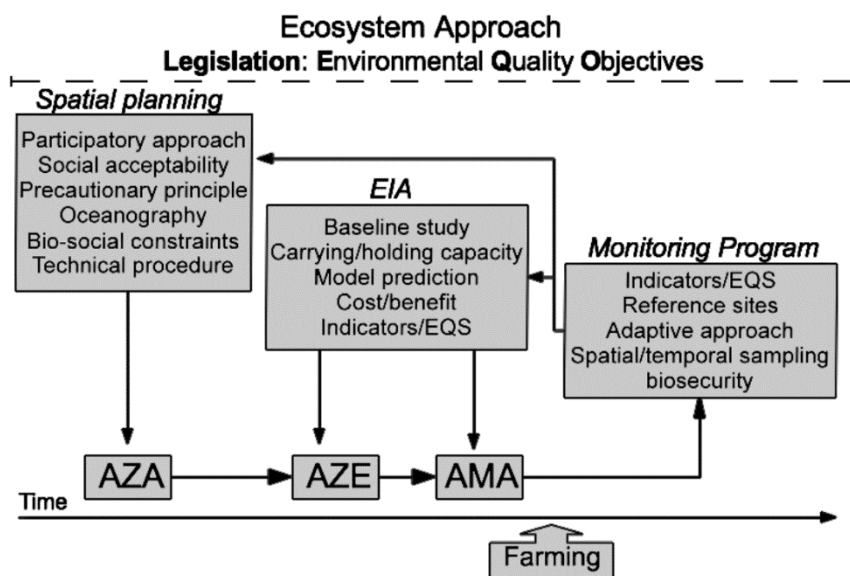


Figure 8. From Sanchez-Jerez et. al. (2016). The sequence of steps and feedback mechanism from defining an Allocated Zone for Aquaculture (AZA), implementing an Environmental Impact Assessment (EIA), determining the Allowable Zone of Effect (AZE) and developing an Aquaculture Management Area (AMA) including monitoring programs.

Site selection

To identify the most appropriate sites within a defined AZA, an environmental impact assessment (EIA) must be carried out. This will include a detailed review of local conditions and baseline monitoring data as well as an analysis of historical data to evaluate risks such as storms or drought events. The EIA will

determine the carrying capacity of individual sites and the wider area, predict potential impacts from aquaculture activities and specify measures to be taken to prevent or mitigate impacts, as well as suggest an Allowable Zone of Effect (AZE). The outcome of this assessment, in particular the estimation of carrying capacity, is then used to set a limit for maximum production within a defined Aquaculture Management Area (AMA). This includes recommendations on production systems, production intensity and other relevant production parameters, as well as selecting the choice of environmental indicators for a monitoring program within the AMA.

Aquaculture Management Areas

Each farming site is embedded within an aquaculture management area. This means an AMA may include several farms owned by different companies, and in some instances a representative from each company will form the AMA management entity. Once an AMA has been established with a clear management boundary and entity, the management entity is responsible for setting and implementing management goals and objectives, and for developing common practices, focusing on measures which cannot be managed at the individual farm level (e.g., coordination of treatments, combined bay-wide monitoring efforts). All of this is laid out in a management plan for the AMA.

AMA Management Plans

The management plan is based on the directions given in the EIA. The plan reflects the limit for maximum production based on the estimated carrying capacity within the AMA. It includes components such as environmental and disease management and controls based on defined environmental indicators, an appropriate monitoring program and indicator thresholds.

To ensure compliance of individual farms sites, that the forecasts made in the EIA remain valid and that no unexpected impacts are occurring, the management entity of the AMA implements and ensures the ongoing evaluation of monitoring data for risk parameters as defined in the EIA. The plan defines and ensures specific measures to be taken immediately if indicator thresholds are breached, in order to either prevent, mitigate, or remedy an impact, depending on the type of indicators and the different thresholds defined. The management entity ensures monitoring data is reported in real-time and that results of monitoring surveys are shared regularly with stakeholders, including authorities and research partners.

In addition to monitoring and evaluating parameters according to the existing management plan, it is key to regularly monitor and evaluate the effectiveness of the management plan itself, and to review and adjust the plan. For example, the management plan should be reviewed if indicator thresholds are breached or if the EIA is updated to reflect changes in production. It is essential that all farms within a designated AMA cooperate and follow the management plan.

The management entity will need to ensure sufficient investment in research is available in order to close any knowledge gaps within a meaningful timeframe, protect against any erroneous assumptions and allow for future unknowns.

Where baseline data are not sufficient or are inconclusive, leading to a low confidence level in the forecasted impacts, a conservative approach (e.g., precautionary principle) will need to be integrated

into the estimated carrying capacity (i.e., maximum production limits), the design of the monitoring program, indicator thresholds, and management responses. For such environments, it may even make sense to determine additional warning thresholds below the defined trigger levels for set indicators, which when reached would signal a risk that limits could be breached. This conservative approach, combined with effective monitoring, management responses and research, will allow iterative adjustments over time, as more data becomes available and the level of confidence in forecasted impacts increases. This can also include adjustments due to advances in technology.

Finally, farming ideally commences once management plans for the AMA have been signed off (Figure 1). However, it is not uncommon that aquaculture has already become established without all of the steps outlined above are in place. Although there are examples of relocating farms (e.g., Chile), it is typically not feasible to relocate farms after the industry has become established and in such situations the focus will need to be on defining AMAs and adapting management plans in order to meet the carrying capacity and acceptable levels of impact within the AMA.

Aquaculture licenses or permits

Licenses or permits are issued by local regulators for individual companies, often for each individual site, and are likely to reflect some of the outcomes of the EIA and parameters of the AMA management plan, identifying species, maximum permitted annual production or peak biomass, culture method, and requirements for regular environmental surveys and other monitoring. In order to establish a functioning system, regulators enforce penalties or other measures for infringing a condition of a license or permit.

Part II Potential implications of an enhanced EIA

As described in the main body of the report, some elements to ensure effectiveness do not seem to have been implemented/enforced in MH, of which several would have been picked up by a voluntary standard's process requirements for an enhanced EIA. Some examples, where voluntary standards could ensure effectiveness in similar situations in the future, are listed here:

- Water quality triggers: the regulatory limit levels (triggers) for water quality parameters were only said to be valid if the impact could be attributed to the marine farming operation. As far as the reviewers are aware, there was no mechanism in place to clarify attribution at the time. In the "Macquarie Harbour Environmental and Fish Health Monitoring Review" it is stated: While correlative evidence is strong, definitive attribution based on a mechanistic understanding of processes is not presently possible (Cawthron, 2015).
Comment: this situation would have triggered a review of the AMA, as no management responses were linked to the monitoring recommendations by the EIA any more.
- Environmental trigger levels: The EIS for Macquarie Harbour that was submitted in 2011 and updated in 2012 for the first expansion from 9MT to just over 15 MT did not identify trigger levels for environmental parameters, instead recommending that a 12-month monitoring

program be completed, and the results analysed to inform the setting of appropriate trigger levels.

Comment: no trigger levels can mean no management response. An enhanced EIA will set triggers according to existing scientific understanding and the AMA management plan will ensure action is taken. Where there is missing data or a low confidence level, an EIA would determine the AMA as a risky system requiring a more extensive monitoring program, more frequent analysis of the monitoring outcome, accompanied by a scientific review, and precautionary trigger levels.

- AZE: The allowable zone of effect was regulated by compliance sites, defined as located 35m outside of lease areas. A Lease area, No. 133 in MH for example, had a size of 120 hectares, the same is true for No. 266.

Comment: This is an unusually large area even for well-flushed sites. Compliance zones more typically start at 35m from the edge of the cage or edge of the array of cages rather than from the edge of the entire lease area. It is expected that in an enhanced EIA with area approach, such relation between lease area and harbour area would have led to smaller AZEs or to increased monitoring and target levels, based on the risk system/unknowns during the expansion.

- Determination of sustainable carrying capacity: The determination of the increase from 9 MT to just over 15 MT in the first expansion in 2012 (see also Annex 10) was based on the sustainable carrying capacity determined using the DHI model. It is true that the use of a model followed scientific advice and the biomass cap for the first expansion started off at a one could say "precautionary" 52.5% of the modelled sustainable biomass. It is also true that it was not known at the time that the model would prove inadequate for MH. Nevertheless, the increase of >60% was immediate and non-staged. In addition, the science behind the increase from just over 15 MT to just over 20 MT in the second expansion in 2015 was apparently not based on the model and remains unclear.

Comment: An "enhanced EIA" most likely would have determined MH as a risky system and consequently prescribed a more precautionary, step-by-step increase of biomass while monitoring and correlating any cause-effects from changes in aquaculture farming and requiring immediate adjustments based on pre-defined triggers. It was also noted during the review that while investment into scientific advice was initiated, the scientific community was asked very specific questions which did not support a complete scientific assessment of the events in MH and corresponding recommendations. For this reason, a list of question/blueprint developed by the scientific community to inform the process and content of an enhanced EIA is recommended in chapter 5.2.

- Effectiveness of the AMA management entity: Auditor comments in initial ASC audit reports suggested the coordinated efforts for monitoring and health were working well, but the relationship between the parties later broke down, resulting in an ineffective AMA (see also chapter 5.4).

Comment: On determination that the AMA has become ineffective, action could have been required; all three companies operating in MH are certified against GSSI recognized certification schemes, a benchmarking program based on FAO ecolabelling and technical guidelines; this is a valuable base to ensure management plans continue to be enforced within the AMA for those risk parameters determined necessary in the EIA.

- EIA Effectiveness: Comments from publicly available ASC audit reports show that the EIA reports for Macquarie Harbour were evaluated by auditors during ASC audits. Although the EIA was initially accepted as complying with all requirements in the standard, by 2017 auditors noted concerns about the effectiveness of the EIA and its recommendations for monitoring. For example, the following comments are from three separate audit reports, for different farm sites:

"The Client has a Biodiversity-focused impact assessment in place and current/future programs underway to minimise impacts, however, the non-conformities identified in 2.1.1 and 2.2.1 suggest that particular aspects of the strategy are functionally insufficient to deliver an absence of impact".

"ongoing water quality monitoring ... has shown a decrease in mid to bottom water dissolved oxygen levels, ... As no bottom water DO concentration targets have been set either by ASC or the Tasmanian Government, no compliance conditions have been breached. The effects of low DO on benthic ecology of MH, including TWWHA, and the endangered Maugean skate are currently being investigated in IMAS research projects."

"The effectiveness of the EIS is under question in light of observed impacts, as are the implementation of mitigation plans, in regards to how they translate into minimising or eliminating environmental impacts".

It is clear from the above comments, and from others not quoted here, that the auditors had concerns regarding implementation, or the ongoing validity and effectiveness of the strategies recommended by the EIA to minimise environmental impacts.

Comment: process requirements for an "enhanced EIA" would have allowed auditors to raise more specific NCs, triggering a review of the impact assessment and corresponding management responses, as soon as monitored impact was no longer in line with forecasted impact.

- Common management practices: Although this example is only relates to one of a number of beneficial management practices in an AMA, it is noticeable that there was no mention of regulatory requirements for "fallowing" and "the use of single year classes" during the two expansion in 2012 and 2015. This, despite the experience of the near collapse of the entire salmon industry in Chile in 2007/8/9 due to the recirculation of disease, and subsequent introduction of new regulation to prevent the same from happening again. In

Chile, this included establishing Aquaculture Management Areas with common measures amongst others for better spacing out farms, as well as requirements on coordinated fallowing and the use of single year classes, in order to break disease and parasite cycles, allow sediments and water quality to partially recover, and understand the recovery rate of the environment.

Comment: only in areas with a long-term in depth understanding of the ecosystem, including cause-effects from aquaculture, would the EIA be able to provide a substantiated case to move away from measures such as "fallowing" and "using single year classes" to prevent from future disease and break existing cycles of disease. New or risky areas would not fall into this category. It is highly unlikely that an enhanced EIA would have concluded that such preventive management measures are not needed during an expansion of production.

- DO monitoring location: monitoring for the limit levels (triggers) for oxygen were required at a depth of two meters, a useful indicator for production fish but less of an indication for water quality of the ecosystem relevant to the *Tasmanian Wilderness World Heritage Area and on the Maugean Skate*. The rationale for the regulatory conditions was the following: "to avoid significant impact on *Tasmanian Wilderness World Heritage Area and on the Maugean Skate*". At the time of the first expansion, there was knowledge of the risk of low values of DO especially in deeper waters. Figure 10 includes data at one EPA site for the >10 years prior, where levels at 5-15m indicate a history of troughs below 70% DO saturation which can pose a risk for salmon farming, and levels at > 15m indicate values ranging 40-60% DO saturation. In 2012 at the time of the first big expansion, values had dropped to 20-50% DO saturation, and by 2014, one year prior to the second big expansion in 2015, values had dropped to 5-40% DO saturation at levels at >15m, the area assumed to be most relevant for the endangered *Maugean Skate*.

Comment: an EIA will set triggers according to existing scientific understanding and the AMA management plan will ensure action is taken. Where there is missing data or a low confidence level, an EIA would determine the AMA as a risky system requiring a more extensive monitoring program, more frequent analysis of the monitoring outcome, accompanied by a scientific review, and precautionary trigger levels.

An "enhanced EIA" will automatically trigger a review of the impact assessment and corresponding management responses, as soon as monitored impact is not in line with forecasted impact.

- DO monitoring frequency: The conditions for expansion required monthly oxygen monitoring.

Comment: this frequency seems unusually low considering the imminent big expansion of production and the existing concerns around DO, as well as concerns raised around the new model employed to estimate the sustainable carrying capacity in MH. In other salmon producing jurisdictions, at least for near-field monitoring, daily DO monitoring with hand-held devices was already common at the time, replaced by continuous real-time DO monitoring by in-situ sensors throughout a large part of the water column some years later.

In areas with long-term in depth understanding of the system and cause-effects from aquaculture, would the EIA be able to provide a substantiated case to move away from measures such as daily DO monitoring. New or risk areas would not fall into this category.

- Adaptive management: The reviewers did not come across “compliance reports”, “response reports”, or other reporting on frequent analysis of monitoring data, subsequent determination of compliance, nor initiation of targeted management measures. Audit reports do, however, refer to an annual compliance survey report⁶, but it cannot transparently be assessed if determinations issued by regulators were enforced or not.
Comment: voluntary standards are in a good position to require compliance with regulatory requirements, and this would especially be of value in risky systems or where adaptive management is part of the management strategy, both of which require a higher level of monitoring, response to monitoring outcomes and mechanism of sanction if e.g., trigger levels are breached or required management responses are not put into practice.

The examples above are clearly selective and do not give an overview of all processes and management in place at the time of the two expansions. It is probable that industry had additional management in place, such as their own DO monitoring for example, in addition to regulatory requirements; however, these examples do indicate where requirements for an “enhanced EIA” by voluntary standards would have supported management effectiveness and could have prevented some of the negative outcome for the environment, aquaculture industry and other stakeholders.

14 ANNEX VI INFORMATION AND CHARTS ON LEASES IN MH

⁶ “Annual Compliance Survey Report February 2015 identified video surveys of the seabed at or near compliance points which showed significant visual impacts as defined in the Licence conditions of bacterial mats and numerous opportunistic polychaetes. The regulators determined that ... must follow 4 pens closest to the non-compliance sites and to conduct video assessment at 4 monthly intervals until further notice.”

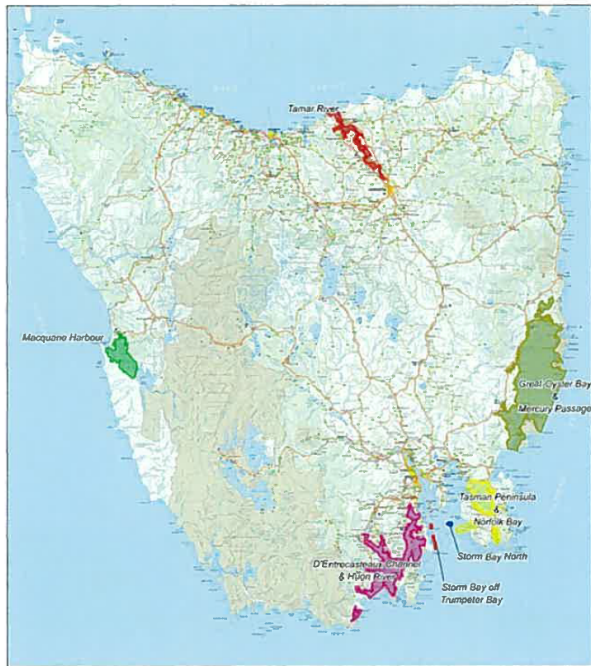


Figure 9. Marine farming development plan areas in Tasmania. Copied from DPIPWE.

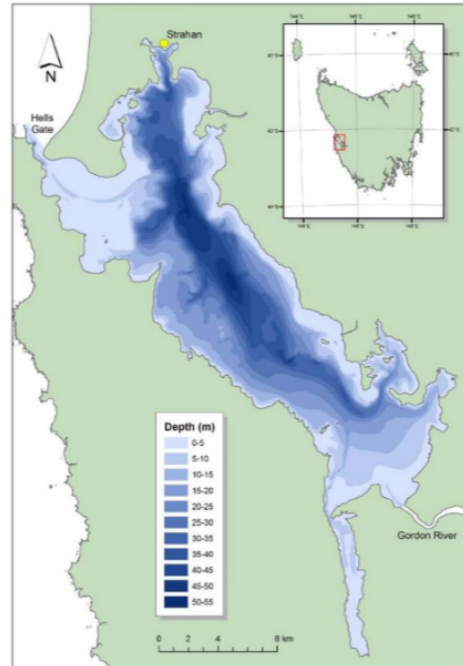


Figure 10. Macquarie Harbour location and bathymetry. Copied from DPIPWE.

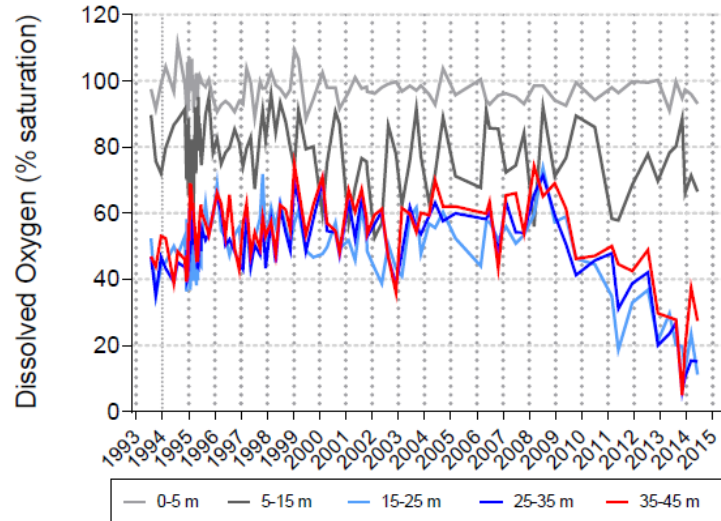


Figure 11. MHDOWG 2014. Long-term trend in dissolved oxygen within a number of depth ranges at EPA site 12.

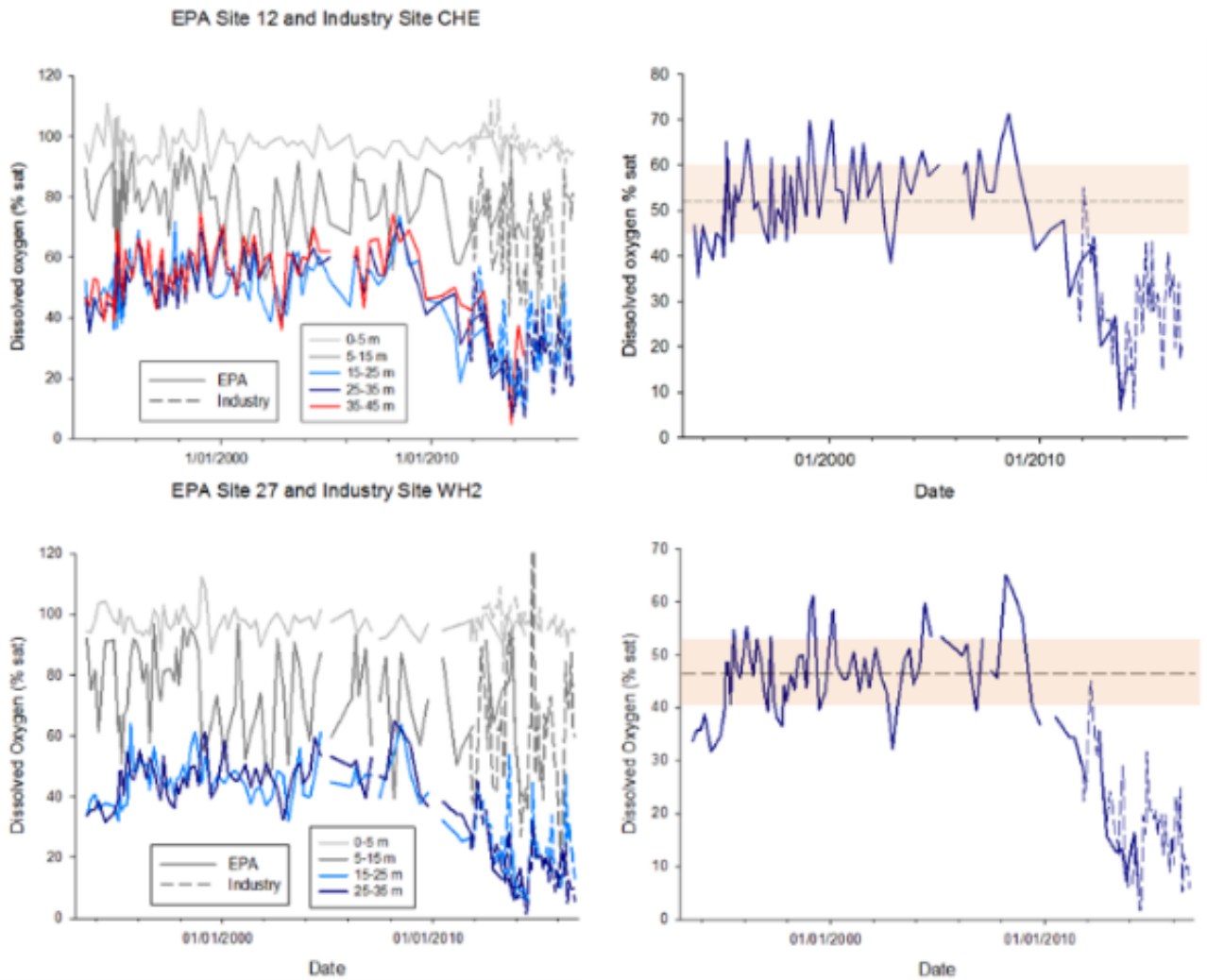


Figure 12. Ross J & MacLeod C. 2017. DO (% saturation) level from two long term EPA monitoring sites, 12 and 27. Industry data for the past 5 years from sites closest to the EPA are also shown for comparison. These sites/data have been shown to be comparable in previous studies (MHDOWG 2014). The plots on the left show the data at different depths whilst those on the right are only for 25-35m, and show the median (dashed line) and the 20th and 80th percentiles (shaded area), calculated from data collected between 1993-2009.

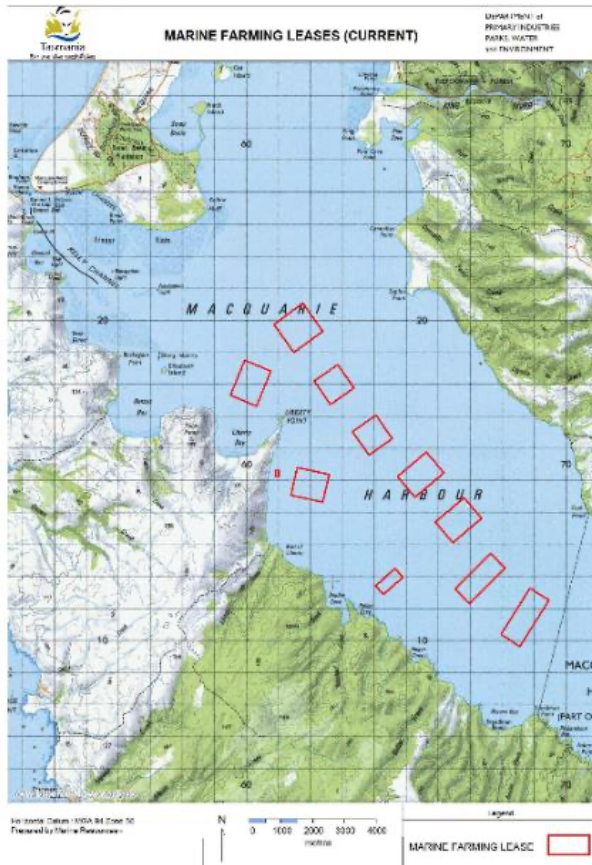


Figure 13. Location of Macquarie Harbour farming leases. Copied from DPIPWE, 2015.



Figure 14. Location of Tasmanian wilderness world heritage area relative to Macquarie Harbour. Copied from DPIPWE, 2015.



Figure 15. Location of Macquarie Harbour farming leases. Copied from DPIPWE, 2015.

Premises Name	Company Name (operated by)	Environmental Licence	Farming Lease
NORTH LIBERTY POINT ('TABLE HEAD CENTRAL')	PETUNA AQUACULTURE PTY LTD	9888/2	133
TABLE HEAD	PETUNA AQUACULTURE PTY LTD	9891/2	215
LIBERTY POINT	TASSAL OPERATIONS PTY LTD	9893/2	214 & 219
NORTH EAST DOUBLE COVE	HUON AQUACULTURE COMPANY PTY LTD	9895/2	220
LIBERTY POINT	PETUNA AQUACULTURE PTY LTD	9892/2	217
EAST OF BUTT OF LIBERTY	HUON AQUACULTURE COMPANY PTY LTD	9896/2	267
NORTH EAST OF HOGAN COVE 'BRYANS BAY'	PETUNA AQUACULTURE PTY LTD	9890/2	213
NORTH EAST PELIAS COVE	HUON AQUACULTURE COMPANY PTY LTD	9894/2	216
NORTH EAST OF BRYANS BAY/ 'FRANKLIN'	PETUNA AQUACULTURE PTY LTD	9912/2	266

Table 5. Leases listed from North to South. Source: <https://maps.thelist.tas.gov.au/listmap/app/list/map>