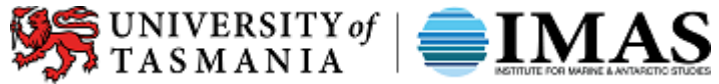


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Dear Sir/Madam,

Thank you for this opportunity to provide comments on the inquiry into the status of the Australian aquaculture sector, the opportunities and barriers to expansion, including ways to streamline and increase the effectiveness of current regulatory frameworks, as well as the ability of business to access and commercialise new innovations.

IMAS is a world leading research organisation, ranked in the top 10 universities globally for fisheries science. This research is strongly underpinned by the Sustainable Marine Research Collaboration Agreement between the Tasmanian Government and the University of Tasmania. This supports the effective and sustainable management of Tasmania's living marine resources. Aquaculture is the fastest growing animal food-production sector worldwide and in Australia much of this growth is in Tasmania. IMAS is a leader in aquaculture research, education and training across many areas relevant to this inquiry.

Our research activities focus on improving performance and yield, understanding population biology, and improving production methods and increasing efficiency for a wide range of aquaculture species, including Atlantic salmon, rock lobster, oysters, and seaweed. IMAS is well known for the development of new aquaculture, both species and technology. We provide significant expertise on the environmental and social interactions of aquaculture, animal health, biosecurity, and welfare. IMAS has a strong track record of providing science-based advice on the efficient management, regulation, and governance of aquaculture in Tasmania and around the world. Our aquaculture education and training includes pre-degree, undergraduate and postgraduate courses and IMAS works closely with industry and other providers to provide the expertise and specialty research across the multiple pathways that are needed to support the growth of the aquaculture industry.

The following comments against Terms of Reference a), b) and c) are submitted by staff from the Institute for Marine and Antarctic Studies (IMAS), University of Tasmania.

Terms of Reference

- a) the nature and current status of Australia's aquaculture sector;
- b) opportunities and barriers to the expansion of the aquaculture sector:
 - i) including ability to access capital and investment;
- c) opportunities to streamline and increase the effectiveness of the current regulatory frameworks that govern aquaculture activities in Australia; and
- d) the ability for businesses to access and commercialise new innovations to expand aquaculture.

Yours faithfully

Gregory Smith, Jeff Ross, Louise Adams, Chris Carter, Caleb Gardner, Karen Alexander, Maree Fudge, Myriam Lacharite, Emily Ogier.

a) The nature and the current status of the Australian aquaculture sector

Key points:

- Aquaculture expansion is expected to slow in coming years
- Established aquaculture enterprises require suitable conditions to expand
- New aquaculture industries are poised for development
- Future expansion will rely on site selection and research engagement

Scope and impediments

Aquaculture production is the farming of aquatic organisms, including fish, crustaceans, molluscs and aquatic plants for consumption. The expansion of aquaculture globally continues at a steady pace with >120 million Tonnes of production in 2019 valued at 274 billion USD (FAO 2021), equating to a global increase in production of 200%, and a value increase of 370% over the past 15 years. Aquaculture expansion in Australia mirrors the global trend with an increase of 223% in production over the same period to 98 000 Tonnes representing a value increase of 189% to \$1.06 Billion USD (ABARE, 2021a). However, the period from 2019/20 and projections out to 2025 flag a considerable slowdown in aquaculture expansion in Australia (ABARE, 2021b). A reduction in new capacity is likely to significantly impact upon the future growth and prosperity in this sector. This is particularly pertinent for Australia with the focus on high value aquaculture products, where Australian aquaculture products are valued at \$10 904 USD per Tonne compared to a global average of \$2 283 USD.

The Australian aquaculture sector is primed for expansion across several key sectors if legislature, financing, and commercialisation conditions are favorable. One of the big expansion opportunities will be in the salmon industry with sustainable growth providing opportunities for the establishment of a \$2 Billion AUD industry by 2030 (DPIPWE, 2018). Prawn farming is also poised for significant expansion in production capacity with Project Sea Dragon in the North West of Australia in the final planning phase of a 130 000 – 180 000 Tonne capacity prawn production project (ICN Gateway, 2021). This project will locate facilities across several nodes across the Northern Territory and Western Australia. Further expansion in the prawn industry is also planned for Queensland with Tassal, a major Salmon company, investing heavily in expanding existing facilities to lift current Australian production 4-fold (ABC Rural, 2019).

There are also several new and emerging industries that have the potential to be established and experience significant growth over the next five years, these include seaweed culture, with projections of \$100 million (GVP) across several Southern Australian sites and lobster farming projections of \$500 million in the next 10 years in Northern Australia (ABC Rural, 2020).

So, while there are opportunities for expansion and indeed the establishment of new aquaculture industries, there will be several impediments to them flourishing. These will include the availability of suitable aquaculture sites for expansion. Site suitability is often with associated infrastructure (roads, electricity, water, internet), remoteness (proximity to

population hubs), appropriate skilled labor to drive expansion, suitable transport and freight logistics, compliance/navigation of environmental and government regulatory framework and obtaining and maintaining a social license to operate (SLO). Aquaculture commercial growth is linked to several TOR associated with this enquiry. From a research perspective, the Institute for Marine and Antarctic Studies is heavily involved in the delivery of high-quality research to this sector, the willingness or indeed ability to engage in commercial research is tempered by the vitality and ability of the sector to grow. If a sector is profitable and in a sustainable expansion phase, they are far more likely to participate and contribute to research that will provide benefit the aquaculture industry and the wider communities that they support.

b) The opportunities and barriers to the expansion of the aquaculture sector

Key points:

- Social license will be key for the sustainable expansion of aquaculture
- The lack of skilled staff is an impediment to aquaculture expansion
- Regional universities are best placed to provide relevant job ready training
- Pathways into aquaculture training will be key to future industry expansion
- IMAS is in the middle of a large investment to expand our aquaculture training facilities and courses. This aims to drive sustainable expansion of the Australian industry. Teaching will be consolidated in Hobart, adjacent to Australia's largest aquaculture production areas.
- IMAS is working to fill specialist expertise gaps, including aquatic animal health, epidemiology and pathogen identification.

Social license to operate (SLO)

In order to secure the future of Australian aquaculture, it is increasingly clear that, alongside effective and responsible production, building and maintaining community support is vital. Worldwide, there have been several examples of where aquaculture has been threatened as a result of a lack of societal acceptability. In Australia, a recent example of this has been the environmental non-governmental organisations (eNGOs) campaigns against proposed fish farm operations in Okehampton Bay on Tasmania's east coast.

The need for a SLO is regarded as a risk to the ongoing operations of the aquaculture industry and is likely to be the key barrier to future expansion. An SLO is a form of soft license, relating to the ongoing acceptance by stakeholders and the public of an aquaculture companies' activities, the loss of which is evident through protesting of development or expansion. In Australia, the public is increasingly questioning whether the industry (and indeed the regulators) holds an SLO, evident in mainstream media such as the ABC 4Corners 2017 documentary 'Big Fish' and the recent release of Richard Flanagan's new 'expose' on the Tasmanian salmon industry 'Toxic'.

IMAS research has made substantial contributions towards understanding the key factors that influence the achievement and maintenance of a SLO by the Australian aquaculture industry (Alexander and Abernethy, 2019; Leith et al. 2014). These include evidence of sustainable and responsible practices, building relationships with stakeholder groups,

effective communication, generating and distributing benefits, and being connected to the community (amongst others). While the importance of an SLO is recognised by the industry (e.g. in the Tassal corporate strategy and Huon Aquaculture's 2020 Annual Report), work still needs to be done to address several of the determinants of societal support. Again, it must be made clear that the need for an SLO applies to government as much as to industry.

Education and training

As the aquaculture sector has grown rapidly over recent years, so too has the demand for skilled labour. In the past 12 months job advertisements for positions in aquaculture have increased by 41%, the second highest sector growth the highest median advertised salary of \$79.5K (Seek.com, 2021).

Tertiary level education in aquaculture started in Australia in IMAS foundation organisations in the late 1980s. IMAS is now in the process of revitalizing education and training in aquaculture with the aim of driving sustainable expansion of this sector in Australia. This requires substantial new capital investment in facilities, consolidating operations into a single site in Hobart, and increasing interaction between students and industry /government. The change will expose students to Australia's largest concentration of marine scientists (CSIRO, AAD, IMAS) plus make for easier interaction with seaweed, salmon and shellfish farming.

For the industry to continue to grow attracting and retaining skilled and unskilled workers presents major challenges, particularly in coastal and regional communities where education attainment and the ability to meet tertiary entrance requirements is often limited. Efforts to establish reliable alternate study pathways from school to VET (Certificate 1-4), University Associate Degree and degree to Higher Research programs have been hampered by frequent changes to VET sector offerings and content changes between RTO providers. UTAS offers articulated programs like University College Associate Degree's offer an alternate study opportunity for students without tertiary entrance requirements to undertake a different pathway into tertiary education. Remote work-embedded study programs also offer great potential, but the capacity for industry to participate is often challenged by staff shortages.

Regional universities are best placed to foster well-established workplace integrated learning programs, internships, and job-ready graduates. Universities closely connected with the sectors can offer short-course and flexible career development pathways for staff within businesses through embedded, postgraduate and research training programs in specific skillsets like selective breeding, fish nutrition and health, engineering, business, and ICT. Companies have also addressed staff retention by providing more workplace flexibility, staff development pathways and staff mobility between sections of companies among other strategies. Basic aquaculture certification (Certificate 3) is now considered a minimum entry requirement to most aquaculture positions.

While alumni from UTAS aquaculture programs (1989-2021), are well represented across aquaculture management positions, the industry have also relied heavily on global recruitment for more senior executive and expertise to support diversification, notably from the major salmon producing regions in Norway, Canada, Scotland and Chile. Reduced access to international expertise during COVID-19 highlights the need to accelerate advanced programs to meet strategic needs in key areas to meet future land-based and off-shore expansion needs. The Australian aquaculture sector offers unique opportunities to train and

export expertise, particularly linked to the emerging offshore aquaculture sector as it develops through the Blue Economy CRC. Indeed, a significant proportion of UTAS aquaculture students originate from interstate or overseas, enrolling with global career aspirations and leaving Tasmania on graduation. Expanding Australian tertiary education and higher degree research programs at postgraduate level to develop and retain Australian expertise and further promote pathways for local employees will be essential for industry as it continues to expand post-COVID.

While some skill gaps are universal between aquaculture sectors (production science, management, ICT, engineering, policy, genetics and selective breeding, aquatic veterinary) others are specific to the salmon sector. For example, unlike salmon, sectors such as prawn, abalone and oysters and some marine finfish (e.g. barramundi, kingfish) require skills in microalgal culture for live feed production. Current prawn aquaculture expansion in QLD, NT and WA led by Project Sea Dragon and Tassal, require staff recruitment for hatchery and technology expertise. New aquaculture developments in seaweed, microalgae and lobster production offering unique and premium products, requiring new skillsets not currently taught in Australian programs. While graduates are highly sought from UTAS programs, the numbers of students graduating annually falls short of the rapidly expanding industry need.

Strengthening Australia's biosecurity response has been highlighted with the recent WSSV introduction to QLD which has had a devastating impact on the SE QLD prawn industry. It is widely acknowledged that there are expertise gaps in aquatic animal health and epidemiology which are essential to support industry biosecurity planning, regulation and management for sustainable industry expansion.

International moves toward land-based aquaculture are reflected in shifts to large scale recirculation in freshwater phases with all three major salmon companies in Australia significantly expanding hatchery and increasing time fish are held on land prior to marine farming phases. Expertise in the design and operation of recirculating aquaculture systems require expert knowledge of both fish physiology and engineering. Significant interest in marine recirculating aquaculture systems for lobster, prawns and macroalgae also require technical expertise.

To supply the needs of a growing sector there will be a need to promote skilled recruitment, strengthen and support advanced education pathways in areas of critical need to meet the evolving and diverse needs for expansion. Importantly, supporting expansion of research and education institutions and providing pathways for advanced training opportunities throughout careers will be central for future aquaculture industry expansion.

c) Opportunities to streamline and increase the effectiveness of the current regulatory frameworks that govern aquaculture activities in Australia

Key points:

- Aquaculture expansion ideally occurs via Marine Spatial Planning (MSP), which is underway at IMAS and brings together multiple users of the ocean to make informed and coordinated decisions.

- National consistency in leasing and licensing processes would lower the administrative burden for integrated companies increasingly seeking to operate across state jurisdictions.
- Existing regulatory frameworks are single species focused which creates an extra costs/limitation to innovation, such as Integrated Multi-Trophic Aquaculture.
- IMAS research on governance of aquaculture activities outside state waters has highlighted the need for development of a regulatory framework at the Commonwealth level.
- Industry growth requires regulations supported by environmental science, effective monitoring, transparent reporting, and objective communication of the impact of operations.

Marine spatial planning

The current regulatory framework is set up for traditional forms of aquaculture practice, which largely take place onshore or in coastal marine sites. The locating of marine sites in increasingly busy and contested coastal areas, however, is one reason for questions around a SLO. Marine Spatial Planning (MSP) for Tasmania is being run through IMAS and brings together multiple users of the ocean to make informed and coordinated decisions about how to use marine resources. Incorporating a MSP process into the broader marine regulatory framework can help to address conflicts arising from the siting of aquaculture in coastal areas.

The Victorian Government has a well developed statewide MSP process, having already completed their planning framework and are now undertaking an assessment to identify priority planning areas. IMAS is currently working through a similar process with Tasmanian state waters (FRDC project 2019-111).

State-by-state consistency

Based on the Canadian experience, differences among state regulatory frameworks increase the costs for an aquaculture industry increasingly marked by integrated companies pursuing industrial-scale production across multiple states. Ensuring state-by-state consistency as well as simplicity and clarity in leasing and licensing processes is likely to lower the administrative burden for companies seeking to operate across state jurisdictions. Recent IMAS research has found that several features can support a streamlined and high-quality regulatory context which enables aquaculture industry growth (CRCp 2019 *Seaweed Solutions 2019*). These include dedicated aquaculture legislation, an inclusive definition of culturable species that includes marine plants and managing aquaculture at the bay scale as well as for individual sites.

Innovation in production

Several innovation trends in aquaculture are gaining traction and will shape the future of the industry. Integrated Multi-Trophic Aquaculture (IMTA) is one such form of innovation - a specific form of polyculture in which species are farmed together across different trophic levels and in which the outputs from one species, usually finfish, are taken up by others, usually seaweeds and shellfish. Existing regulatory frameworks are currently designed to deal with single species aquaculture. This means that where aquaculture companies are experimenting with IMTA, duplication in licensing and permitting is a potential cost or

limitation to innovations of this kind. Regulatory frameworks should be updated to promote IMTA (CRCp 2019 *Seaweed Solutions 2019*).

Expansion into new aquaculture is underway, such as seaweeds, rock lobsters and bugs – all of which have extensive development programs at IMAS. A lack of data on the effects of large-scale production of species such as seaweeds is creating caution among regulators and acting as a constraint on the development of this industry.

Moving production offshore is of interest due to space constraints in coastal areas and also as a step towards greater social license to operate. For Australian aquaculture to expand offshore the current regulatory framework needs to be reviewed and revised. While there are some opportunities to develop deep, high energy areas close to shore such as Storm Bay in Tasmania, most opportunities for aquaculture development exist offshore

IMAS has expertise in marine governance with projects currently underway on offshore aquaculture. Operations outside state waters are currently constrained as the Commonwealth government has no direct legislative or regulatory instruments addressing these activities. There is Commonwealth legislation that will apply to aquaculture siting and operations, e.g., through the Environment Protection and Biodiversity Conservation Act 1999 and the Biosecurity Act 2015. In general, moving will bring such operations into Commonwealth waters where there are no clear regulatory arrangements directed at aquaculture. This situation provides immediate challenges but can be addressed by utilising the framework provided under the Offshore Constitutional Settlement (OCS).

The OCS, and intergovernmental agreement has established “complementary” commonwealth and state legislation – the Coastal Waters (State Powers) and Coastal Waters (State Title) Acts 1980. Each state enacted their own legislation, matched by legislation enacted by the Commonwealth. This design means that the Commonwealth and states Coastal Waters (State Powers/Titles) legislation complements each other and established an areas of state jurisdiction three nautical mile offshore from a baseline in most cases the low water mark. In effect these arrangements entrenched the State or territory jurisdiction over what became known as ‘state waters’ – waters within a line drawn three nautical miles offshore of the territorial sea baseline. The OCS includes “Agreed Arrangements” across a range of marine sectors, but as yet does not address aquaculture.

Future development should include collaborative Commonwealth and state governments working together to work on an appropriate regulatory framework, including an OC type agree arrangement for offshore aquaculture.

Science based regulation.

Research generated by the IMAS (and its predecessors) on the environmental impacts and interactions of aquaculture (notably finfish) has been pivotal in the development and implementation of science-based management and regulation of the aquaculture sector in Tasmania and abroad (e.g. Crawford et al., 2003; Macleod & Forbes, 2004; Macleod et al., 2006; Ross and Macleod, 2013, 2017). This includes contributing to the development of monitoring methods and environmental standards that have been used to assess environmental performance and compliance of the sector over the past two decades. To ensure that current and future Tasmanian aquaculture practices remain sustainable as the industry expands into new growing areas and continues to evolve with new production technologies, EPA Tasmania is currently reviewing existing monitoring practices and

developing a new environmental standard aligning with best practice for Tasmania. IMAS is playing the lead role in the assessment and validation of monitoring practices, including the application of new monitoring technology (e.g., autonomous vehicles, real time monitoring via acoustic sensors, satellite sensing) that has the capacity to improve efficiencies and outcomes of regulatory monitoring and management. These developments will be critical as the industry looks to expand further offshore into more exposed waters where the challenges and operational costs of monitoring will increase significantly.

IMAS research has also focused on developing and applying pilot decision-support tools for aquaculture siting that could feed into a more comprehensive participatory Marine Spatial Planning (MSP) framework, should regulators decide to pursue it (Ross et al., 2020). These tools anchor decision-making into objective assessments of resources (available marine estate) based on the biophysical state of the marine environment. Coupled with this biophysical assessment are spatial relationships – when identified and defined - with other competing marine uses, including commercial and recreational activities, and socio-cultural values. These modelling exercises support informed and transparent decision-making by explicitly considering available resources, trade-offs, and potential synergies among ocean users. They however require accurate and accessible information, as well as broad input from stakeholders for resources and values to be accurately represented.

Despite the strong foundation in science, representation of industry expansion in the popular media demonstrates that the science that underpins environmental management and regulation is not well understood or acknowledged. The Global Salmon Symposium convened by IMAS in 2017 underlined the need for improved communication and transparency on environmental data and performance to improve community confidence and address negative perceptions of the industry (Carter et al., 2019). There have been some positive steps with greater access to environmental data and information provided on websites including company sustainability dashboards (e.g. <https://dashboard.huonaqua.com.au/>; <https://dashboard.huonaqua.com.au/>), the creation of the Tasmanian Government Salmon Farming data portal (<https://salmonfarming.dpipwe.tas.gov.au/>) and IMAS's salmon environmental interactions website (<https://salmoninteractionsteam.org/>). However, to improve social acceptance of the industry there remains a clear need to provide more effective and timely communication that demonstrates the critical role that science is playing in providing independent advice for environmental regulation and management.

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