Attention: Marine Farming Planning Review Panel

Regarding: the Terms of Reference for Proposed Salmonid Farming Operations at Okehampton Bay

What follows is Environment Tasmania's submission in relation to the Terms of Reference (TOR) for the review of the Okehampton Bay finfish lease within the Greater Oyster Bay and Mercury Passage Marine Farm Development Plan. Before addressing the TOR, Environment Tasmania would like to raise concerns about a number of issues which limit the public's ability to make a fully informed submission and undermine the integrity of the review process.

Firstly, while the Review Panel is being presented to the public as 'independent', **6 of 8 panel members are selected by the Department led by the Minister for Fisheries, and the Review Panel has no independent decision-making powers.**

Secondly, the data on which one-third of the TOR are based is not publicly available. It is impossible to conduct a public review of data that is not publicly available.

Environment Tasmania lodged a 'Right to Information' request with DPIPWE in May this year, seeking access to the data on which this review is based. To date we have received nothing from the Department and the Ombudsman is currently reviewing DPIPWE's failure to respond to our request within the statutory timeframe.

A week into the four week public submission period, DPIPWE responded to public pressure and made available parts of a summary report which is based on the environmental baseline data for the site from 2002. This report does not contain all of the baseline data for the site – **a notable exception being the result of benthic infauna sampling.** These sampling results are crucial as they allow the community to see the level of biodiversity at the site and if farming proceeds, will be used to measure the damage done under salmon pens.

Tassal, the industry proponent, is currently the only party with access to all environmental baseline data and surveys for the site. Given the narrow focus of the TOR pertaining to environmental baseline data, and the fact that the industry proponent is the only party with access to all baseline and monitoring data, Environment Tasmania has concerns that this

review process could provide a vehicle for allowing industry-driven changes that will weaken existing baseline data for the Okehampton Bay site.

Tassal has made available on their website what they claim to be sufficient information to inform public comment, and it is weaker than the 2002 baseline data for the site. It includes graphs of monthly temperature and dissolved oxygen, for example, which is meaningless when daily maximum temperature and dissolved oxygen are the key considerations for fish health and site sustainability.

Environment Tasmania would like to formally register its objection to any changes to existing baseline data that do not involve a strengthening of baseline data through the addition of contemporary data to the existing time series. **Any move to dispense with or weaken existing baseline data will raise substantial concerns about the integrity of the review process.**

Thirdly, the public submissions period for this review has been too short to enable concerned members of the public to educate themselves on the science of environmental monitoring. The submission period has run for *just 3 weeks* following DPIPWE's decision to release parts of the data on which submissions were to be based.

Fourthly, the limited nature of the review's TOR further compounds concerns regarding the Minister for Fisheries intention to allow an open and transparent review of the Okehampton Bay lease. The TOR allows for submissions addressing just three dot-points, which largely pertain to environmental management and monitoring. As a result the TOR fails to fully address the objectives of the *Marine Farm Planning Act* (1995). There are no clear, specific TOR pertaining to impacts of fin-fish farming at the site on other coastal users, including the tourism industry, the commercial fishing industry, recreational fishing and boating communities and the local community on the east coast.

In relation to the specific TOR on the adequacy of baseline data and regulations for the site - **independent consideration of contemporary science on fish farm impacts in inshore areas indicates that the Okehampton Bay site is not a suitable location for salmon farming. The site depth is too shallow, the water is too warm and the current speed too low to support intensive salmon farming.** The original Marine Farm Plan states water temperatures range up to 23.5 degrees celcius, which is well above the maximum temperature for growing healthy salmon. Current speed is low (*0 - 5 cm 2)* and the site is also shallow (21 m), which means flushing is weak and waste matter will build up under net pens.

The site is currently experiencing harmful algal blooms, creating pressure for our shellfish industries and risks to human health. Introducing a significant additional source of nitrogen will increase the risk of harmful algal blooms in the Bay**.**

The site is also adjacent to both an endangered whale migratory route and Maria Island Marine Reserve. Evidence of the impacts of inshore salmon farming demonstrates that

farming at the lease site could endanger these important natural values, on which the tourism and wild-catch fishing industries, and the local communities enjoyment of the area, depend.

No lease in Tasmania, including the lease for fin-fish farming at Okehampton Bay, should be approved until a full, transparent site assessment has been conducted using best-practice, evidence-based criteria for determining site suitability. **Environment Tasmania requests an independent review of the suitability of the Okehampton Bay lease for fin-fish farming before any production goes ahead at the site.** This should involve appointment of an independent review panel and expansion of the review's terms of reference to adequately reflect the objectives of the *Marine Farm Planning Act*.

Environment Tasmania also requests an opportunity to speak to the references within this submission at public hearings.

Sincerely,

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Environment Tasmania.

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The Review Panel's lack of independence from the Minister for Primary Industries.

Prior to addressing the Terms of Reference, Environment Tasmania would like to raise concerns about representation in the media of the role of the Marine Farm Planning Review Panel. While Minister for Primary Industries and Water, Jeremy Rockliff, has described the Review Panels assessment of the Okehampton Bay lease as an 'independent assessment', the Review Panel in fact has no independent review powers. It is therefore misleading to describe the functions of the Marine Farm Planning Review Panel as an independent review of the Minister's decision relating to the Okehampton Bay licence. This is not an independent review process, but one that is tightly directed by the Minister whose department has the conflicting responsibility of promoting and doubling the size of Tasmanian salmon industry by 2030.

1. **The panel is not independently appointed**

The *Marine Farming Planning Act 1995* (Tas) establishes the 8 member Marine Farming Planning Review Panel. One position is reserved for the Director of the Environmental Protection Authority, and one position is nominated by the Chair of the Tasmanian Planning Commission. The remaining 6 positons are appointed by the DPIPWE.

2. **The panel has no independent powers**

After the Marine Farming Planning Review Panel refused a lease expansion application at Soldiers Point in April 2011 (Draft Amendment No. 3 to the D'Entrecasteaux Channel Marine Farm Development Plan Feb 2002), then Minister for Primary Industries, Mr Bryan Green, led changes to the *Marine Farming Planning Act* (1995) to restrict the Panel's decision making powers so that they could only make recommendations to the Minister, rather than having power to refuse applications for amendments allowing new/expanded lease areas. In December 2011, Dr Lois Koehnken, the scientist on the Panel who was integral in the Soldiers Point decision, was asked not to reapply for her position.

3. **There are no general rights of appeal**

Despite operating from Marine Farm Development plans that are twenty years old and in some cases were written by the aquaculture industry, and oversight by a Marine Farming Planning Review Panel with no independent powers of review, there are currently limited rights of appeal for stakeholders negatively impacted by aquaculture developments. Once a Marine Farm Development Plan has been certified, there is no further public involvement in the lease allocation, licencing or development processes.[1]

This stands in contrast to applications assessed under the *Land Use Planning and Approvals Act* 1993 (Tas) (LUPAA). Under LUPAA, any person who made a representation in relation to a proposed development has a right to appeal to the Resource Management and Planning Appeal Tribunal (RMPAT). Appeals under Tasmania's marine planning act are limited to

[1] http://www.edotas.org.au/wp-content/uploads/2014/01/Improving-Tasmanias-Marine-Farming-Framework.pdf

appeals against a refusal to consider an amendment or to grant a lease, or appeals on the grounds that the proposal will adversely affect other marine farming operations. Put simply, the aquaculture industry has a right of appeal, the public and other affected stakeholders do not.

4. **The review's Terms of reference (TOR) is limited**

The TOR allows for submissions addressing just three dot-points, which largely pertain to environmental management and monitoring. There are no clear, specific TOR pertaining to impacts of fin-fish farming at the site on other coastal users, including the tourism industry, the commercial fishing industry, recreational fishing and boating communities and the local community on the east coast. This limits the Review Panel's ability to meet the objectives of the Marine Farm Planning Act, copied below, which requires a fuller consideration of the integration of marine farming with other marine and land uses and the community's right to have an interest in these activities.

"(1) The purpose of this Act is to achieve well-planned sustainable development of marine farming activities having regard to the need to –

(a) integrate marine farming activities with other marine uses; and
(b) minimise any adverse impact of marine farming activities; and
(c) set aside areas for activities other than for marine farming activities; and
(d) take account of land uses; and
(e) take account of the community's right to have an interest in those activities

It will be difficult for the community to have faith in the recommendations of the Review Panel, or the Minister's decision, given the TOR fail to reflect fully the purpose and objectives of the Act.

Terms of Reference 1 and 3: *Adequacy of environmental science and monitoring and regulations within the Marine Farm Development Plan*

1. **Regulations the panel will use to review the lease are 20 years old**

While Minister Rockliff has stated a need to review environmental baseline data for Tassal's Okehampton Bay lease because it is 20 years old, the regulations that the Review Panel will measure the data against are also 20 years old. Tasmania's current Marine Farm Development Plans were written two decades ago. Unfortunately Tasmania's approach to marine farm planning is substantially behind international best-practice and the current science on the impacts of open-pen, ocean-based fish farming.

2. **What we now know about the impacts of open-pen, ocean-based fish farming**

There is consensus in the scientific literature; ocean-based fish farming in open pens damages the marine environment, with the level of damage dependent on the intensity of

production and the sites capacity to assimilate pollution.[2] Damage is inevitable in open-pen systems, because they provide no way of capturing the tonnes of waste produced by farming – this waste is simply released into the water.

Waste produced by salmon farming includes uneaten fish food, fish faeces and urine and organic matter from net-cleaning.[3] The major components of solid and dissolved waste are various forms of carbon, nitrogen and phosphorous.[4]

This waste settles on the seabed and enters the water column. A build-up of organic matter in sediments on the seabed produces major changes in sediment chemistry. Changes typically associated with a severe build-up of organic matter are a reduction in sediment oxygen levels and the subsequent production and release of methane and toxic hydrogen sulphide.[5] Low dissolved oxygen concentrations can harm benthic invertebrates, fish and other organisms. This can lead to anoxic and hypoxic events, where sediment flora and fauna do not have sufficient oxygen to survive.

In the water column, soluble nutrients can alter the species composition and density of phytoplankton, increasing the risk of toxic algal blooms (DPIF, (1997)). [6]

The extent and nature of the damage caused by open-pen, ocean-based fish farming depends on the intensity of production and site location.[7] The scientific literature shows that high intensity production in onshore locations creates a high risk of nutrients accumulating and causing damage to the marine environment. That is because shallow sites with low current speeds and poor flushing capacity, and sites in close proximity to other land-based sources of nitrogen pollution, have less capacity to assimilate the pollution introduced by fish farming.[8]

Proper siting of fish farms – with suitability based on an assessment of the sites capacity to assimilate pollution, is crucial for minimising the negative effects of open-pen farming on the marine environment. Unfortunately, Tasmania has limited regulations regarding the siting of ocean-based, open-pen fish farms. As a result, fish farms have gone ahead in

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[2] Price et al (2015). Marine cage culture and the environment: effects on water quality and primary production. Journal of Aquaculture Environment Interactions, Vol. 6.
[3] Impact of Aquaculture (2001). Commonwealth Environment Department. https://www.environment.gov.au/resource/impact-aquaculture.
[4] Ibid.
[5] Price et a; (2015). Hargrave (2010) Empirical relationships describing benthic impacts of salmon aquaculture. Journal of Aquaculture Environment Interactions. Vol. 1.
[6] Impact of Aquaculture (2001). Commonwealth Environment Department. https://www.environment.gov.au/resource/impact-aquaculture.

[7] Levings et al, (1995); Hargrave, (2003); Belle and Nash, (2008); Scott, (2010); Bergheim, (2012); Kutti et al. (2007a); (Black *et al.*, 1996); Preece,)2012a).

[8] Bergheim (2010). http://www.scielo.cl/pdf/lajar/v40nSpecIssue/art26.pdf.

onshore locations with limited capacity to assimilate the levels of pollution introduced into the water by multiple, high intensity fish farm operations.

In Macquarie Harbour, this had led to plummeting dissolved oxygen levels, mass fish kills and increased disease amongst farmed fish.

"*Based on regulatory and other monitoring data presented in reports and synthesis documents (i.e. MHDOWG 2104; Aquadynamic Solutions 2015), it appears there is correlative evidence that finfish farming is affecting the water quality of the harbour environment and is contributing to benthic DO reductions in the system*." [9]

In Huon and the Channel, work by Volkmann et al (2009) points to the nitrogen introduced into the water column from tonnes of pollution introduced by fish farms as a cause of increased phytoplankton abundance and risk of algal blooms.

"*Our measurements and modelling indicate that the salmonoid industry is a significant contributor of nutrients to this region and that these have led to measurable increases in phytoplankton abundance*."[10]

3. International best-practice – proper siting of farms

Countries seeking to limit the damages caused by intensive, ocean-based, open-pen farming are investing in land-based farming operations. To encourage the growth of the land-based salmon farming sector, the Norwegian Government has waived licence fees for land-based production.

In January this year, a committee appointed by the Norwegian Ministry of Fisheries concluded that no license fees or quotas should be required for land-based salmon production in Norway. This creates a market incentive for salmon-farming companies to consider producing on land in Norway, as there is currently strong competition for new net pen licenses, which can cost NOK 60 million (about U.S. $10 million) per license.

Land based recirculating aquaculture systems release no waste into the environment, eliminate the risk of escapes, vastly reduce the risk of disease and recycle 95 per cent of their water. This year Scotland launched the world's biggest land-based tank for growing market-sized salmon.

Leading producing countries with substantial investments remaining in marine-based farming have updated their planning and regulations to reflect the science on fish farm impacts. In Norway, farms have been moved out of near-coastal areas, to sites with higher current speeds and water depths of greater than 50 metres.[11] This move offshore occurred

[9] http://dpipwe.tas.gov.au/Documents/Report%20Cawthron%20Review.pdf. Page 43.

[10] Ibid. Page 3.
[11] Sunde et al. 2003

in response to the evidence on the impacts of onshore farming, which demonstrates that farm locations with shallow water, low current speed and poor flushing, cause maximum damage to the environment. This is because shallow sites with poor flushing capacity are unable to assimilate tonnes of pollution, which in turn, builds up under pens.

"Past marine aquaculture practices resulted in environmental degradation, yet in high production areas like northern Europe the industry has largely learned from those mistakes and reduced environmental impacts per unit production largely through a combination of improved feeds and proper siting of farms (Grøttum & Beveridge 2007)"[12]

Proper siting of fish farms is crucial for minimising the negative impacts of fish farming on the marine environment. And there is clear, peer-reviewed evidence regarding the criteria that needs to be considered when assessing a site's suitability for open-pen fish farming.

4. Tasmania – no clear, evidence-based criteria for assessing site suitability

Currently Tasmanian planning regulations, including the Marine Farm Development Plan for Greater Oyster Bay and the Mercury Passage, contain no clear criteria or minimum thresholds for assessing a site's suitability for open-pen farming.

Below is a list of best-practice planning criteria, taken from peer-reviewed science on open-pen siting, which Tasmania's current marine farm planning regulations fail to include. These criteria, with minimum thresholds for approval, need to be addressed in regulation governing the formation of Marine Farm Development Plans.

No lease, including the lease for fin-fish farming at Okehampton Bay, should be approved until a proper site assessment has been conducted using best-practice, evidence-based criteria for site suitability.

- Criteria to guide an area-based approach to planning that considers the carrying capacity of marine farming zones;
- Nutrient budgets for marine farming zones that inform considerations of the amount of nitrogen that can be discharged by farms;
- Occurrences of harmful algal blooms within the marine farming zone and the areas vulnerability to harmful algal blooms;
- Minimum site depths;
- Minimum current velocity;
- Minimum flushing capacity;
- Maximum release of toxic sulphides;
- Maximum release of biofouling organisms during in situ net cleaning;
- Minimum distance from other fisheries;
- Minimum distance from high conservation value areas;
- Minimum distance from popular boating and recreational fishing areas;
- Minimum distance from popular tourism areas and public beaches.

[12] Marine cage culture and the environment: effects on water quality and primary production. Carol Price1,*, Kenneth D. Black2, Barry T. Hargrave3, James A. Morris Jr.1. 2015.

Terms of Reference Two: *The adequacy of the environmental baseline data and surveys to allow the Director, Environmental Protection Authority to establish a contemporary environmental management regime for the purposed marine farming activity'*

1. **The environmental baseline data and surveys for the site are not publicly available**

There are clear difficulties with holding a review in which one-third of the TOR refers to the adequacy of environmental baseline data when all environmental baseline and monitoring data for the lease site is not available for affected stakeholders to review.

Environment Tasmania has a Right to Information (RTI) Request in with DPIPWE asking for all environmental data and survey results relating to the Okehampton Bay lease site. We have been seeking this data for a number of months. At the time of writing, the department is outside of the statutory timeframe for response and we have received no reply to our RTI request. The Ombudsman is currently reviewing DPIPWE's decision not to respond to our request within the statutory timeframe.

In response to public pressure, one week into the four week submission period, DPIPWE release part of the survey based on the baseline data for the site. This is not all of the baseline or monitoring data for the site. The version of the survey document released by the department also contains a notable omission when compared with the original environmental survey – the results of sampling of benthic infauna have been removed. Benthic infauna sampling is a crucial part of baseline data and monitoring because it allows the community to see the level of biodiversity at the site and if farming proceeds, will be used to measure the damage done under salmon pens.

Environment Tasmania has had the opportunity to site the results of benthic infauna sampling for the site and they show a healthy abundance of marine life at a near-pristine site with a fine sandy bottom. The public should have an opportunity to see the results of this sampling. It is likely that this biodiversity will be severely damaged at the farming intensity proposed by Tassal – the water at the site is too shallow and the current speed too weak to flush the waste that will be introduced to the site.

It is impossible to review the adequacy of baseline data without access to all of the baseline data, monitoring data and full and complete environmental surveys for the site. What follows are details on what the baseline data for finfish leases should include, based on contemporary science on siting location.

2. **There should be no discounting or weakening of existing baseline data**

It is crucial that if this review process leads to gathering of new data and that this new data updates and expands on existing baseline data for the site. For instance, monthly averages of key indicators like water temperature, Dissolved Oxygen and phytoplankton abundance, should not be accepted as indicators of site suitability and there should be no removal of

requirements for sampling of benthic infauna. The review should not be used as an opportunity to 'redraw the line' on baseline data, or gather new data that fails to consider all of the chemical and biological indicators that were measured in the 2000 baseline study.

Existing baseline data needs to be incorporated into any updated report and remain within the formal baseline survey for the site. Any new data added to the original baseline survey must at the very least address the same variables and sampling times measured in the original baseline data.

Any discounting of original baseline data or reduction in the chemical and biological parameters considered in updated data, will look to the community like a cynical attempt by proponents to avoid comparison of impacts against original baseline data.

3. What best practice environmental baseline data should include

The environmental baseline data required for Okehampton Bay needs to provide an evidence base sufficient to enable assessment of site suitability for open-pen fish farming at the intensity proposed.

It is the role of government, not industry, to set minimum thresholds for key criteria relating to site suitability. Baseline studies need to provide government with sufficient data and site information to assess site suitability in line with regulated minimum thresholds. To enable this, baseline data and site information needs to include:

- Proposed number of fish within the lease area.
- Proposed number of pens within the lease area.
- Stocking density.
- Food conversion efficiency ratio, to enable feed and faecal waste calculations.
- Projected tonnage of waste introduced into the marine environment.
- Projected nitrogen introduced into the water column; other sources of nitrogen; consideration of site carrying capacity.
- The zones occurences of and sensitivity to harmful algal blooms.
- Median water depth.
- Cage depth.
- Cage diameter.
- Tidal amplitude.
- Mean peak current speed.
- Annual temperature time series.
- Percentage sediment dry weight as silt and clay.
- Surface sediment organic matter content.
- Surface sediment redox potential.
- Surface sediment stable isotope analysis including % nitrogen, carbon, sulphides.
- Sediment particle size analysis.

- Water column parameters including ammonia, nitrate, nitrite, phosphate, silicate, nitrogen, phosphorous, dissolved oxygen, salinity and phytoplankton biomass and community composition (chlorophyll a, HPLC pigments and cell counts).
- Benthic faunal analysis – resulting from sampling not just video survey.
- Threatened and endangered species habitat or migratory zone within the lease area and within 10 kms of the lease area.

4. Science-based assessment of the suitability of the Okehampton Bay site for finfish farming

- Water temperature

The Marine Farm Development Plan for the zone recognises that temperatures are high – ranging up to 23.5 degrees celcius. The Marine Farm Development Plan for this area needs to be updated to reflect current science on ocean warming. The global ocean is projected to continue warming (IPCC, 2013). Ocean temperatures on Tasmania's east coast are now among the most rapidly warming in the world. Wu et al (2012) state that ocean warming on the east coast of Australia has been two to three times faster than the global mean.

According to CSIRO senior principal research scientist Alistair Hobday, East Coast waters are in the world's top 20 fastest warming ocean temperatures, and are now 2.5 degrees celcius above the global average at 18 degrees celcius. In January 2016, this average lifted to 4.5 degrees celcius above average at 23 degrees because of a 130-day marine heatwave. Dr Hobday says this slow warming is permanent, with no end in sight, and poses a challenge to Tasmania's seafood industry.

"With the East Australian Current heading further south there will be a faster warming in the East Coast waters for the next 50 to 100 years. Seafood industries will continue to be challenged as they don't cope well in warm water."[13]

Research shows that water temperature of thirteen degrees celcius produces the most efficient growth rate for salmon (Ernst M Hevrøy et al., 2013) and water temperatures over 17 degrees celcius results in sub-lethal stresses (Brett *et al.*, 1982). Water temperatures at Okehampton Bay are too warm to grow healthy salmon, without negative impacts on dissolved oxygen and salmon health.

- **Current speed**

The Marine Farm development Plan for Great Oyster Bay states that the area has low current speeds.

[13] http://www.themercury.com.au/news/tasmania/ocean-temperatures-on-tasmanias-east-coast-are-among-the-fastestrising-in-the-world/news-story/70e83dcbe51376aa439a53cd2d8d32f7

"*These studies indicate that the currents in Great Oyster Bay are generally low, between 0 and 5 cm-2*"[14]

Parts of the baseline survey released by DPIPWE support this. Current speed at 6 metres is 2.65 cm-2 with a standard deviation of 1.1.

The scientific literature[15] shows that fish farms in areas with low current speeds have more serious impacts on the marine environment, because pollution form farms doesn't flush, but accumulates under net pens. It is not appropriate to proceed with fin-fish farming in an area with such low current speeds.

- **Water depth**

The Marine Farm Development plan for Great Oyster Bay and the Mercury Passage indicates that water depth at Okehampton Bay ranges from 22-28 metres. Parts of the baseline survey released by DPIPWE indicate that the mean depth at the site is 21 metres. This is too shallow to support proper flushing of waste. In Norway, fish farms have been moved offshore to areas more than 50 metres deep.[16] The shallow water at Okehampton Bay, in addition to low current speed at the site, will be insufficient to prevent waste matter accumulating under net pens.

- **Harmful algal blooms**

Tasmania's east coast is currently experiencing Harmful Algal Blooms.[17] Ten shellfish growing areas have been shut down because of toxic algae, extending from St Helens down the east coast to Frederick Henry Bay in the south east and Dover in the south.

Introducing more nitrogen into a system already experiencing toxic algal blooms will increase the chance of future blooms. This year similar algal blooms devastated Chile's salmon farms. Linked to warming waters, the toxic algae saw 25 million fish killed in March. [18]

Proceeding with salmon farming at Okehampton Bay, a site already experiencing warming waters and toxic algal blooms, would pose a risk to the marine environment, the shellfish industry, and potentially human health. The Tasmanian Government has a current warning

[14] http://dpipwe.tas.gov.au/Documents/GOBMP-MFDP-October-1998-(Modified-May-2010).pdf
[15] Levings et al, (1995); Hargrave, (2003); Belle and Nash, (2008); Scott, (2010); Bergheim, (2012); Kutti et al. (2007a); (Black *et al.*, 1996); Preece,)2012a). Hargrave (2010). Price et al (2015). Sunde et al. 2003.
[16] Sunde et al. 2003.
[17] http://www.abc.net.au/news/2016-08-14/tasmanian-toxic-shellfish-spread-worst-yet/7732992.
[18] http://www.ft.com/cms/s/0/1978a158-12ac-11e6-91da-096d89bd2173.html?siteedition=intl#axzz4Is0Ww8Mr

out against shellfish consumption on the east coast, stating that residents who cook or eat wild shellfish from the east coast risk serious illness.

5. Proximity to sensitive sites

The lease is less than 8 kms from Maria Island Marine Reserve. Current direction means that it is possible that biofouling organisms from in situ net cleaning at the site will reach the Marine Reserve. The main biofouling organisms found in Tasmanian salmon farms are hydroids of the genera Ecto - pleura, Plumelaria, Obelia and Sarsia.[19] Like all cnidarians, hydroids and anemones possess millions of harpoon-like stinging cells (nematocysts) that contain nerve- or cardiotoxins and are used to capture and immobilise prey (Sher & Zlotkin 2009, Frazão et al. 2012, Cegolon et al. 2013).[20]

Recent trials in Ireland suggest that 'shredded' fragments of E. larynx arising during net cleaning might have the ability to cause pathological levels of gill irritation and damage in farmed Atlantic salmon (Baxter et al. 2012). In addition to being potential agents of gill and skin disorder, biofouling organisms can also act as hosts for aquatic pathogens. Depending on local current regimes, cleaning waste from fish farms may thus become transported, and pose disease risks to adjacent or regional aquaculture facilities. [21]

Damage or fragmentation of organisms during cleaning may also result in the release of viable gametes (eggs and sperm) if cleaning is undertaken at intervals that allow organisms to mature. This may facilitate the spread of invasive biofouling species through high-density farming regions – a particular risk if farming regions are adjacent to high conservation value areas or marine reserves.[22]

In Macquarie Harbour, pollution indicator species from fish farms have travelled 7.5kms from fish farm sites. Maria Island is an important site for conservation, science and tourism. Fish farming should not be allowed within 10 kms of the Marine Reserve or migratory routes for endangered whales in the Mercury Channel.

6. Adequacy of monitoring requirements

Monitoring requirements should be guided by the regulatory minimums for operating established in baseline data, to enable a comparison of conditions prior to and following farming activity. DPIPWE's current monitoring requirements rely solely on video surveys taken once per year. To enable monitoring of impacts, monitoring needs to require benthic and water sampling. Sampling should occur twice a year, reporting against the following baseline conditions.

- Number of fish farmed.

[19] Floerl etal 2016. Aquacult Environ Interact. Vol. 8: 407–417, 2016
[20] Ibid.
[21] Ibid.
[22] Ibid.

- Daily feed input and nitrogen discharge.
- Video survey for visual impacts within farming areas and 35 metres from farming areas.
- Benthic faunal analysis based on sediment sampling.
- Indicators of benthic enrichment including redox potentials, free sulphides within and 35 metres from lease areas.
- Daily Dissolved oxygen logs at 2 and 20 metres; within and 35 metres from lease areas.
- Daily water temperature logs.
- Ammonia at 2 and 20 metres; within and 35 metres from lease areas.
- Nitrate at 2 and 20 metres; within and 35 metres from lease areas.
- Daily phytoplankton biomass and community composition (chlorophyll a, HPLC pigments and cell counts).