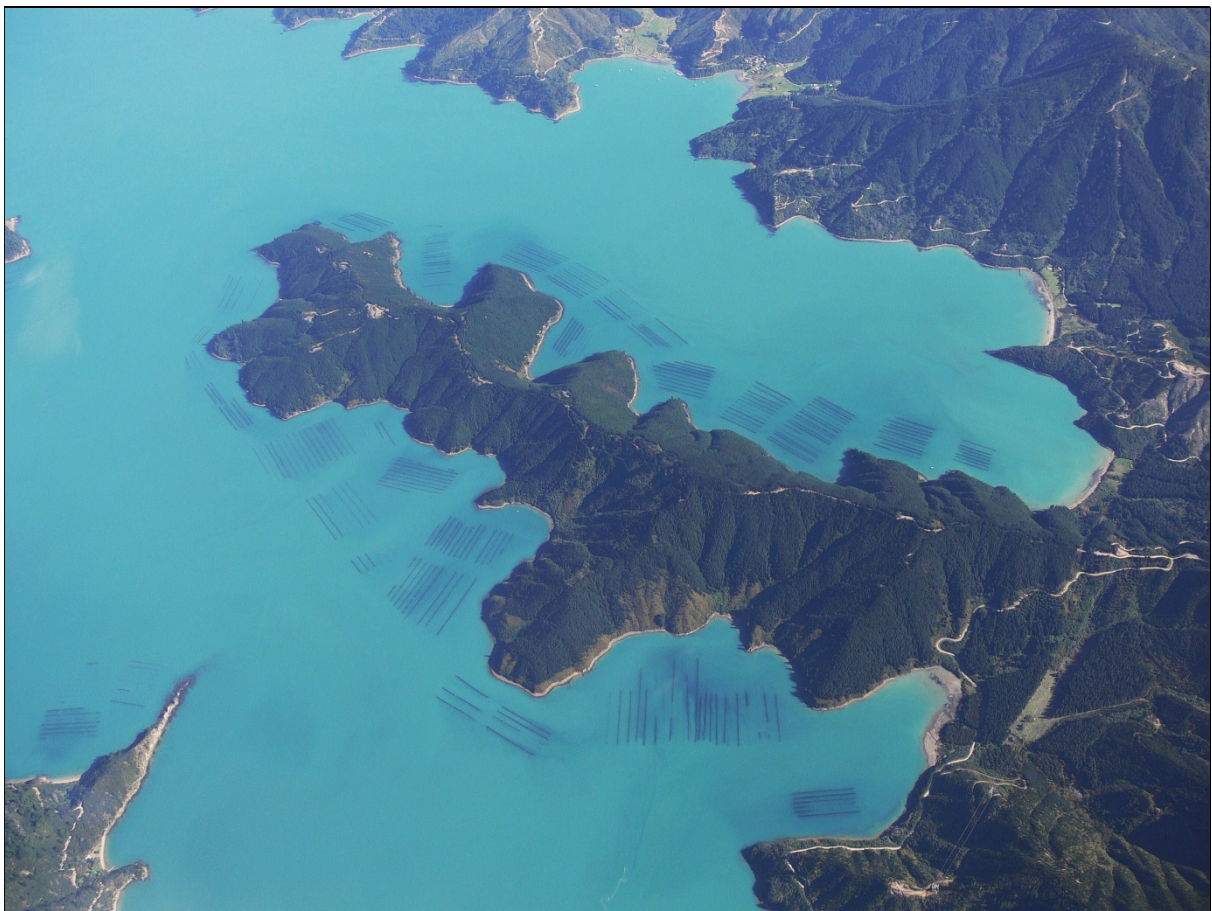


# **Recommendations of the Marlborough Aquaculture Review Working Group**



**July 2019**

## **Background**

1. The Council publicly notified the Proposed Marlborough Environment Plan in June 2016. Before doing so, the Council determined that the provisions managing marine farming were to be removed from the notified Plan. Instead, the review of the operative provisions of the Marlborough Sounds RMP and Wairau/Awatere RMP managing marine farming was to continue. The Council at the time was not satisfied that the draft provisions adequately gave effect to Policy 8: Aquaculture of the New Zealand Coastal Policy Statement 2010.
2. In September 2016, the Council decided to appoint a Marlborough Aquaculture Review Working Group (MARWG) to assist the Council with the review process. The MARWG was to consist of members of the marine farming industry, community organisations and central government agencies. The MARWG was then formed over the following months and the MARWG held its first meeting in March 2017.
3. The MARWG members are set out in full in Appendix 1.
4. A Technical Advisory Group (TAG) was also established at the same time as the MARWG to assist it with any technical matters. The TAG members are also set out in full in Appendix 1.

## **Process**

5. The MARWG commenced meeting in March 2017. 16 meetings were held between February 2017 and June 2019.
6. The Council provided the MARWG with a starting proposition for the review process. For completeness, the starting proposition is attached as Appendix 2. The scope of the review process did not include fin fish marine farming. The reasons for constraining scope in this regard are set out later in this report.
7. The members of the MARWG from the Kenepuru and Central Sounds Residents Association expressed concern about the starting proposition and consistently did so through the review process. Reflecting this concern, they have presented a dissenting view of the recommendations (see later).
8. The MARWG meetings were chaired by Councillor Trevor Hook. Councillor David Oddie also attended the meetings. As they articulated to the MARWG on more than one occasion, the councillors considered their role in the review process to be one of facilitation only. Both councillors withdrew from those meetings during which the MARWG considered draft MEP provisions to avoid any perception of conflict of interest.

9. Council also approached each Te Tau Ihu iwi and Ngai Tahu/Ngati Kuri and held hui with several iwi to also discuss the review process. The same starting proposition was discussed at these hui. The iwi authorities consulted expressed a view that they did not want to be involved directly in the MARWG but did seek to be informed of the outcome of the review process.
10. In terms of the review process, this involved:
  - Dividing Marlborough’s coastal marine area into coastal management units for the purpose of the review process;
  - Establishing the natural and broad human use values that exist in each coastal management unit from existing sources of information<sup>1</sup>;
  - With the starting proposition providing the overarching context, using this information to review the appropriateness of the location of existing marine farms;
  - Confirming a spatial allocation for the existing marine farms considered to be appropriate by establishing an “Aquaculture Management Area” (AMA);
  - Considering the potential to relocate inappropriate marine farms or inappropriate lines within coastal management units to alternative locations in the same coastal management unit or an alternative coastal management unit;
  - Considering the potential for marine farms to create cumulative benthic and water column effects and developing a method to address the potential for cumulative benthic effects;
  - Considering the opportunity for marine farming to occur in offshore waters.
11. On a number of occasions, the MARWG required technical support with the above tasks. On these occasions, requests were made to the TAG. The TAG was convened by Dr Steve Ulrich. Responses to questions were provided in writing and were considered as part of the MARWG’s agenda. Dr Ulrich attended MARWG meetings on these occasions.
12. As the review process developed, especially the process of considering the appropriateness of existing marine farms in each CMU, principles for managing marine farming emerged. These principles were recorded and used by the MARWG as a basis for preparing draft MEP provisions. The final stage in the review process was considering and confirming the draft MEP provisions to be recommended to the Council.

## Uncertainty

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<sup>1</sup> Natural and human use values were not always explicitly recorded at the time that the MARWG considered each CMU, but they were implicitly taken into account and documented as part of the review process.

13. One of the challenges that the MARWG faced during the process of review was the uncertainty regarding the effects of human activity, including marine farming, on the marine environment of the Marlborough Sounds. This includes the potential for adverse effects of activities on land and in the marine environment to be cumulative.
14. The MARWG believes that there is a real need for additional data/information on specific matters and at discrete locations to establish the nature of the cause and effect relationship between activities and the adverse effects evident (and perhaps yet to be detected) in the marine environment.
15. The provisions that the MARWG has recommended proposes collecting additional environmental data, and as a minimum sulphide levels in seabed sediments, as an indicator of adverse benthic effects. The MARWG also recommends the adoption of response mechanisms with respect to the results obtained from the additional monitoring.
16. There are some on the MARWG that believe that this monitoring is insufficient to allow for the existence of cumulative adverse effects to be established. This concern is recorded later in this advice.
17. Notwithstanding the additional monitoring, there will remain information gaps when attempting to establish the potential for cumulative effects and to manage those adverse effects. These information gaps are identified later in this advice. It is the expectation of the MARWG that the Council will, in collaboration with other management agencies, commence collecting data to fill those information gaps.

## **Recommendations**

18. The following package is provided by the MARWG to the Council for its consideration.
  - 1) Draft provisions that could be inserted into the PMEP by way of variation;
  - 2) A draft spatial allocation provided by way of a GIS tool.
  - 3) A draft compilation of natural and human use values for each CMU which informed the spatial allocation of coastal space for marine farming;
  - 4) A draft discussion paper that could assist with any community engagement undertaken as part of the process leading up to or after notifying the variation.
19. In summary, the recommendations are as follows:
  - 1) Areas considered appropriate for marine farming be provided for by way of AMAs;
  - 2) AMAs generally be between 100 metres and 300 metres offshore, unless natural and human use values within the Coastal Management Unit make that “coastal ribbon” inappropriate;

- 3) Where 2 applies, apply the AMA to reflect existing consented marine farming space;
  - 4) Applying for replacement consents for existing marine farms to be a controlled activity within the AMA for like-for-like structures and activities;
  - 5) Authorisations be used to provide the existing consent holders the ability to apply for a replacement consent within a specified, but limited time period;
  - 6) Where existing marine farms are considered to be in inappropriate locations, provide alternative coastal space to relocate those farms to;
  - 7) Marine farming outside of AMAs but within the enclosed waters of the Marlborough Sounds be a prohibited activity;
  - 8) Provide the ability to apply for a resource consent to establish a farm in open coastal waters as a discretionary activity
  - 9) Monitoring for the cumulative effects of marine farming (and other activities) should commence and a regime for responding to the monitoring results be included in the variation.
20. Subject to the points made below, the MARWG recommends that the draft provisions and spatial allocation be adopted for the purpose of community consultation. Additionally, the MARWG recommends that the compilation of natural and human use values (and the methodology used to compile it) be made available to assist with community consultation. Finally, the MARWG encourages the Council to consider the draft discussion document that has been prepared as a basis for engaging with the community on the variation.
21. In providing the package, the MARWG, or individual members of the MARWG, wish to make the following points. Regard should be had to these matters when considering the draft provisions and the draft spatial allocation.

**(i) Fin fish**

There is considerable uncertainty over the spatial allocation of coastal space for fin fish farming and management of potential adverse effects of fin fish farming given the processes that have occurred in the past or that are currently underway. These processes include the Board of Inquiry process for the New Zealand King Salmon plan change and concurrent resource consent application (and subsequent appeals) from 2011 to 2014, the Minister of Fisheries consideration of the use of Section 360A to amend the Marlborough Sounds Resource Management Plan in order to enable the relocation of salmon farms in the Marlborough Sounds and the Minister of Conservation's decision to call in resource consent applications to undertake monitoring for the purpose of establishing offshore salmon farms around the South Island.

Due to the uncertainty created by these processes, the MARWG has not considered the management of fin fish farming. Nor did the MARWG consider the potential environmental effects of fin fish farming.

The MARWG has a strong preference for the Variation to the MEP to be completed by including an appropriate spatial allocation for fin fish farming and by including provisions to manage the effects of fin fish farming. When there is more certainty provided at the completion of the processes identified above, the MARWG encourages the Council to include provisions in the Variation to manage fin fish farming.

**(ii) NES for Marine Aquaculture**

At the same time as the work of the MARWG was underway, central government was preparing a National Environmental Standard for Marine Aquaculture (NES). It was understood by the MARWG that the NES would provide the regulatory framework for the re-consenting of existing marine farms (but not new marine farms). Aside from the public information available from consultation in 2017, the MARWG did not have the benefit of the draft NES. There was therefore uncertainty regarding the relationship between the outcome of the review process and the NES. However, MPI staff sat on the MARWG and they were able to raise matters of integration and consistency during the review process.

**(iii) Dissenting view of Trevor Offen and Hanneke Kroon**

The representatives of the Kenepuru and Central Sounds Residents Association, Trevor Offen and Hanneke Kroon, have presented the MARWG a paper identifying what in their view are “systematic fundamental flaws” in the starting proposition and therefore the recommendations. This paper is included as Appendix 3;

**(iv) Concern expressed by Rob Schuckard**

Rob Schuckard has found it difficult to assist with a determination of the appropriateness of marine farming in the absence of information to determine the sustainability of marine farming. The reasons for the concern are set out in an Appendix 4.

**(v) Further information**

It is important that the Council and other agencies continue to seek and secure information about the health of Marlborough’s marine environment and the effects of activities on that environment on an ongoing basis. This task could be informed, where

appropriate, by the TAG. The information gathered through this process will inform management responses and future planning processes. Information gaps are identified later in this report.

**(vi) Influence of PMEP hearings on timing of process**

The hearings for the Proposed Marlborough Environment Plan commenced in November 2017. The hearing process created a significant resourcing constraint to continuing the momentum of the MARWG. This was because both staff and MARWG members were directly involved in those hearings. Meetings were only able to be held sporadically in 2018.

**Information gaps**

Cumulative effects of marine farming

22. One of the challenges that the MARWG faced during the process of review was the uncertainty regarding the effects of human activity, including marine farming, on the marine environment of the Marlborough Sounds. The issue of planning in an environment of uncertainty is recorded in full elsewhere in this report.
23. The MARWG has recommended that the Council commence monitoring indicators of cumulative effects. This includes both benthic effects and water column effects.
24. There is a real need for additional data/information on specific matters and at discrete locations to establish the nature of the cause and effect relationship between activities and the adverse effects evident (and perhaps yet to be detected) in the marine environment. The recommendations contained in this report with respect to monitoring seek to ensure that any future review of marine farming provisions is informed by more comprehensive information and therefore involves less uncertainty. In particular, there is a need to commence monitoring appropriate indicators of water column effects. This would be in addition to the recommended monitoring of total free sulphide as an indicator of benthic effects.
25. The Council's Coastal Research and Coastal Monitoring Strategies should reflect the fact that monitoring for cumulative effects is a priority. There may also be an ongoing role for the TAG to inform the development, implementation and review of these strategies.
26. The MARWG also notes that its recommendations limit the potential for growth in marine farming in the enclosed waters of the Marlborough Sounds (compared to the operative Marlborough Sounds Resource Management Plan). This provides the opportunity to monitor

the effect of marine farming from a relatively stable baseline with respect to the intensity of marine farming.

#### Natural and Human Use Values

27. For the most part the CMU values were populated from existing verifiable information. In some instances, the information sources were necessarily anecdotal and, due to the nature of the MARWG, some CMUs have had more detailed anecdotal input than others.

#### Seabird Habitat

28. Important Bird Areas for seabirds have been identified by Forest and Bird for the Marlborough Sounds. However, this work focussed on four species only: King Shag, Fluttering Shearwater, Fairy Prion and Australasian gannet. There are a further four seabird species threatened and a further 11 seabird species at risk. Further work is required to establish the habitat and the status of these seabirds. Such information will prioritise future management and guide research, as well as supporting Policy 11 of the New Zealand Coastal Policy Statement 2010 'To protect indigenous biological diversity in the coastal environment'.

#### **Recommendations on community engagement**

29. The MARWG is aware that the Council has statutory obligations with respect to consulting on any Variation to the PMP, including a requirement to consult with tangata whenua iwi through iwi authorities. The MARWG considers engagement with Marlborough's tangata whenua iwi to be particularly important in this case given that the iwi authorities have not been part of the review process undertaken by the MARWG.
30. The MARWG is also aware that the Council has undertaken consultation on marine farming in the past as part of the review of the operative planning documents, and therefore already has a considerable body of community feedback on the management of marine farming. Having said this, it is very important that the Council receives community feedback on any specific Council proposal that derives from the MARWG's recommendations.
31. As a minimum, that engagement should include consultation with marine farmers on the basis that any Variation will directly influence the location and operation of existing marine farms in Marlborough, especially the Marlborough Sounds. That consultation should occur prior to the notification of any Variation.
32. In terms of broader community engagement, the MARWG recommends that "drop in" days be considered as an alternative to public meetings. Such days provide an opportunity to gain information about the proposal in both an informative and informal way. It also provides



greater flexibility to the community in terms of time of attendance. The information days could occur in the following locations:

- Blenheim;
- Picton;
- Havelock;
- Waitaria Bay;
- Okiwi Bay.

33. The MARWG understands that the role it has played in the review process is now complete. The MARWG expresses its appreciation of the opportunity to be involved in the review process. The forum provided marine farmers, community representatives and Crown agencies the opportunity to hear the views of other MARWG members directly (rather than via the Council). That conversation in itself enabled the participants to gain a good understanding of the reasons for those views. The ability to provide the recommendations contained in this report reflects the collective understanding that was built through the review process.
34. Some members of the MARWG may wish to take an active part in community consultation. That may be through attendance at drop in days (if this recommendation is adopted) or through the making of submissions. It has been clear to the ARWG from the outset of the review process that involvement in the review does not preclude participation in subsequent statutory processes.

## **Appendix 1: Membership of the Marlborough Aquaculture Review Working Group and Technical Advisory Group**

### **Marlborough Aquaculture Review Working Group**

Graeme Coates (Marine Farming Association)

Jono Large (Marine Farming Association)

Ted Culley (Sanford Ltd)

Milan Talley (Talleys Ltd)

John Young (Clearwater Mussels Ltd)

Rebecca Clarkson (Aquaculture New Zealand Ltd)

Rob Schuckard (Sounds Advisory Group)

Judy Hellstrom (Sounds Advisory Group)

Eric Jorgensen (Marlborough Sounds Integrated Management Trust)

Trevor Offen and (as an alternate) Hanneke Kroon (Kenepuru and Central Sounds Residents Association)

Michael Neilson (MPI)

Lionel Solly (DoC)

Pere Hawes (MDC)

Helen Marr (Consultant Planner, Perception Planning)

### **Technical Advisory Group:**

Dr Richard Ford (MPI)

Dr Dave Taylor (Cawthron Institute)

James Bentley (Boffa Miskell Ltd)

Luke Grogan (Harbourmaster, MDC)

Andrew Baxter (DoC)

Dr Niall Broekhuizen (NIWA)

Dr Steve Urlich (MDC)

**Appendix 2: Marlborough District Council Position Paper for  
MARWG**

**MARLBOROUGH DISTRICT COUNCIL  
POSITION PAPER FOR AQUACULTURE REVIEW  
WORKING GROUP**

**22 March 2017**

**Confidentiality and LGOIMA Status**

*This report is confidential and for the purpose of free and frank exchange of information to assist the Marlborough District Council to prepare planning instruments. It must not be copied, relayed or used, except with the authority of the Marlborough District Council.*

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## 1 Background

1.1 The Marlborough District Council (“MDC”) planned to notify provisions regulating aquaculture in the Coastal Marine Area (“CMA”) as part of its notified MEP. The decision was made to withdraw those provisions. The Council was not satisfied the proposed provisions adequately gave effect to Policy 8 of the New Zealand Coastal Policy Statement 2010;

1.2 The current distribution of marine farms is set out in **Appendix 1**.

1.3 MDC has carried out significant consultation in relation to aquaculture in the CMA since the review commenced in 2010. That consultation is sufficient for it to form **preliminary** views as to the approach which should be adopted for the management of aquaculture in the CMA.

1.4 This approach is also influenced by the provisions of the New Zealand Coastal Policy Statement 2010 (NZCPS), particularly Policy 8. The proposed MEP must give effect to the provisions of the NZCPS.

1.5 The purpose of the working group meetings is to invite participants to contribute to the refinement of the framework that MDC now proposes.

## 2 The proposed aquaculture framework

2.1 There will be an aquaculture section of the MEP that will not replicate and will implement the notified objectives and policies in Volume 1. The aquaculture section will contain objectives and policies and rules specific to the management of aquaculture;

2.2 Within the CMA, 45 Coastal Management Units (**CMU**) will be identified based on geographical factors. Those units have been identified and shown in **Appendix 2**. In those CMUs there will be identified Aquaculture Management Areas (“**AMAs**”). The intent is to create AMAs in each CMU where marine farming already exists. These will be discrete areas that correspond to the size and arrangement of existing marine farms. The number of existing marine farms that relate to each AMA will vary. The AMA will be arranged so they are at least 100m from MLWM. This will provide for a continuation of the pattern of ribbon development enabling an appropriate marine farm arrangement having regard to landscape, navigation and public access values set out in a table in **Appendix 3**.

2.3 For each AMA there will be a schedule that references the CMU and the identity number of each marine farm within it. The size of the AMA will be registered in the schedule together with a list of permitted marine farms. Rules will be employed to identify those marine farms that are to transition to that AMA(s) through the re-consenting process.

2.4 In each AMA(s), space will be allocated as follows:

- (i) Existing coastal permit holders will have priority access to the AMA(s) where these are currently sited adjacent to, encroaching on, or within a proposed AMA(s);

- (ii) Coastal permit holders will have their permit applications processed as a controlled activity where the area of the marine farm is unchanged and it is to be located entirely within an AMA;
- (iii) Conditions may be set on a range of matters including monitoring, navigation, reporting etc.; and
- (iv) Coastal permits will usually be granted for 30 years.

2.5 As the working group considers the values that exist within each CMU it may identify opportunities for new AMAs. Given this is new space, applications for coastal permits will be assessed as discretionary activities.

2.6 The applications will be subject to a policy framework that will:

- (i) Not allow development of mid-bay farms; and
- (ii) Preserve headlands and other significant features where aquaculture currently does not exist.

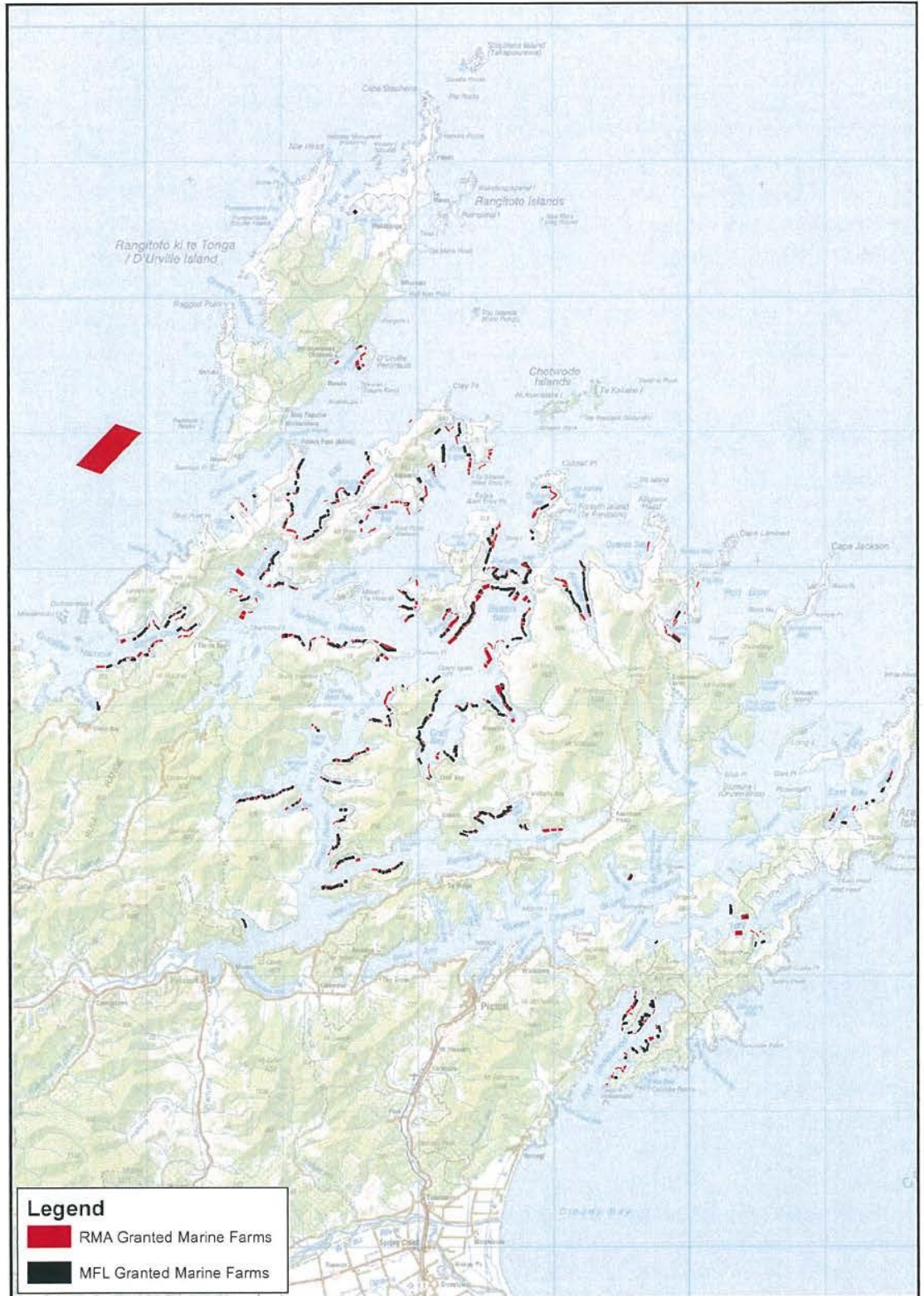
2.7 Policy will prioritise the allocation of alternative space, where available, to marine farm permit holders that choose to replace the existing marine farms currently located within ONFLs or Areas of Ecological Significance or within CMZ1 (MSRMP);

### **3 Way forward**

3.1 MDC would like feedback on the proposed framework. It would also like feedback on the values of each CMU and any assessment of the capacity for additional development within each CMU as well as the arrangement of AMAs.

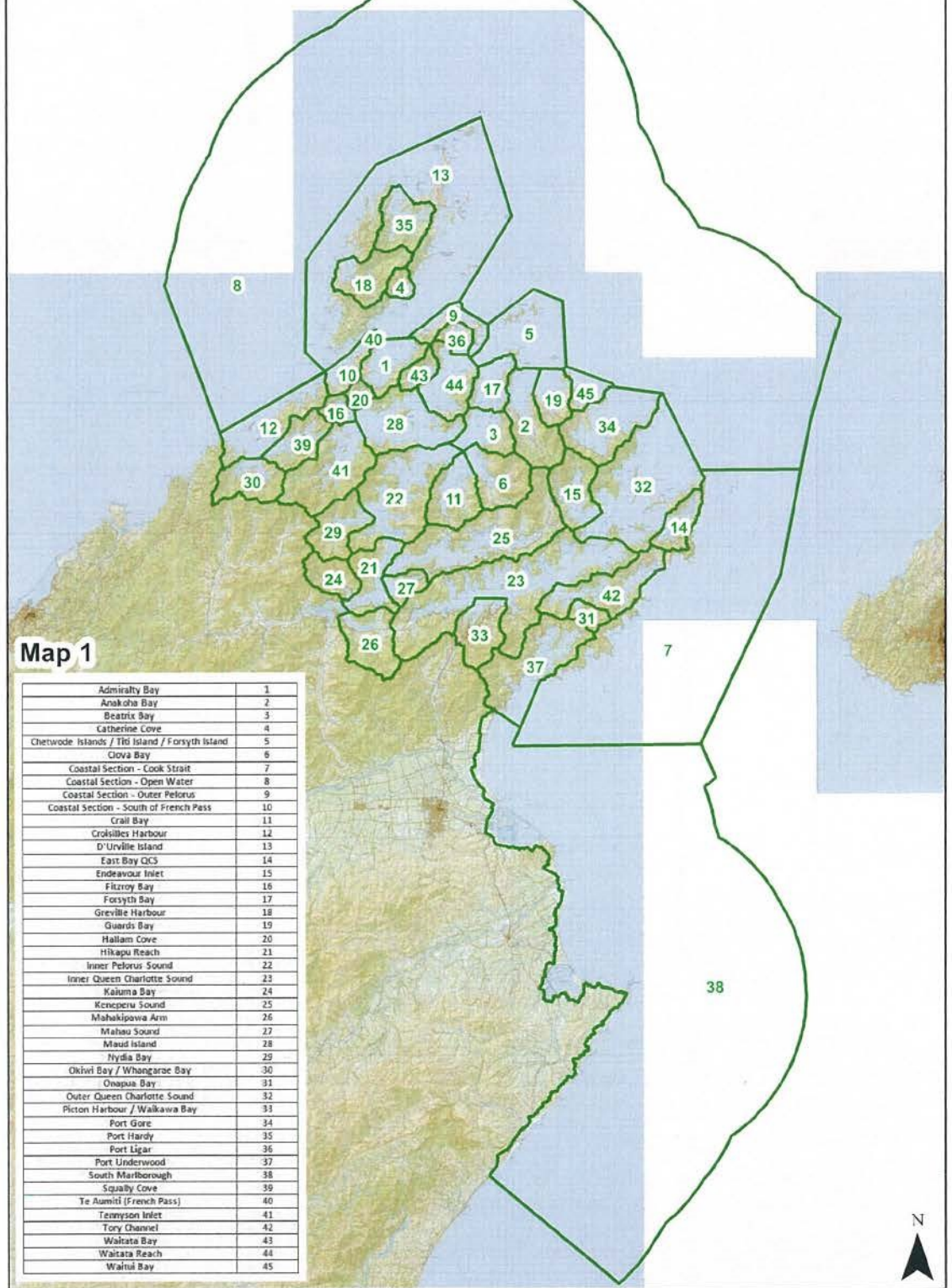
**Appendix 1**



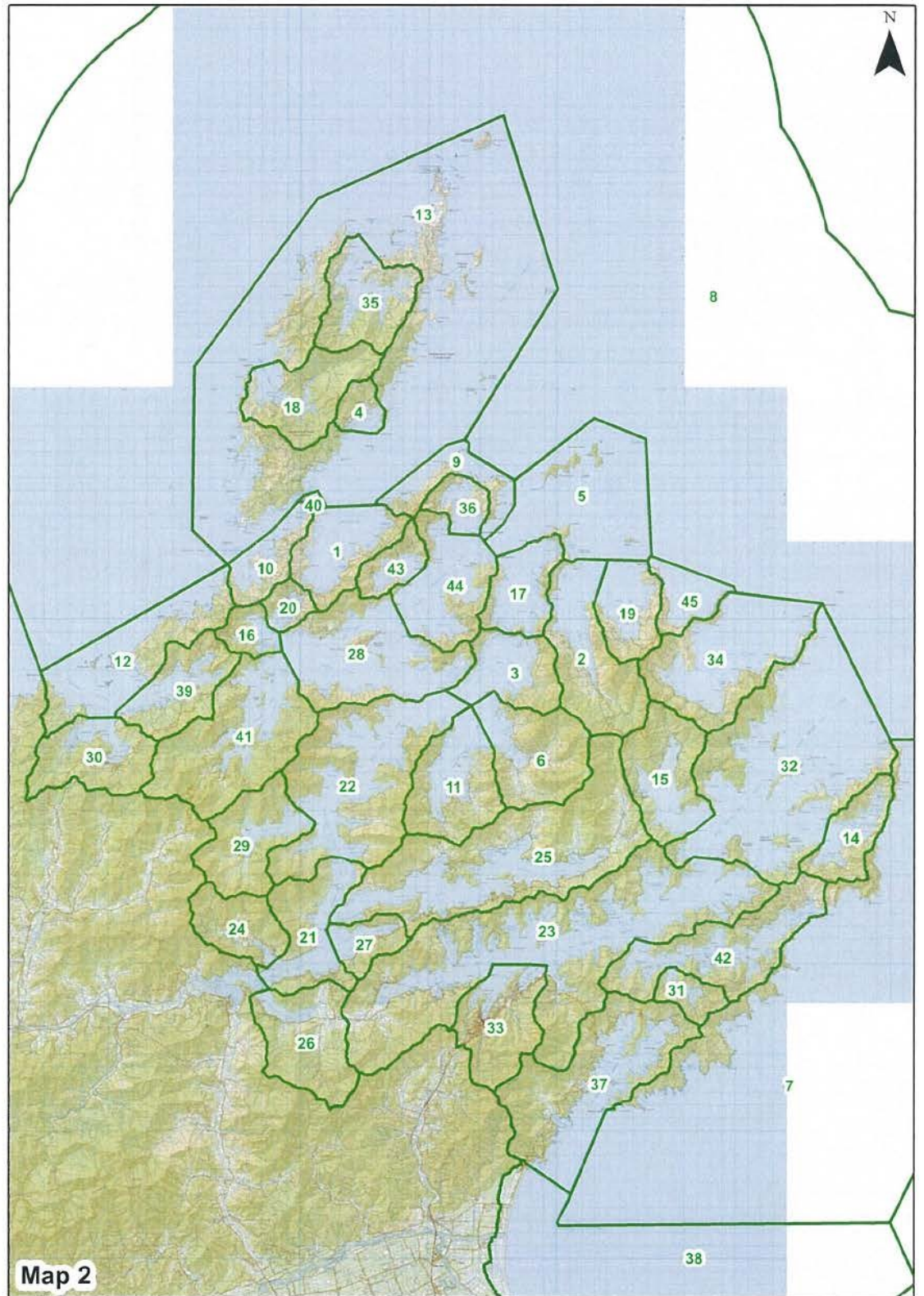


**Appendix 2**

### Marine Space Utilisation - Spatial Value Planning - Unit Overview







## Appendix 3:

## Kenepuru & Central Sounds



## Residents Association Inc.

### Dissenting View of Trevor Offen and Hanneke Kroon

### Aquaculture Review Working Group

28 June 2019

#### Review Working Group

#### Dissenting Position – Trevor Offen and Hanneke Kroon representing the Kenepuru and Central Sounds Residents' Association (KCSRA)

This memorandum records the dissenting position and recommendations of Trevor Offen and Hanneke Kroon, representing the Kenepuru and Central Sounds Residents Association Inc, on the proposed aquaculture rules and Proposals for the Marlborough Environment Plan (MEP) that are to be presented to the Marlborough District Council (the Proposals). It is summary level only and records only our main points of dissension. Our dissension points highlight what we believe to be systemic and fundamental flaws in the Proposals.

For clarity we note that the scope of the Aquaculture Review Working Group (Group) discussions were expressly agreed to be confined to bi-valve marine farming.

In the following we firstly summarise what our recommendations are. Following that we briefly explain the reasons for our recommendations.

#### Our Recommendations :

1. That either:
  - a) The Proposals be amended to incorporate a fully discretionary activity consenting regime for each Aquaculture Management Area (AMA) through which cumulative effects can be fully and publicly assessed at 20 year intervals and from which appropriate thresholds for marine farming within the AMA can be determined. Allocations for resource consents within an AMA would then be determined by the thresholds determined by the AMA resource consent. This is KCSRA's preferred recommendation; **or**
  - b) AMAs be reconsidered in advance of notification of the Proposals having a full and proper regard to cumulative effects, including in particular the requirements of New Zealand Coastal Policy Statement 2010 (NZCPS) policies 13(1(b), 15(b), 7, 14 (among others).

If such a system is not adopted then in our view it will be necessary for the re-consenting of all existing marine farms to be fully discretionary - as these cumulative effect matters will otherwise need to be properly assessed and addressed at a farm consent level.

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#### Kenepuru & Central Sounds Residents Association Inc.

President	Andrew Caddie	president@kcsra.org.nz
Vice President	Tom Wright	vicepresident@kcsra.org.nz
Secretary		secretary@kcsra.org.nz
Treasurer	Stefan Schulz	treasurer@kcsra.org.nz

2. That if 1(b) above is adopted future consenting within AMA's is discretionary to accommodate the recognition of evolving public values in the Sounds.
3. That a case study based adaptive management regime be adopted to address water column effects in low flush intensively farmed Coastal Management Units (CMU) or AMA's – including in particular the effects of zooplankton depletion on the food web and biodiversity.
4. That AMA's be contained within a prescribed ribbon of between 100 and 250m from mean low water mark - rather than a 100 – 300m ribbon.
5. That there be no policy of relocating marine farming activity found to be inappropriate. In this regard AMA's should not extend outside of the prescribed ribbon in order to facilitate the relocation of existing farm space that is determined inappropriate elsewhere, or because existing farm space in the 50 – 100m ribbon cannot be relocated to the outside of the farm or elsewhere.
6. That the absolute protection from marine farming as proposed for Queen Charlotte Sound be extended to, at the least, all of the existing Coastal Marine Zone 1 areas in the Kenepuru and Pelorus Sound.
7. That a threshold of extraordinary activity be included for plan change applications within the Kenepuru and Pelorus Sound.
8. That spatial limits or thresholds be put on applications for open coast marine farming.
9. That resource consent allocations for marine farm space within AMAs be publicly tendered.
10. That this dissenting position be included in any Marlborough District Council (MDC) public consultation documentation.

## **Background and Reasons for Recommendations**

### ***Recommendation 1 - Aquaculture Management Areas and Cumulative Effects***

We support the use of AMAs to the end that they stand to facilitate much greater efficacy in the assessment and management of the environmental effects of aquaculture activity - namely by a disciplined focus at an AMA scale rather than at a farm by farm scale.

Unfortunately, whilst we formally proposed ongoing environmental effect assessments under the MEP at an AMA level very early on in the Group, this was not picked up on by industry or MDC participants. As a result the utility of AMAs under the Proposals is limited to that of spatial delineation. They simply function as lines in the water – rather than as areas that are appropriate for consideration of the activity and where properly determined environmental thresholds can be efficiently applied.

### ***Baseline***

The AMAs have been developed subject to the baseline premise put up by the MDC that all existing marine farming can be accommodated within the enclosed waters of the Sounds. As a consequence AMAs were set out through a process of MDC mapping around the existing farming activity - but starting at 100m and going out to 300m (or more if an existing farm already extended beyond 300m). Almost all space that might be considered appropriate for marine farming within the Sounds has already been applied for. As a result there were limited relocation options and only a small number of adjustments were made to

existing farm density for farm specific issues and for outstanding natural landscape value issues.

It is important to note that whilst the Group's framework was set up to facilitate values based assessments of CMU's, the process of determining a discrete and comprehensive set of values for all CMU's was abandoned early on by the Group, it proceeding with a core set of generic values perceived as common throughout the Sounds. Moreover, in our view the process of setting AMA's was not driven by these core values. Rather, and as noted, it was significantly constrained by the MDC principle of fitting in all existing farms. Whilst values were periodically raised, their recognition was generally taken as contingent on alternative space being found for the infringing marine farming consent(s).

Most importantly, no assessment of the *cumulative effects* of the existing aquaculture activity on landscape or natural character (including ecological) values was undertaken in determining the AMAs.

Our position is that the AMAs in the Proposals have thus not been properly determined, notably on a cumulative natural character (including ecological) and landscape level. This plan development dilemma has been exacerbated by the process of notifying landscape and natural character Proposals to be included within the MEP without a proper understanding of how those Proposals could be impacted by the aquaculture Proposals.

### **Recommendation 2 – Activity Status**

If recommendation 1(b) is adopted then the Proposed adoption of controlled activity status for future consenting is inappropriate. This is because there will remain a need to facilitate the consideration of effects of AMA's as public values in the Sounds change in the future.

Controlled activity status means that resource consent applications cannot be denied, irrespective of effects. The adoption of controlled activity status for existing marine farming was proposed by MDC from the outset of the Group and was never an agenda item for Group discussion. Moreover, a basis for the adoption of controlled activity status for existing marine farming has never been formally proffered to the Group. Indications are that it is seen by MDC as a means of affording consenting efficiency and certainty to the industry.

In our view adopting a regime that sacrifices the proper assessment and testing of public values in the coastal marine area, because that is more efficient and certain, frustrates core Resource Management Act 1991 (RMA) principles.

This is exacerbated by the failure of the Proposals to address the cumulative effects of the existing level of farming. In parts of the Sounds marine farming should not proceed at the existing levels, let alone be locked in for the future at this level.

The failure of the Group to consider using AMAs as the ongoing focus for disciplined environmental impact assessments, rather than individual farms, stands as a missed opportunity to effect a much more efficient consenting regime without sacrificing the ongoing consideration of publicly held values in the Sounds.

Controlled activity status is also inappropriate at a higher public policy level. The coastal marine area is a public asset that must be used optimally. Public values will evolve in highly valued areas such as the Marlborough Sounds and these values should not be disregarded through controlled activity status. That can only frustrate the optimal use of what are highly valued public resources. Citing certainty for industry investment is no answer to this. It may be a consideration for the assessment of the appropriateness of marine farming, but it is not a reason for not properly assessing it at all.

We note that similar proposals for controlled activity status for aquaculture were recommended to Government by the Sir Doug Kidd led *Aquaculture Advisory Ministerial Panel* in 2010 in the lead up to the 2011 RMA aquaculture provision reforms. The recommendation was not accepted by the then Government.

Recommendations 1a and 1b afford efficacy in the re-consenting process whilst enabling cumulative effects to be properly assessed, considered and managed on an on-going basis. However, in our view, a fully discretionary farm by farm consenting regime is the only appropriate planning approach if cumulative effects are not otherwise properly assessed, considered and managed on an on-going basis.

### ***Recommendation 3 - Cumulative Effects - Zooplankton***

Cumulate effects on ecological natural character values warrant a particular focus. There are still some large information gaps in mussel farming ecological effects. Nonetheless the existing science, including the recent NIWA Biophysical Model (NBPM), raise what we consider to be serious red flags around the existing level of marine farming activity, in particular in low flush intensively farmed areas. Most significant are the NBPM predicted effects of existing farming on zooplankton<sup>1</sup>. We raised this matter with the Group early on, including the tabling of an expert opinion that ecological carrying capacity is likely being exceeded in some central Sounds areas, and reiterated our concerns at various points throughout the Group process. We were advised by MDC that these matters would be addressed by way of adaptive management in the Proposals.

Written questions to the ecological Technical Advisory Group (TAG) directed squarely at the impact of zooplankton<sup>2</sup> depletion were responded to in writing by Dr Ulrich, the then MDC Coastal Scientist. His response, with all due respect, did not answer the questions raised.

The result is that the Proposals make no attempt at all to do any of the following fundamental requirements of an adaptive management regime, namely:

- identify the impact of existing marine farming on zooplankton, and thus the food web, in at risk areas; and
- identify how this transgresses into changes in biodiversity; and
- identify an acceptable level of change to biodiversity from marine farming activities in these areas; and
- identify the change in marine farming activity required (if any) in these at risk areas so as to fall within that band of acceptable level of biodiversity effect; and
- Provide a mechanism to adapt to the level of marine farming change required (if any).

Monitoring is instead promoted as a solution to information gaps. However, it must be understood that no amount of 'monitoring' from now on is ever going to identify what impact the existing level of marine farming is already having on the ecosystems in these at risk areas. This is because there is no baseline data to compare future monitoring data to. Monitoring will only ever report variations in the likes of zooplankton levels over what they are already with the existing marine farming activity.

Where there is no baseline information available, such as we face with the existing marine farming in the Sounds, then computer modelling must necessarily become a focus. The

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<sup>1</sup> See also the pages 3-4 of the Rob Schuckard paper included with the ARWG Recommendations *Issues – a brief analysis of 'effect of mussel farming'* 15 April 2019



NBPM is the most recent and comprehensive tool available in this respect. It reports zooplankton depletion of up to 90% or more in some at risk areas.

Our position is that positive and effective steps *must* be taken to address these existing marine farming effects now in areas identified as of concern by the NBPM.

Our recommendation is that the effects of marine farming in the at risk areas be empirically determined. This could be done initially on a case study basis, rather than through a broad application across all at risk areas. For example:

- A representative low flush intensively farmed area would be selected.
- A base level survey of biodiversity and water column characteristics in the case study area would be undertaken.
- A safe level of marine farming for the selected area would be determined using modern models and tools, such as the NBPM and calculations prescribed by the Aquaculture Stewardship Council Bivalve Standard<sup>1</sup>.
- Marine farming in the case study area would then be managed down to the safe levels determined by the modern models and calculations.
- Changes in biodiversity and water quality characteristics post the adoption of safe farming levels would be measured and calibrated against concurrent before and after control site surveys to eliminate non-aquaculture causation.

The result would be much needed empirical evidence of the cumulative effects of intensive mussel farming on ecosystem values in the at risk low flush areas of the Sounds.

#### ***Recommendation 4 – Ribbon Size***

The existing plan indicates a ribbon appropriate for marine farm development of 50 to 200m from mean low water mark – a 150m wide ribbon<sup>2</sup>. It was put to the Group by MDC from the outset that this be extended in the MEP to a 200m wide ribbon – a 33% increase in area appropriate for marine farming. Whilst some farms have been consented beyond 200m under the existing plan, in our view many, if not most of these, have been so consented without any proper regard to cumulative effects and before the introduction of the environmental standards now promulgated by the NZCPS.

If recommendations 1a or 1b are adopted then ribbon size will be properly determined and our recommendation 4 becomes redundant. Failing that, and given the existing level of marine farming cannot be taken as appropriate without a proper assessment and management of cumulative effects, it follows that a 33% increase in area indicated as appropriate for marine farming by the MEP must also be inappropriate.

#### ***Recommendation 5 – Relocation Policy***

A resource consent holder has no right to a renewal of that resource consent and as far as we are aware there is no RMA or other legal mandate for MDC to assume that such an entitlement exists. A policy of relocating inappropriate marine farm consents is thus difficult to rationalise. We acknowledge that recognising the social and economic values of marine farming is appropriate, but that does not elevate the consideration of the relocation of existing activity to something that is above that of a proposal for new activity.

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<sup>1</sup> ASC Bivalve Standard – version 1.0 Jan 2012. This was recommended to the Group by TAG as an effective triage tool.

<sup>2</sup> This is promulgated in the existing plan through marine farming being a discretionary activity within the 150m ribbon and a non-complying activity otherwise.

In our view this misconceived policy has further frustrated an appropriate determination of AMA's by the Group, notably through the perceived need to relocate inappropriate consents in an approach of 'less inappropriate development is appropriate development'. This approach manifested itself in various ways including:

- AMAs being extended beyond 300m to accommodate existing but inappropriate consents from elsewhere; and
- AMAs being extended beyond 300m to accommodate lines of a farm within the 50-100m zone; and
- AMAs being proposed in some existing Coastal Marine Zone One areas only because space was 'needed' to accommodate existing consents or because existing consents could not be relocated; and
- Some parts of an AMA being left at 50m from shore notwithstanding that all other farms in the AMA are set out at 100m.

### **Recommendation 6 – Absolute Protection**

The Proposals afford absolute protection from aquaculture development to Queen Charlotte Sound to protect *'the particularly high recreational, scenic, and amenity values present in that area.'*

This policy suggests that no parts of the Pelorus or Kenepuru Sound holds such values. We see this policy basis as both factually flawed and inappropriately sacrificial to the Pelorus and Kenepuru Sounds.

The existing Marlborough Sounds Resource Management Plan (MSRMP) recognises that there are such areas in the Pelorus and Kenepuru Sounds, notably the Coastal Marine Zone One areas. The current MSRMP identifies these areas *"as being where marine farming will have a significant adverse effect on navigational safety, recreational opportunities, natural character, ecological systems, or cultural, residential or amenity values."*<sup>1</sup>

Existing resource consents within these areas are recognised as a planning anomaly<sup>2</sup>.

No basis was made out to the Group for failing to afford to these areas the same absolute protection that is afforded to Queen Charlotte Sound. In our view this was inappropriately driven by the MDC's position of fitting all existing resource consents in.

### **Recommendation 7 – Plan Change Threshold**

The Proposals contradict themselves by declaring that the Sounds are "full or approaching full" yet facilitate plan changes adding further AMAs in the inner Sounds without any substantial policy threshold beyond that as is required for marine farming consents within existing AMAs.

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<sup>1</sup> Policies 9.2.1.1.1 and 9.2.1.1.6 and Method 9.2.2

<sup>2</sup> Paragraph 233 - *Port Gore Marine Farms Ltd v Marlborough District Council* Decision No. [2012] NZEnvC 72 – *"Because the activity is discretionary the council considered that the Sounds Plan recognised and anticipated marine farming at this site (provided the effects could be mitigated) and therefore a farm was in keeping with the objectives and policies of the planning framework. With respect that was rather facile. The site is in the middle of the CMZ1 where all marine farming is prohibited, presumably because it does not meet the objectives and policies of the various planning instruments. The fact that mussel farming on the site is (anomalously) a discretionary activity must mean that just as there is no presumption that a farm on it does not meet the relevant objectives and policies, similarly there is no presumption that it does. The application should be considered on its merits and the council failed to do that."*

This is all the more alarming given there is no policy whatsoever addressing the cumulative effect of marine farming on biodiversity values through zooplankton depletion, food web disruption and other water column effects.

Given the inner Sounds are recognised as “full or approaching full” it must follow, in our view, that a plan change application for yet further AMA’s would need to meet an extraordinary activity test. For example, this could require that the plan change is required to facilitate a marine farming activity that could not, if space was available, be undertaken within existing AMA areas.

### ***Recommendation 8 - Open Coastal Marine Farming***

We were open to the consideration of open coastal marine farming but only on the basis that the areas were appropriate for marine farming *and* would be used only to replace some of the existing inappropriate mussel farming in intensively farmed low flush/low current inner sounds areas. This is not reflected in the Proposals.

The identification of virtually the entire outer Sounds environment as open for marine farming applications is a huge shift in policy position that in our view was promoted within the Group without any assessment of the environmental risks or other wider implications, such as the uncertainties it will impose on other users holding values in this vast area. There is also a risk of a gold rush of speculators seeking consent rights in this vast area.

Because of this there should, at the least, be limits imposed on applications for marine farming activity in open coastal waters. The objective being to enable applications and development to be contained and controlled whilst both the potential effects, and the public’s appreciation of such on their values in the area, are well settled in.

### ***Recommendation 9 - Allocation of Resource Consent Application Rights***

There are significant issues of public equity and fairness around the law and practice of existing consent holders having pre-emptive rights to the free use of public marine resources.

This pre-emptive right is also the cause of much of the conflict around marine farming consenting in the Marlborough Sounds. This is because consent holders stand to lose the benefit of their pre-emptive right to free use of the public resource if marine farming activity is found to be inappropriate. Thus, existing consent holders have as an incentive the motivation to protect “their” consented space by doing whatever they can to argue that their existing activity is appropriate development.

The Proposals make no attempt to positively address these allocation issues. We do not support any allocation regime that simply grants existing consent holders pre-emptive rights to the free use of public marine resources.

No case was proffered to the Group for the adoption of the consent allocation system in the Proposals. Our position is that other allocation methods, such as a public tendering system<sup>1</sup>, will address both the public equity issue and the consenting conflict issues that currently exist and should thus be the preferred option. In our view, a properly considered public tendering system will:

- Identify uneconomic farm areas.<sup>2</sup> Uneconomic farms or areas will not be tendered for.

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<sup>1</sup> Tendering is the default consent right allocation system under the RMA - section 165H

<sup>2</sup> We requested marine farm yield data to facilitate this through the Group but were denied the information.

- Tendering of consent rights will not, of itself, affect available marine farm space or jobs. Tenderers will only pay up to what still leaves a fully viable business for them.
- Industry infrastructure would not be affected. If existing farmers are out-tendered then successful tenderers will still need access to infrastructure - and the market will allocate that infrastructure accordingly. Many marine farm consents are already leased or contracted out to other operators.
- It is fair in that the water space is public and so pre-emptive rights for marine farming resource consents should not be given to anybody.
- It would help financially facilitate a properly designed and implemented case study and monitoring protocol for existing (and future) marine farming activity in the Marlborough Sounds.
- It will eliminate the acrimonious nature of the current consenting process – applicants will not be motivated by the promise of super profits through the effective ownership of water space rights into the future if they are successful.

### ***Recommendation 10 – Inclusion of Dissenting Position in Public Consultation***

We believe our dissenting position raises important issues and offers considered comment and alternative recommendations in key areas. In our view it is important that our dissenting position be incorporated into any public consultation process to ensure that that process is open, balanced and objective.

## **Section 32 Report**

The Association requires that this dissenting memorandum also form part of the Section 32 materials when that report is prepared.

## **Further Information**

KCSRA would be happy speak to councillors before or when the Proposals are tabled or to field any questions or queries from any councillor on this memorandum. To this end please feel free to contact KCSRA through the email given below.

For and on behalf of the Kenepuru and Central Sounds Residents' Association  
Inc

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Hanneke Kroon  
28 June 2019

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## **Appendix 4: Concern of Rob Schuckard**

## Issues – a brief analysis of ‘effect of mussel farming’.

Rob Schuckard - 15<sup>th</sup> April 2019

### Marlborough Aquaculture Review Working Group

Appropriateness of the allocation of marine farming also requires an overall assessment of its ‘effect’ on the wider environment being the result of the spatial allocation. Such an analysis is essential to ensure that matters of sustainability are met to create certainty of outcomes for both industry and people in the Sounds coastal environment. Such analysis has to take into account a declining state of the biodiversity.

Without such analysis, the guiding principles provided to ARWG, in particular the maintenance of the same level of aquaculture in the inner sounds, bear the risk of a certain bias about sustainability.

Impact of mussel farms on the benthic environment relate to changes in benthic biogeochemistry, resulting in a high abundance of nematodes and polychaetes tolerant of enriched, low-oxygen conditions<sup>10</sup>. Bio-turbators like polychaetes play a major role in the breakdown, subduction and incorporation of organic matter into sediments as well as the aeration of the benthic environment. Bio-turbators recycle organic material through nitrification<sup>11</sup> and denitrification processes. Tube building polychaetes (e.g. *Maldanidae*), have been recorded to rapidly subduct freshly deposited algal carbon and inorganic materials to a depth of 10cm or more in the sediment column. They play a fundamental role in the recycling of organic material<sup>12</sup>.

A shallower redox depth<sup>13</sup> through higher organic matter content results in a reduction of abundances of some taxa relatively intolerant of conditions below the farms (but increases

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<sup>10</sup> Taylor, D., Knight, B., Atalah, J., Clement, D., Clark, D., Forrest, R. and Keeley, N. 2011. Assessment of the Environmental Effects of Converting a Mussel Farm to a Finfish Farm, MF8230, Beatrix Bay. Cawthron Institute Report No. 2054.

<sup>11</sup> Nitrification is the aerobic process where bacteria change ammonia to nitrite and nitrite to nitrate. Denitrification is the anaerobic process where other bacterial species can take nitrate and change it back to nitrogen gas.

<sup>12</sup> Levin, L., Blair, N., DeMaster, D., Plaia, G., Fornes, W., Martin, C., and Thomas, C.. 1997. Rapid subduction of organic matter by maldanid polychaetes on the North Carolina slope. *Journal of Marine Research* 55:595-611.

<sup>13</sup> Organic enrichment of sediments usually leads to reduced conditions which equate to “bad” sediment quality, wherein natural benthic communities undergo substantial changes. The oxidation-reduction (redox) conditions in surface sediments depend on the degree of organic enrichment.

in abundance of other species). This is an effect of the activity<sup>14</sup>. Taxa that became absent underneath a mussel farm compared to the control site were *Maldanidae*, a very important polychaete bioturbator and prey species for a variety of flatfish.

Sedimentation from mussel farms cause an increase of oxygen consumption through changed biogeochemical cycles of N and P. Anaerobic conditions with the release of hydrogen sulphide will result in significant reductions of in-faunal species abundance<sup>15</sup>. A decreased ecosystem performance coincides with a decreased biodiversity<sup>16</sup>. In Beatrix Bay between 250 and 400 tonnes of shell, mussels and sediment is released under each hectare of farm each year. For the 304 hectares (approximately) of current farms in e.g. Beatrix Bay, a minimum of 76,000 tonnes of sediment<sup>17</sup> is deposited.

An annual estimate for nitrogen extraction through mussels from the Marlborough Sounds has been estimated to be between 373 tonnes<sup>18</sup> to 266 tonnes for the Pelorus Sound and 11.8 tonnes for the Queen Charlotte Sound<sup>19</sup>. Where this removal of nitrogen is an ecosystem service, the spatial context and ecosystem occupancy of marine farms compared to the serviced area has never been taken in consideration. Where there is a net removal of phosphorus and nitrogen from the ecosystem in the form of mussel meat, mussel farms increase the retention time of both nutrients in the coastal area, through the deposition of faeces and pseudo-faeces on the sea-bed. The amount of nitrogen associated with deposition is approximately twice of what is harvested and the amount of phosphorus is approximately five times higher<sup>20</sup>.

Denitrification and nitrification are processes of ultimate importance to ecosystem functionality of the Marlborough Sounds and are integrated in the biophysical modelling of these coastal waters. Denitrification is the anaerobic process where other bacterial species can take nitrate and change it back to nitrogen gas. In the '*with denitrification*' scenarios, it

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<sup>14</sup> Brown, S., Stenton-Dozey, J., Hadfield, M., Cairney, D.. 2009. Fisheries resource impact assessment for a marine farming permit application in Horse Bay, Pelorus Sound, Site U990821. NIWA Client Report:2009-039, Sanford Havelock.

<sup>15</sup> Vaquer-Sunyer, R., Duarte, C.M. 2010. Sulfide exposure accelerates hypoxia for marine biodiversity. *Proceedings of the National Academy of Sciences* 105. 1542-15457.

<sup>16</sup> Lohrer, A.M., Thrush, S.F. and Gibbs, M.M. 2004. Bioturbators enhance ecosystem function through complex biogeochemical interactions. *Nature*: 7012: 1092-1095.

<sup>17</sup> *R.J.Davidson Trust v Marlborough District Council* [2016] NZEnvC 81[59]

<sup>18</sup> Taylor, D., Keeley, N., Forrest, R., Knight, B., Dunmore, R.. 2010. Assessment of the environmental effects of converting a mussel farm to salmon farm, MF 8080, Port Ligar. Report No. 1883.

<sup>19</sup> Gillespie, P., Knight, B. and MacKenzie, L. 2011. The New Zealand King Salmon Company Limited: Assessment of Environmental Effects – Water Column. Report No. 1985 – August 2011.

<sup>20</sup> Brigolin, D., Maschio, G.D., Rampazzo, F., Giani, M., Pasters, R.. 2009. An individual-based population dynamic model for estimating biomass yield and nutrient fluxes through an off-shore mussel (*Mytilus galloprovincialis*) farm. *Estuarine, Coastal and Shelf Science* 82: 365-376.

is assumed that 75% of any particulate organic nitrogen (from any source) which settles to the bed will be lost from the system through denitrification (whilst the remaining 25% is returned to the water column as ammonium)<sup>21</sup>.

Effect of grazing suspended mussels on a wide range of invertebrate spawning products and zooplankton through digestion of larvae in the planktonic stage is recorded; while initial support for larviphagy was also recorded in a preliminary study on mussel feeding in the New Zealand situation<sup>22</sup>. Consumption of zooplankton and fish eggs by suspension-feeding bivalves has now, for some time, been recognized as a common feeding strategy of bivalves of all types. Where bivalves formerly considered to feed only on phytoplankton they also can digest a wide range of zooplankton and fish eggs<sup>23,24,25,26,27,28</sup>. The larval grazing bivalves in filter feeding aquaculture operations have been raised by Ministry of Primary Industry (MPI)<sup>29</sup> as an 'effect':

*'The presence of high densities of filter feeders could reduce larval recruitment into fishery populations through consumption of fish eggs and larvae by farmed mussels and oysters.'*

and

*'Effects occur within the farm but may have longer-term consequences at the population level, depending on the species and population range.'*

and

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<sup>21</sup> Broekhuizen, N., Hadfield, M., Plew, D. 2015. A biophysical model for the Marlborough Sounds. Part 2: Pelorus Sound. NIWA Client Report No. CHC2014-130. NIWA Project: MDC13301.

<sup>22</sup> Robinson, K., Zeldis, J., and Ross, A. 2002. Do mussels eat zooplankton. *Water and Atmosphere* 10(3) 2002.

<sup>23</sup> Lehane, C; Davenport, J. (2002). Ingestion of mesozooplankton by three species of bivalve: *Mytilus edulis*, *Cerastoderma edule* and *Aequipecten opercularis*. *Journal of the Marine Biological Association U.K.* 82:3999/1–6

<sup>24</sup> Wong, W.H., Levinton, J.S. (2006). The trophic linkage between zooplankton and benthic suspension feeders: direct evidence from analyses of bivalve fecal pellets. *Marine Biology* 148: 799-805.

<sup>25</sup> Troost, K., Kamermans, P., and Wolff, W.J.. 2008. Larviphagy in native bivalves and an introduced oyster. *Journal Of Sea Research* 60: 157-163.

<sup>26</sup> Lonsdale, D.J., Cerrato, R.M., Holland, R., Mass, A., Holt, L., Schaffner, R.A., Pan, J., Caron, D.A.. 2009. Influence of suspension-feeding bivalves on the pelagic food webs of shallow, coastal embayments. *Aquatic Biology* 6:263-279.

<sup>27</sup> Troost, K., Stamhuis, E.J., and van Duren, L.A.. 2009. Feeding current characteristics of three morphologically different bivalve suspension feeders, *Crassostrea gigas*, *Mytilus edulis*, and *Cerastoderma edule* in relation to food competition. *Marine Biology (Dutch waters)* Describes lab set-ups for feeding rates data suitable for geoduck studies. *Mar. Biology* 156: 355-372.

<sup>28</sup> Peharda, M., Ezgeta-Balic, D., Davenport, J., Bojanic, N., Vidjak, O., Nincevic-Gladan, N... 2012. Differential ingestion of zooplankton by four species of bivalves (Mollusca) in the Mali Ston Bay, Croatia. *Marine Biology* 159

<sup>29</sup> Ministry of Primary Industries: Literature Review of Ecological Effects of Aquaculture. 2013. ISBN 978-0-478-38817-6



*‘Further modelling (and validation) is required to improve estimates of larval mortality associated with mussel and oyster farming and, in turn, the effects of shellfish aquaculture on wild fish populations’*

Whether progress has been made by MPI to address these questions of uncertainty is unclear.

Mussel farm concentrates the sedimentation of C and N that was before farming distributed in water column over a wider area. Both faeces and pseudo-faeces have high sinking rates and settle in small discrete areas in and around the farms. In areas of low flushing or shallow water depth there is a strong correlation between the models of deposition and ground controls with deposition distances <50m<sup>30</sup>. In more exposed sites with strong tidal current, the footprint can be more than 250m<sup>31</sup> away from the source. In Beatrix Bay, macro invertebrate communities of farm-affected stations were distinctly different from the reference station 250 m away<sup>32</sup>. The dissimilarity was primarily due to an enhancement of the small surface deposit-feeding polychaetes, accompanied by the displacement of a number of species (and species groups) that could be important with regard to sediment bio-turbation. A number of taxa that would be expected to play an important role in irrigating and maintaining aerobic conditions in surface sediments were either not present or considerably reduced in the farm-influenced sediments. Examples of displacement were a number of subsurface deposit-feeding species of polychaete worms, two species of suspension-feeding bivalves, a burrowing cumacean and a brittle star. Displacement of the relatively large burrowing brittle star was regarded to be particularly important with implications for the sediment bio-turbation capacity at the farm-affected stations. Accumulation of organic material below mussel longlines enhances mineralization rates and changes the nitrogen turnover route:

*Higher mineralization rates, in particular, may result in an enhanced sulfide production. Nitrogen removal through denitrification may be reduced and the nitrogen turnover pathways changed so that a*

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<sup>30</sup> Hartstein, N.D. and Stevens, C.L. 2005. Deposition beneath long line mussel farms. *Aquacultural Engineering* 33: 192-213.

<sup>31</sup> Keeley, N., Forrest, B., Hopkins, G., Gillespie, P., Knight, B., Webb, S., Clement, D. and Gardner, J. 2009. Sustainable Aquaculture in New Zealand: Review of the Ecological Effects of Farming Shellfish and Other Non-fish Species. Cawthron Report No. 1476.

<sup>32</sup> Christensen, P.B., Glud, R.N., Dalsgaard, T. and Gillespie, P. 2003. Impacts of logline mussel farming on oxygen and nitrogen dynamics and biological communities of coastal sediments. *Aquaculture* 218: 567-588.

*dissimilative reduction of nitrate to ammonium may conserve nitrogen in the coastal environment instead of removing it*<sup>34</sup>

The Marlborough Sounds marine biodiversity is not in good shape. The significant issues are: fewer fish, not as many species, serious loss of biogenic habitats (including tubeworms) and sedimentation in estuaries smothering thousands of hectares of seabed and biosecurity incursions.<sup>33</sup>

Increasing pressures upon the marine realm threaten marine ecosystems, especially seabed biotopes, and thus a well-planned approach of managing use of marine space is essential to achieve sustainability<sup>34</sup>.

With an ever-increasing area of aquaculture developing at a faster rate than ever before, the maintenance of the natural capital in areas like the Marlborough Sounds is being questioned. Any integration principle used should be ecologically-relevant, transparent and well documented. Present ecosystem conditions must be understood within the context of a trajectory of change, where the knowledge of the history and biophysical conditions of the local environment need to be integrated in today's management. Single-species and single issue management strategies need to consider system interactions at the landscape level and the internal dynamics of the particular system in question<sup>35</sup>.

Of essence in the endeavours to achieve sustainable management is the maintenance of biodiversity; to work out theoretical principles and translate them into practical measures. New Zealand is committed to maintain its biodiversity. The purpose of the Biodiversity Strategy 2000<sup>36</sup> was to establish a strategic framework for action, to conserve and sustainably use and manage New Zealand's biodiversity with a particular focus to protect New Zealand's indigenous biodiversity. The strategy presents a number of desired outcomes to be achieved for 2020. Of relevance to this case, a selection:

- *New Zealand's natural marine habitats and ecosystems are maintained in a healthy functioning state. Degraded marine habitats are recovering. A full*

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<sup>33</sup> Marlborough District Council 2015. State of the Environment Report 2015. Our Land, our Water, Our Place – Page 150.

<sup>34</sup> Salomidi, M., Katsanevakis, S., Borja, Á., Braeckman, U., Damalas, D., Galparsoro, I., Mifsud, R., Mirto, S., Pascual, M., Pipitone, C., Rabaut, M., Todarva, V., Vassilopoulou, V., Vegafernandez, T. 2012. Assessment of goods and services, vulnerability, and conservation status of European seabed biotopes: a stepping stone towards ecosystem-based marine spatial management. *Medit. Mar. Sci.*, 13/1, 2012, 49-88

<sup>35</sup> Wallington, T.J., Hobbs, R.J. and Moore, S.A.. 2005. Implications of Current Ecological Thinking for Biodiversity Conservation: a Review of the Salient Issues. *Ecology and Society* 10: 1-15.

<sup>36</sup> The New Zealand Biodiversity Strategy February 2000, ISBN 0-478-21919-9

*range of marine habitats and ecosystems representative of New Zealand's indigenous marine biodiversity is protected.*

- *Rare or threatened marine species are adequately protected from harvesting and other human threats, enabling them to recover.*
- *Marine biodiversity is appreciated, and any harvesting or marine development is done in an informed, controlled and ecologically sustainable manner.*

Declining environmental conditions under and in the vicinity of farms as a result of faeces and pseudo-faeces deposition in small discrete areas in and around the farms, have a generally negative impact on oxygen-related processes for the different life stages of fish; settlement probability of juveniles, habitat utilization of spawning fish, age structure of successful spawners and food consumption rates of adult fish<sup>37,38,39</sup>

Dissolved oxygen is also regarded to be the most critical water quality variable for aquaculture<sup>40</sup>. As the overall size and density of farmed sea space increases, there is greater potential for indirect effects on food webs beyond the immediate culture area. Significant local impact of mussel farms on benthic microphyte and infauna composition as well as on oxygen and nitrogen cycling has been identified<sup>41</sup>.

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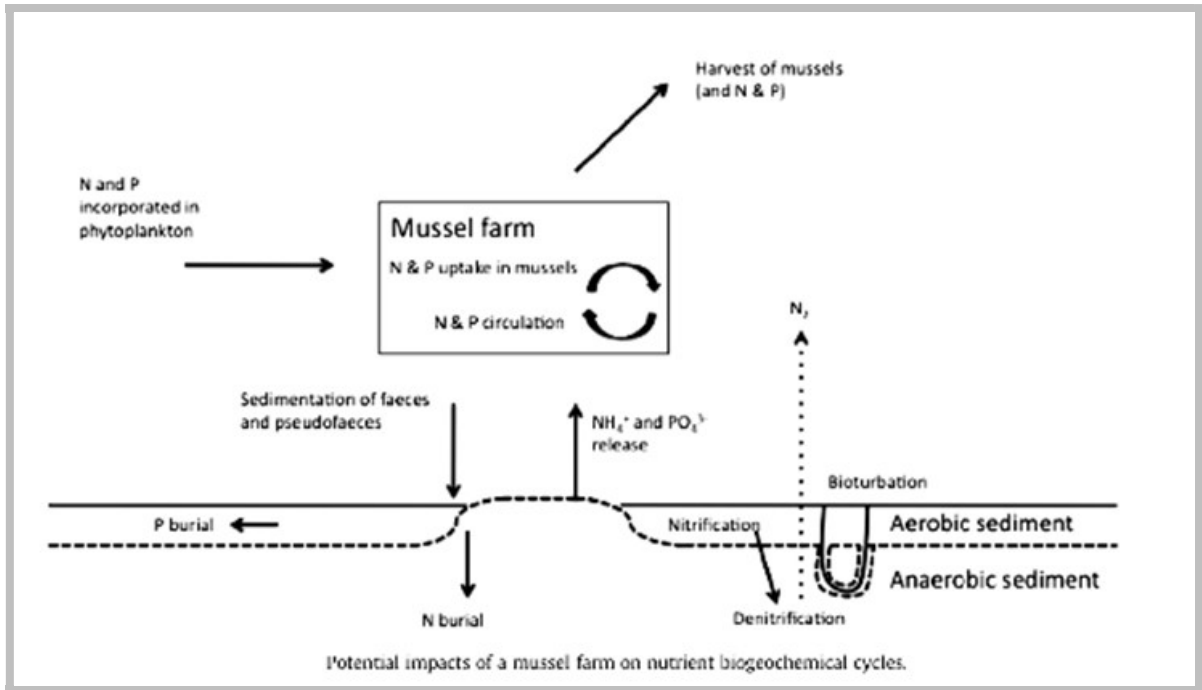
<sup>37</sup> Folke, C. , Kautsky, N., Berg, H., Jansson, A., Troell, M.. 1998. The ecological footprint concept for sustainable seafood production: A review. *Ecological Applications*, 8(1) Supplement, 1998, pp. S63–S71

<sup>38</sup> Hinrichsen, H.H., Huwer, B., Makarchouk, A., Petereit, C., Schaber, M. And Voss, R. 2011. Climate-driven long term trends in Baltic Sea oxygen concentrations and the potential consequences for eastern Baltic cod (*Gadus morhua*). *ICES Journal of Marine Science*, 68: 2019-2028.

<sup>39</sup> Diaz, R., Rabalais, N.N. and Breitburg, D.L. 2012. *Agriculture's Impact on Aquaculture: Hypoxia and Eutrofication in Marine Waters*. OECD Publishing 2012.

<sup>40</sup> Boyd, C.E. and B.J. Watten. 1989. Aeration systems in aquaculture. *Reviews of Aquatic Science* 1:425-472.

<sup>41</sup> Stadmark, J. and Conley, D.J. 2011. Mussel farming as a nutrient reduction measure in the Baltic Sea: Consideration of nutrient biogeochemical cycles. *Marine Pollution Bulletin* 62: 1385-1388.



Denitrification/nitrification and the impact of mussel farm (From: *Stadmark and Conley 2011*)

The nutrients and fine particulate matter which are part of that sediment are dispersed at a rate which is a function of the current flow at the individual sites and the flushing characteristics of the bay as a whole.