BEFORE AN EXPERT PANEL **FTAA-2504-1048**

UNDER	the Fast Track Approvals Act 2024
IN THE MATTER	of a substantive application for marine consents that would otherwise be applied for under the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
BY	Trans-Tasman Resources Limited

EVIDENCE OF DR ALISON MACDIARMID (MARINE ECOLOGY) ON BEHALF OF TRANS-TASMAN RESOURCES LIMITED IN RESPONSE TO COMMENTS RECEIVED

13 OCTOBER 2025

HOLM | MAJUREY

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EXECUTIVE SUMMARY

1. In my evidence I respond to matters raised in submitter evidence relevant to my area of expertise. Specifically, I provide evidence in response to submissions raising concerns about:

   a) Reliance on modelled information to assess environmental impact;

   b) Effects on primary productivity;

   c) Impacts on rocky reefs;

   d) Impacts on benthic invertebrate filter feeders;

   e) Location of rare and vulnerable marine ecosystems;

   f) Impacts on mining related underwater noise on fish;

   g) Impacts on fishing;

   h) Impact on and recovery of seafloor communities in the mining area; and

   i) Cumulative effects.

2. I am satisfied that with the quantity and quality of the data available the impacts are sufficiently well defined and in adequate detail for me to have confidence that granting consent, subject to the proposed conditions, will avoid material harm, and will favour caution and environmental protection in relation to the effects of the proposed mining operations and resulting sedimentation.

3. I confirm my opinions previously expressed in previous evidence and confirm the appropriateness of the proposed conditions, acknowledging the amendments and additions proposed in my evidence below.

INTRODUCTION

Qualifications and experience

1. My name is Dr. Alison Bronwyn MacDiarmid.

2. I was awarded a Bachelor of Science by the University of Auckland in 1979, a Master of Science by the University of Auckland in 1981, and a PhD in Zoology by the University of Auckland in 1988.

3. I am a Regional Manager at the Wellington Greta Point campus of **Earth Sciences New Zealand** (formerly the National Institute of Water and Atmospheric Research (**NIWA**)), where I have been employed since 1987 in various marine research roles.

4. I have 38 years of professional experience in marine ecology and fisheries, particularly spiny or rock lobsters and other reef associated species, scampi, hoki, and orange roughy and have previously served on fisheries stock assessment working groups for several species, and on the Ministry for Primary Industries Biodiversity Research Advisory Group and Aquatic Environment Working Group. I have broad research interests and experience in marine biodiversity, marine historical ecology, marine ecosystem goods and services, the state of the marine environment, and human impacts on marine ecosystems. In addition, over the last 20 years I have led many investigations for commercial clients on a variety of research questions. I have authored 48 science journal papers, nine book chapters, 122 consultancy reports and 121 conference presentations. In 2013 I was presented the New Zealand Marine Sciences Society Award for an outstanding contribution to New Zealand marine science. In 2013 I was also presented with the NIWA Excellence Award for Leadership.

Code of Conduct

5. I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Practice Note dated 1 January 2023. I have read and agree to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Involvement in project

6. I have been involved in TTR's project since 2010 as the key NIWA project manager coordinating and sometimes undertaking over 40 distinct research projects.

7. I previously gave evidence for Trans-Tasman Resources Limited (**TTR**) before a Decision-making Committee (**DMC**) in 2017. My evidence before the 2017 Committee comprised:

   (a) Expert Evidence of Alison MacDiarmid on behalf of Trans Tasman Resources Limited, 15 December 2016;[1]

   (b) Expert Rebuttal Evidence of Alison MacDiarmid on behalf of Trans Tasman Resources Limited, 9 February 2017;[2]

   (c) Expert Supplementary Evidence of Alison MacDiarmid on behalf of Trans Tasman Resources Limited, 1 May 2017;[3]

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[1] MacDiarmid (2016). Expert Evidence of Alison MacDiarmid on behalf of Trans Tasman Resources Ltd.

[2] MacDiarmid, A. (2017). Expert rebuttal evidence of Alison MacDiarmid on behalf of Trans Tasman Resources Limited, dated 9 February 2017.

[3] MacDiarmid, A. (2017). Expert supplementary evidence of Alison MacDiarmid on behalf of Trans Tasman Resources Limited, dated 1 May 2017.

(d) Joint Statement of Experts in the Field of Effects on Benthic Ecology, 20 February 2017;[4]

(e) Joint Statement of Experts in the Field of Effects on Fish, 17 February 2017;[5]

(f) Joint Statement of Experts in the Field of Effects on Fishing (Commercial, Recreational and Customary Fishing), 15 February 2017;

(g) Joint Statement of Experts in the Field of Effects on Marine Mammals, 3 March 2017;[6]

(h) Written responses to questions approved by the DMC in Minute 21, 17 February 2017;

(i) Summary of Expert Evidence of Dr Alison MacDiarmid, 20 February 2017;[7]

(j) Oral evidence on 21 February 2017 (Transcript pages 412-432, 435-442); and

(k) Oral evidence on 3 March 2017 (Transcript pages 1083-1090).

8. I also helped to prepare various reports which formed part of TTR's 2016 application, which are listed here:

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4 EPA (2017). Joint statement of experts in the field of effects on benthic ecology. 20 February 2017.

5 EPA (2017). Joint Statement of Experts in the Field of Effects on Fish. 17 February 2017.

6 EPA (2017). Joint Statement of Experts in the Field of Effects on Marine Mammals. 3 March 2017.

7 MacDiarmid, A. (2017). Summary of Expert Evidence of Dr Alison MacDiarmid on behalf of Trans-Tasman Resources Limited, dated 20 February 2017.

(a) South Taranaki Bight Factual Baseline Report (MacDiarmid et al., 2015);[8]

(b) Benthic habitats, macrobenthos and surficial sediments of the nearshore South Taranaki Bight (Anderson, MacDiarmid & Stewart, 2015);[9]

(c) Benthic flora and fauna of the Patea Shoals region, South Taranaki Bight (Beaumont, Anderson and MacDiarmid, 2015);[10]

(d) Zooplankton communities and surface water quality in the South Taranaki Bight February 2015 (MacDiarmid et al., 2015);[11]

(e) South Taranaki Bight Fish and Fisheries (MacDiarmid, Anderson and Sturman, 2015);[12]

(f) Assessment of the scale of marine ecological effects of seabed mining in the South Taranaki Bight: Zooplankton, fish, kai moana, sea birds, and marine mammals (MacDiarmid, Thompson and Grieve, 2015);[13] and

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8 Report 1-NIWA STB Baseline Environmental Report FINAL November 2015.pdf + Appendices 1-4.

9 Report 2-NIWA Benthic Habitats, Macrobenthos and Surficial Sediments of the Nearshore South Taranaki Bight Report-FINAL November 2015.pdf

10 Report 3-NIWA Patea Shoals Benthic Ecology FINAL November 2015.pdf

11 Report 9_NIWA Zooplankton Communities and Water Quality Report FINAL May 2015.pdf

12 Report 10-NIWA South Taranaki Bight Fish and Fisheries Report FINAL November 2015.pdf + Appendices A-C

13 Report 17_NIWA Assessment of the scale of marine effects Report FINAL September 2015.pdf

(g) South Taranaki Bight Commercial Fisheries: 1 October 2006 – 30 September 2015 (MacDiarmid and Ballara, 2016).[14]

9. I also previously gave evidence for TTR before a DMC in 2023. My evidence before the 2023 Committee comprised:

(a) Expert Evidence of Alison MacDiarmid on behalf of TTR, 19 May 2023;[15]

(b) Expert Rebuttal Evidence of Dr Alison MacDiarmid on behalf of Trans Tasman Resources Limited, 23 January 2024;[16]

(c) Joint Statement of Experts in the field of: Effects on marine mammals, 19 February 2024;[17]

(d) Joint Statement of Experts in the fields of: Effects on fishing; and on the effects on fish, 20 February 2024; and

(e) Joint Statement of Experts in the fields of: Sediment plume modelling; and effects on benthic ecology, 23 February 2024.

10. My involvement in the present application has been to review and update relevant parts of the impact assessment and update the information about the location and extent of fishing in the Proposed Mining Area (**PPA**), areas affected by the mining plume, and in the South Taranaki Bight (**STB**) as a

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[14] Report 18-NIWA South Taranaki Bight Commercial Fisheries Report FINAL May 2016.pdf

[15] MacDiarmid, A. (2023). Expert evidence of Dr Alison MacDiarmid on behalf of Trans Tasman Resources Limited, dated 19 May 2023.

[16] MacDiarmid A (2024) Expert rebuttal evidence of Dr Alison MacDiarmid on behalf of Trans Tasman Resources Limited. 23 January 2024.

[17] EPA (2024) A joint statement of experts in the field of effects on marine mammals. 19 February 2024.

whole (MacDiarmid et al. 2023)[18]. On 2 September 2025, I provided to the expert panel an oral overview of the STB environment and the likely impacts of the proposed mining operations on components of the ecosystem.

Scope of evidence

11. In this evidence I respond to matters raised in submitter evidence relevant to my area of expertise. Specifically, I provide evidence in response to submissions raising concerns about:

a) Reliance on modelled information to assess environmental impact;

b) Effects on primary productivity;

c) Impacts on rocky reefs;

d) Impacts on benthic invertebrate filter feeders;

e) Location of rare and vulnerable marine ecosystems;

f) Impacts on mining related underwater noise on fish;

g) Impacts on fishing;

h) Impact on and recovery of seafloor communities in the mining area; and

i) Cumulative effects.

12. While not contained in this evidence brief, I have also provided further response comments in the response tables provided as part of TTR's wider comments response package to the FTAA Panel. I confirm that comments in response to

[18] MacDiarmid, A., MacGibbon, D., Anderson, O. (2024). South Taranaki Bight Fishing -1 October 2007 - 30 September 2023. NIWA Client Report 2024053WN. Prepared for Trans Tasman Resources Ltd

ecology and coastal processes have been provided by myself and are within my scope of expertise.

RESPONSE TO SUBMITTER COMMENTS

13. Rather than respond individually to the large number of submissions concerning issues in my area of expertise, below I respond to each key concern raised by submitters.

Reliance on modelled information to assess environmental impact

14. The EPA and some other submitters[19] suggest that the reliance on modelled data to assess the potential effects of the proposal and evaluate potential environmental harm introduces an unacceptable level of uncertainty.

15. I acknowledge that assessment of impacts of mining derived sediments suspended in the water column and deposited on the seabed on flora and fauna outside of the PPA, including those on rocky reefs, are dependent on the quality of the sediment plume[20,21], optical[22], and primary production[23] modelling undertaken. In this regard I note that:

(a) Models of this sort are inherently uncertain because of the complexity of the natural systems they are trying

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19 Wanganui Manawatu Sea Fishing Club and Patea & Districts Boating Clubs; Horizons Regional Council; Taranaki Offshore Partnership; Taranaki Regional Council; Mark Bamford; Seafood New Zealand; Whanganui District Council; New Zealand Rock Lobster Industry Council.

20 Hadfield, M. & Macdonald, H. (2015). Sediment Plume Modelling. NIWA Client Report No: WLG2015-22, prepared for Trans Tasman Resources Ltd, 117 p.

21 Macdonald, H. & Hadfield, M. (2017). South Taranaki Bight Sediment Plume Modelling - Worst Case Scenario. NIWA Client Report No: 2017049WN, prepared for Trans Tasman Resources Ltd, 51 p.

22 Pinkerton, M. & Gall, M. (2015). Optical effects of proposed iron sand mining in the South Taranaki Bight region. NIWA Client Report No: WLG2015-26, prepared for Trans-Tasman Resources Ltd, 79 p.

23 Cahoon, L.B., Pinkerton, M., and I. Hawes. 2015. Effects on primary production of proposed iron sand mining in the South Taranaki Bight. Report to Trans-Tasman Resources, Ltd. 28 p.

to represent and the variability of components in such systems;

(b) Despite this, models of this sort are in my experience both necessary and useful for undertaking effects assessments as there is no other way of assessing the complex interaction of all the different parameters;

(c) The modelling undertaken is state of the art, calibrated using actual environmental data, and has been vigorously reviewed and challenged already through the 2017 and 2024 DMC procedures; and it is my understanding that there was reasonable consensus among experts in 2017[24] and in 2024[25] that the modelling was fit for purpose;

(d) In particular, the modelling undertaken by Macdonald & Hadfield (2017)[26] in response to a direct request from the DMC at the time, incorporated a "worst case scenario" and sediment related effects have been assessed on that basis, which gives confidence that the assessments are appropriately cautious.

16. It is pertinent to point out here that the modelling undertaken to date has been complimented and supported by a wide range of biological and oceanographic field sampling and that the proposed conditions inclusive of pre- and post-commencement monitoring, development of an operational sediment plume model (**OPSM**), and SSC limit confirmation, in

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[24] Joint Statement of Experts in the Field of Effects of Sediment Plume on Primary Production, Dated 14 February 2017, Issue 5, paragraph 33.

[25] Joint Statement of Experts in the Fields of: Sediment Plume Modelling; and Effects on Benthic Ecology, Dated 23 February 2024.

[26] Macdonald, H.S and Hadfield, M.G. (2017). South Taranaki Bight Sediment Plume Modelling Worst Case Scenario, 51 p.

combination will allow verification of the SSC and impact assessments generated by the earlier work.

17. Therefore, I am confident that the modelled information provides a necessary and sound basis for evaluation of the potential environmental impacts of the proposed mining operations and that the concerns raised by submitters will not eventuate and can be set aside.

Effects on primary productivity

18. A number of submitters[27] expressed concern about suspended sediments in the mining plume affecting primary production in the STB and subsequently the rest of the marine ecosystem.

19. Regarding the effects of the sediment plume on the ability of macro-algae, as well as other primary producers to undertake photosynthesis, I note the evidence of Prof. Dr Larry Cahoon[28], a US based expert in benthic micro-algal ecology of continental shelf ecosystems, who on behalf of TTR noted:

(a) the resilience of primary producers, including phytoplankton, microphytobenthos and macroalgae ("seaweeds"), to short-term fluctuations in light availability (photo-adaptation) typical in the STB due to the existing sediment impacts in the STB

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[27] Mark Bamford; Whanganui District Council; Talleys; Opunake Boat and Underwater Club; South Taranaki District Council; Te Kahui Maru; Okahu Inuawai; Ohawe Boat and Angling Club; Climate Justice Taranaki; Seafood New Zealand; New Zealand Rock Lobster Industry Council; Parliamentary Commissioner for the Environment; Nga Tangata Tiakio; South Taranaki Underwater Club; Wanganui Manawatu Sea Fishing Club and Patea & Districts Boating Clubs; Horizons Regional Council; Minister for Oceans and Fisheries; Te Kahui o Taranaki; Taranaki Regional Council.

[28] Expert evidence of Dr. Lawrence Cahoon on behalf of Trans-Tasman Resources Limited, 9 December 2016.

environment as a result of storm and high river runoff events;

(b) the likelihood that primary production by phytoplankton in the STB is likely nutrient-limited, not light limited;

(c) that many microalgae may also be capable of heterotrophic production (mostly uptake of dissolved organic material), with this mode of production supplementing or even replacing primary production (photosynthetic formation of new organic matter), particularly when light is limiting; and

(d) that macroalgae have the additional advantage of being able to store photosynthetic products in their larger bodies for extended periods of time, enabling them to adapt to quite substantial changes in light availability.

20. Dr Cahoon also noted that while there will be significant and detectable effects on light levels and thus primary production in the plume in the immediate vicinity of the active mining site (<2 km distant), these effects would decrease exponentially with distance from the site of active mining as the presence of the plume will be more intermittent at sites > 2 km from the actual mining site owing to increasing variability in flow vectors with distance from the mining site.

21. Given the relatively small spatial footprint of sand mining activities at any point in time compared to the STB area, and the inherent variability in the physical environment, Dr Cahoon considered that on the scale of the sediment model domain, impacts of mining on primary production would be statistically indistinguishable from natural variability

22. Dr Cahoon concluded that the impacts on primary production and ecosystem processes dependent on it from

this project will be temporally and spatially limited, occurring in an environment where physical disturbance on much greater scales is a normal feature, and well within the adaptive capacity of the primary producer community. He foresaw no significant impacts on primary production or ecosystem processes dependent on it at any but very local and temporary scales. He considered the localised elevation in SSC arising from the proposed sand mining activities represent an impact to which continental shelf ecosystems are robustly adapted and from which they recover rapidly.

23. Therefore, it is my opinion, that primary production in the STB will not be significantly affected by the proposed mining operations and that the concerns raised by submitters will not eventuate and can be set aside.

Impacts on rocky reefs

24. The Taranaki Regional Council, Whanganui District Council, South Taranaki Underwater Club, Wanganui Manawatu Sea Fishing Club and Patea & Districts Boating Clubs, and other submitters[29] all raised concerns regarding the assessment of effects on rocky reefs given the lack of mapped locations of all reef systems in the STB, and uncertainty regarding the sediment plume modelling approach.

25. In this regard I note that NIWA random sampling surveys undertaken for TTR confirmed the presence of rocky reef habitats at 12 sites inshore of the PPA. More recently, Morrison et al. (2022)[30] surveyed a route track of more than 250 km, mapping 61.5 km^2 of seafloor in the STB and identifying

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29 The Kahui o Taranaki; Minister for Oceans and Fisheries; Mark Bamford; Seafood New Zealand; Whanganui District Council; Ohawe Boat and Angling Club; Horizons Regional Council.

30 Morrison et al. (2022). Offshore subtidal rocky reef habitats on Pātea Bank, South Taranaki. NIWA Client Report 2022229AK, 211 p. see Policy-and-Planning-February2023-web-version-v2.pdf (trc.govt.nz)

numerous reefs ranging from small knolls and patches, through to extensive linear ridges several kilometres long. Morrison et al. (2022) demonstrates that subtidal reefs are common on the Pātea Bank inshore of the PPA, with many more awaiting discovery by multibeam sonar mapping. Associated with these reefs are extensive areas of biogenic habitat, dominated by macroalgae (notably *Ecklonia* forests, *Caulerpa* meadows, mixed macroalgal meadows, and soft bryozoan fields), as well as areas of sponge garden. The associated fish assemblages are abundant. The unusual distance of these reef systems from shore, occurring on a wide shallow continental shelf, makes them relatively unique in the New Zealand context.

26. The reefs within 2-3 km of the PPA are at the highest risk from the effects of the sediment plume when mining takes place at its northern end as they will be exposed to higher levels of suspended sediments for longer periods. In this regard I note that TTR intends to survey to a distance of 3 km from the boundary of the PPA to establish the position of all reefs in this at-risk zone. The Sediment Plume Modelling and Effects on Benthic Ecology JWS – dated 23 February 2024 - was not addressed during the planning witness conferencing, as it was only made available as the conferencing was commencing. That JWS includes the following: *52. AM [Dr MacDiarmid] and GB [Dr Barbara] agree with the assumptions and facts. AM and GB agree that if there are large reefs close (within 1-2 km near field plume modelling area) to the proposed mining site, there is potential for significant ecological impact*.

27. In response, I propose two amendments to conditions, and an additional condition, as follows:

(a) Add the following words into condition 48 (pre-commencement monitoring): Provide data from multi-beam swath mapping to identify all reef habitat within a distance of 3 km from the boundary of the extraction area;

(b) Add the following into the list in condition 55 (Environmental Monitoring and Management Plan (**EMMP**)): k. Identify whether operational responses are necessary to avoid material harm to any reef habitat identified by the pre-commencement bathymetric survey.

(c) Add a new companion condition along the following lines: 30A Extraction operations shall not commence within 3 km of the boundary of the Coastal Marine Area until at least 5 years following the commencement of extraction activities.

28. Locating extraction operations 3 km from the CMA boundary for 5 years, means that extraction closer to any potentially sensitive areas (e.g. reefs landward of the mining area in the CMA) would not occur until there was a considerable quantum of monitoring data available and effects within 2 km that were of concern to Drs MacDiarmid and Dr Barbara and 3 km mentioned by Dr Dearnley, would not arise.

29. Therefore, it is my opinion, that if the above conditions are included in the proposed conditions, rocky reef habitats in the STB will not be significantly affected by the proposed mining operations and that the concerns raised by submitters will not eventuate and can be set aside.

Impacts on benthic invertebrate filter feeders

30. The South Taranaki Underwater Club and other submitters[31] raised concerns about the impact of the mining sediment plume on the feeding ability of filter feeders such as shellfish,

[31] Wanganui Manawatu Sea Fishing Club and Patea & Districts Boating Clubs; Horizons Regional Council; Minister for Oceans and Fisheries; Te Kahui Maru.

sponges and bryozoans, particularly on the rocky reefs inshore of the PPA such as the North and South Traps, "The Crack", "Project Reef" and reefs mapped by Morrison et al. (2022)[16].

31. It is pertinent here to repeat some of my previous evidence and introduce some new evidence on the ecologically consequential concentrations of suspended sediment on benthic invertebrate fauna. Specifically, I note that:

    (a) Filter feeding bivalves, especially those occurring in naturally turbid environments such as those found in the CMA zone (out to 12 NM) of the STB, can compensate efficiently for a decrease in food quality over a wide range of suspended sediment concentrations (**SSC**) by maintaining an effective pre-ingestive mechanism of selection for organic particulate matter, as well as increasing filtration and rejection rates (Navarro and Widdows 1997)[32].

    (b) A laboratory experiment has indicated that SSC of 80 mg/l or higher have adverse effects on the condition of the horse mussel *Atrina zelandica* (Ellis et al. 2002)[33].

    (c) Green-lipped mussels, *Perna canaliculus*, decline in filtration rate only when SSC is above about 1,000 mg/l (Hawkins et al. 1999)[34]. More recently, Biggar et al.

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[32] Navarro, J.M.; Widdows, J. (1997). Feeding physiology of *Cerastoderma edule* in response to a wide range of seston concentrations. Marine Ecology Progress Series 152: 175–186

[33] Ellis, J.; Cummings, V.; Hewitt, J.; Thrush, S.; Norkko, A. (2012). Determining effects of suspended sediment on condition of a suspension feeding bivalve (*Atrina zelandica*): results of a survey, a laboratory experiment and a field transplant experiment. Journal of Experimental Marine Biology and Ecology 267: 147– 174.

[34] Hawkins, A.J.S.; James, M.R.; Hickman, R.W.; Hatton, S.; Weatherhead M. (1999). Modelling of suspension-feeding and growth in the green-lipped mussel *Perna canaliculus* exposed to natural and experimental variations in seston availability in the Marlborough Sounds, New Zealand. Marine Ecology Progress Series 191: 217–232

(2025)[35] found juvenile mussels were highly resistant to short-term (5 days) and long term (30 days) exposure to SSC up to 1250 mg L^{-1}, with no effect on their mortality or nutritional condition but increased shell growth, consistent with previous studies that have found increased bivalve growth with high SSC (Emerson, 1990[36]; Dekshenieks et al., 1993[37]; Colden and Lipcius, 2015[38])

(d) The response of two New Zealand invertebrate species (a common cushion sponge *Crella incrustans* and large dog cockle *Tucetona laticostata*, which are both present within the STB) to elevated suspended sediments has been experimentally assessed.[39] Both had high survival rates, and no effect was observed on oxygen consumption following four weeks of exposure to SSCs of up to approximately 700 mg/L. Although sediments had accumulated internally within *C. incrustans*, around a third of

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[35] Brandy S. Biggar, Andrew Jeffs, Jenny R. Hillman (2025). Effects of suspended sediment on survival, growth, and nutritional condition of green-lipped mussel spat (*Perna canaliculus*, Gmelin, 1791), Journal of Experimental Marine Biology and Ecology, 582, https://doi.org/10.1016/j.jembe.2024.152074

[36] Emerson, C.W., (1990). Influence of sediment disturbance and water flow on the growth of the soft-shell clam, *Mya arenaria* L. Can. J. Fish. Aquat. Sci. 47, 1655–1663. https:// doi.org/10.1139/f90-189.

[37] Dekshenieks, M., Hofmann, E., Powell, E., (1993). Environmental effects on the growth and development of eastern oyster, *Crassostrea virginica* (Gmelin, 1791), larvae: a modeling study. J. Shellfish Res. 12.

[38] Colden, A.M., Lipcius, R.N., (2015). Lethal and sublethal effects of sediment burial on the eastern oyster *Crassostrea virginica*. Mar. Ecol. Prog. Ser. 527, 105–117. https://doi. org/10.3354/meps11244

[39] Cummings, V.J., Beaumont, J., Mobilia, V., Bell, J.J., Tracey, D., Clark, M.R., Barr, N. (2020). Responses of a common New Zealand coastal sponge to elevated suspended sediments: indications of resilience. Marine Environmental Research, 155: 104886

sponges had cleared these sediments two weeks after the elevated SSCs were removed.[40, 41]

32. I note that the modelled spikes in background plus mining derived SSC on inshore reefs are much lower (by up to 1 or 2 orders of magnitude) than the concentrations reported in the above studies[42] and that the SSC percentile limits identified (Condition 5 and Schedule 2) have been developed to ensure that effects on reef fauna will be negligible and thus of no 'material harm'. Therefore, I conclude that effects on reef fauna will be negligible and thus of no 'material harm'.

33. Further, I note that the 2017 DMC was seemingly satisfied that inclusion of 'The Crack' and 'Project Reef' as compliance monitoring sites with associated SSC limits (Condition 5 and Schedule 2 of the Proposed Marine Consent Conditions) would address their concerns regarding the impact of mining derived sediments.

34. Therefore, it is my opinion, in light of the above research and conditions, filter feeding fauna in the STB will not be significantly affected by the proposed mining operations and that the concerns raised by submitters will not eventuate and can be set aside.

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[40] Cummings, V.J., Beaumont, J., Mobilia, V., Bell, J.J., Tracey, D., Clark, M.R., Barr, N. (2020). Responses of a common New Zealand coastal sponge to elevated suspended sediments: indications of resilience. Marine Environmental Research, 155: 104886

[41] https://www.sustainableseaschallenge.co.nz/tools-and-resources/sponges-and-suspended-sediment-on-the-south-coast/

[42] See Figure 4 in Expert evidence of Dr. Lawrence Cahoon on behalf of Trans Tasman Resources Limited, 9 December 2016

Location of rare and vulnerable marine ecosystems

35. In its invited submission[43], the EPA expressed a general concern that much of the information referenced in the application dates back approximately ten years or more and that reliance on dated information also raises questions about whether the application provides a sufficiently current understanding of potential environmental effects. The EPA was particularly concerned that TTR's analysis of rare and vulnerable marine ecosystems in the STB is based on surveys conducted in 2013 and predictive modelling and therefore, appears limited in scope with the adequacy of modelling questioned.

36. I acknowledge that while the research and assessment work undertaken by NIWA for TTR is of varying age from 2012 to 2024, the less recent work was reviewed and updated where necessary to support TTR's 2016 application and the 2024 application. A further review of this information has been undertaken as part of the preparation of this application, to ensure the information is sufficiently up-to-date to be reliable and commensurate with the relevant effects, and to satisfy the statutory requirements set out in Section 8 of TTR's Impact Assessment to make decisions using the best available information. Notwithstanding, TTR's proposal provides for a suite of monitoring to occur prior to any excavation activities being undertaken and one of the purposes of this monitoring is to confirm the current understanding of the seasonality and natural variability of environmental parameters that will be monitored during mining and to provide data to validate the background data. This process will ground-truth and validate the currently available information in advance of any extraction works commencing.

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43 Rojas Nazar, U.A. (2025). Response to request for section 51 report for Taranaki VTM Project, 19 p., EPA

37. With specific regard to rare and vulnerable ecosystems I note that these were identified inshore of the PPA on rocky reef outcrops both in NIWA surveys carried out for TTR and for the TRC (see my comments on Impacts on rocky reefs above) and offshore around the deep margins of the Patea Shoals. This information was supplemented by the most recent models of the predicted probability of occurrence for 17 benthic invertebrate genera including 9 corals, 2 sponges, 3 bryozoans, 2 lamp shells, and 1 bivalve, which include one or more species of habitat-forming/sensitive environment species (Lundquist et al. 2020)[44]. In part these models use the information previously collected by NIWA during benthic surveys undertaken for TTR[2,3] and are useful for predicting the occurrence of these genera in locations not sampled.

38. Acknowledging the above, species distribution models are best considered complementary to field surveys/sampling as population surveys, even if well replicated spatially and repeated over seasons and years, can never monitor all locations at all times. Species distribution models complement field sampling by using associated environmental variables to fill in the gaps in space and time that always arise from sampling. Species distribution models based on well-designed survey data are best as they provide high quality abundance data.

39. However, distribution models for benthic species are only as good as the substrate data available to which to fit the model. For example, where the locations of rocky reefs are unknown, the models cannot identify the specific distribution of macro-algal beds, corals, sponges, etc.

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[44] Lundquist, C., Stephenson, F., McCartain, L., Watson, S., Brough, T., Nelson, W., Neill, K., Anderson, T., Anderson, O., Bulmer, R., Gee, E., Pinkerton, M., Rowden, A., Thompson, D. (2020) Evaluating Key Ecological Areas datasets for the New Zealand Marine Environment. NIWA Client Report 2020109HN. Prepared for the Department of Conservation, 138 p.

40. Therefore, I am confident that the balance of older and more recent information provides a necessary and sound basis for evaluation of the potential environmental impacts of the proposed mining operations generally and on rare and vulnerable marine ecosystems specifically, and in my opinion the concerns raised by submitters can be set aside.

Impacts on mining related underwater noise on fish

41. Seafood New Zealand and other submitters[45] raised concerns about the impact of underwater noise on the well-being of fish species in the STB.

42. In my statement to the 2017[46] hearing (MacDiarmid (2016)), I presented evidence regarding the latest research about the vocalisation and hearing abilities of New Zealand marine fish species. In the years since that hearing there is further published information on this matter (e.g. Radford et al. 2016[47]., van Oosterom et al. 2016[48], Putland et al. 2017[49],

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[45] New Zealand Rock Lobster Industry Council; Wanganui Manawatu Sea Fishing Club and Patea & Districts Boating Clubs; Te Kahui Maru.

[46] MacDiarmid (2016) Expert Evidence of Alison MacDiarmid on behalf of Trans Tasman Resources Ltd.

[47] Radford CA, Ghazali SM, Montgomery JC, Jeffs AG (2016) Vocalisation Repertoire of Female Bluefin Gurnard (*Chelidonichthys kumu*) in Captivity: Sound Structure, Context and Vocal Activity. PLoS ONE 11(2): e0149338. https://doi.org/10.1371/journal.pone.0149338

[48] van Oosterom, L., Montgomery, J. C., Jeffs, A. G., & Radford, C. A. (2016). Evidence for contact calls in fish: conspecific vocalisations and ambient soundscape influence group cohesion in a nocturnal species. Scientific Reports, 6(1). https://doi.org/10.1038/srep19098

[49] Putland RL, Merchant ND, Farcas A, & Radford CA (2017). Vessel noise cuts down communication space for vocalizing fish and marine mammals. Glob Change Biol. 2017;1–14.

Radford et al. 2018[50], Wilson et al 2023[51]). Below I summarise this older and new information and comment on its relevance to the proposed mining operations in respect to those species known to be present within the STB.

43. Bluefin or red gurnard (*Chelidonichthys kumu*) grunts and growls have mean peak frequencies between 129 to 215 Hz (Radford et al. 2016). John Dory (*Zeus faber*) vocalisations or 'barks', ranged between 200–600 Hz, with a peak frequency of 312 ± 10 Hz (Radford et al. 2018). Radford et al. (2015)[52] describe vocalisations in the bigeye (*Pempheris adspersa*)[53] and Radford et al. (2011[54] and 2013[55]) describe its hearing mechanism and determined they detect sound up to 1,000Hz but are most sensitive at lower frequencies (100–400Hz). Caiger et al. (2013)[56] found hapuka (*Polyprion oxygeneios*) hearing ability increased with age to reach a bandwidth of 100–1000Hz and with greatest sensitivity to 100-600Hz one year

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[50] Radford CA, Putland RL, Mensinger AF (2018) Barking mad: The vocalisation of the John Dory, *Zeus faber*. PLoS ONE 13(10): e0204647. https://doi.org/10.1371/journal.pone.0204647

[51] Wilson, L., Constantine, R., Pine, M.K. et al. Impact of small boat sound on the listening space of *Pempheris adspersa*, *Forsterygion lapillum*, *Alpheus richardsoni* and *Ovalipes catharus*. Sci Rep 13, 7007 (2023). https://doi.org/10.1038/s41598-023-33684-0

[52] Radford, C.A.; Ghazali, S.; Jeffs, A.G.; Montgomery, J.C. (2015). Vocalisations of the bigeye, *Pempheris adspersa*: characteristics, source level, and active space. Journal of Experimental Biology http://jeb.biologists.org/content/early/2015/01/15/jeb.115295.abstract.

[53] Although bigeye don't occur within the STB I have included information about their sensitivity to underwater sound to assist in describing hearing in NZ fishes generally.

[54] Radford, C.A.; Caiger, P.; Ghazali, S.; Higgs, D.M. (2011) A new connection: Enhanced hearing ability in the New Zealand bigeye, *Pempheris adspersa*. Journal of the Acoustical Society of America 129, 2472, http://dx.doi.org/10.1121/1.3588128.

[55] Radford CA, Montgomery JC, Caiger P, Johnston P, Lu J, Higgs DM. (2013). A novel hearing specialization in the New Zealand bigeye, *Pempheris adspersa*. Biology Letters 9: 20130163. http://dx.doi.org/10.1098/rsbl.2013.0163

[56] Caiger, P.E.; Montgomery, J.C.; Bruce, M.; Lu, J.; Radford, C.A. (2013). A proposed mechanism for the observed ontogenetic improvement in the hearing ability of hapuka (*Polyprion oxygeneios*). Journal of Comparative Physiology A 199:653–661.

after hatching. Caiger et al. (2012)[57] found juvenile (about 55mm fork length) snapper (*Pagrus auratus*) had bandwidths of auditory sensitivity ranging from 100 to 2000Hz but were most sensitive to lower frequencies (100–400Hz). However, exposure of juvenile snapper to a noisy underwater environment (120dB re 1 μPa) for two weeks decreased sensitivity to the lower frequencies by up to 10dB re 1 μPa. Recovery of sensitivity was not investigated.

44. Given the sensitivity of fish, it is likely there could be masking of individual fish calls in the near vicinity of the iron sand recovery operations (e.g. Putland at al. 2017, Wilson et al. 2023). However, in the case of the PPA, the movement of fish away from the areas of SSC above 2 mg/l should mean few fish remain in close proximity to the mining noise generation sources thereby reducing the risk of individuals from being exposed long-term to damaging levels of sound. From a population perspective, given that the known principal sound producing or responsive fish in the project area are mobile and widely distributed, the effects of underwater sound produced during iron sand recovery operations on their populations in the STB is likely to be negligible.

45. Wilson et al. (2023) found from theoretical and in situ studies that sound pollution from small recreational outboard propelled boats hinders the ability of small site attached reef fishes to perceive acoustic cues by 30% or more when the boat came within 24m. This effect is very likely to have a larger impact on reef fish at the popular diving and recreational fishing reef sites in the STB than the 10+ km distant mining operations.

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57 Caiger, P.E.; Montgomery, J.C.; Radford, C.A. (2012). Chronic low-intensity noise exposure affects the hearing thresholds of juvenile snapper. Marine Ecology Progress Series 466: 225–232.

46. Overall, I consider that in light of the above research and likely movement away from the elevated SSC in the area immediately around the mining operations, fish in the STB will not be significantly affected by the proposed mining operations and that the concerns raised by submitters will not eventuate and can be set aside.

Impacts on fishing

47. A number of submitters including Seafood New Zealand, Talley's, Sealord, other commercial fishing interests and customary fishing bodies[58] argue that TTR has not undertaken a full economic evaluation of the effects of the proposed mining operations on the fisheries in the STB and that the information provided in MacDiarmid et al (2024)[59] is insufficient for this purpose, particularly in light of the changing distribution of fishing due to management imposed restrictions and climate change causing a change in the mix of species present (e.g. an increase in snapper).

48. There is no disagreement with Seafood NZ and other submitters about what the report by MacDiarmid, A., MacGibbon, D., Anderson, O., 2024[8] "South Taranaki Bight Fishing" provides. It is simply an update of the relevant information about fishing activity in the STB displayed at the finest scale allowed by Fisheries New Zealand to protect the fishing locations of individual fishers. However, it is important to understand that this spatial restriction meant that to calculate the number of fishing events occurring in the PPA, Mining Area A median SSC, and Mining Area B median SSC, MacDiarmid et al. (2025) had to construct bounding boxes of 0.2 degrees

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58 Mark Bamford; Brooks Seafood Ltd and Awaroa Fisheries Ltd; Te Rūnanga o Ngāti Mutunga; Te Ohu Kaimoana Trustee Ltd; Climate Justice Taranaki Incorporated; New Zealand Rock Lobster Industry Council; Ngā Tāngata Tiaki o Whanganui; Minister for Oceans and Fisheries; Te Kaahui o Rauru Trust.

59 MacDiarmid, A., MacGibbon, D., Anderson, O. (2024). South Taranaki Bight Fishing: 1 October 2007 - 30 September 2023. NIWA Client Report No: 2024053WN, 37 p.

around each so as not to violate the release clauses of the data. In all cases the bounding boxes created are substantially larger than the areas the polygons themselves cover, and results in the number of fishing events in each being inflated thus producing outputs that exaggerated fishing activity. On average, this method over-estimated the number of fishing events in the PPA, Mining B median SSC and Mining A median SSC areas by 7.6, 20.2 and 25.4 times respectively (see discussion of this point in MacDiarmid et al. (2024).

49. The report by MacDiarmid et al. (2024) shows that on average 25 fishing events, mostly set netting in recent years, occur in the PPA each year. Taking into account the 7.6 x inflation factor described above, this reduces the likely number of fishing events in the PPA in any one year to about 3.3 events. Mining will occur in just 5% of the PPA (900m x 900m blocks at one time) in any one year with fishing excluded from 1 nautical mile radius of the IMV (about 10 km^2) but allowed to continue in the remainder of the PPA and wider STB (as their quota area provides). Thus, on average 0.5 events per year (or approx. 1 event every 2 years) would be displaced by a few kms to potentially occur elsewhere in the PPA and wider STB (as their quota area provides).

50. Mining will also cause a sediment plume and the report by MacDiarmid et al. (2024) shows that on average 23 to 33 fishing events, mostly set netting in recent years, occur in the Mining B median SSC and Mining A median SSC areas where mining will cause SSC to reach a precautionary level of 2 mg per litre that may cause displacement of fish to areas of lower SSC. Taking into account the 20.2 x and 25.4 x data inflation factors described above, this reduces the likely average number of fishing events in the Mining B median SSC and Mining A median SSC areas in any one year to between 1.1 and 1.3 events.

51. Fishery scale impact studies, as suggested by Seafood NZ, are not required to conclude that the economic impact on the fisheries or individual fishers will be negligible at this very low scale of potential displacement.

52. I agree that the fisheries management closures and gear restrictions, as well as the change in mix of species in the STB, potentially a result of climate change, are impacting on the nature of fishing in the STB but suggest these effects far outweigh the demonstrably negligible effects of fishing event displacement due the proposed mining operations.

53. Here I also note my conclusions from my previous Rebuttal Evidence (2024)[60] regarding the impact of the proposed mining operations on commercial fish species. *"A review of the spatial and foraging ecology of the key fauna occurring in the STB identified that for most fish species there should be negligible effects of mining 50 Mt per annum according to standard evaluation criteria. This is principally because the scale of the mined area and the areas of elevated suspended sediment concentrations (SSC) are small compared to the area used by the populations of these species. Consequently, they are likely to be displaced from or experience a decrease in prey abundance or availability over a very small part of their distribution.*

One non-commercial species, eagle ray, may be affected to a moderate extent by the proposed iron sand recovery activities."

54. Therefore, it is my opinion, that the concerns raised by submitters about the effects of the proposed mining operations on fish and fishing will not eventuate and can be set aside.

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[60] Expert Rebuttal Evidence of Dr Alison MacDiarmid on behalf of Trans Tasman Resources Limited, 23 January 2024.

Impact on and recovery of seafloor communities in the mining area

55. The EPA, Seafood NZ, and other submitters[61] raised concerns about the time for seafloor communities in the mined sediments to recover.

56. The proposed iron sand recovery operations will, over a period of 20 years, gradually (about 5% of the PPA per year) and sequentially impact the benthic fauna throughout the PPA. It is likely that the vast majority of biota will not survive the mining, processing, and re-deposition process.

57. Active seabed processes will tend to winnow any fine particles from redeposited surface sediments and transport unmined sediments into the area – both processes will drive the characteristics of surface sediment towards that originally present, and a similar benthic community can be expected to eventually repopulate the surface sediment and this process will start to occur almost immediately following the re-deposition event.

58. Repopulation of the redeposited sediments will, for most species, occur via settlement of planktonic larval stages that are likely to have originated many kilometres away. Mobile benthic invertebrate species are very uncommon in the proposed mining area and immigration from immediately adjacent areas to the strip being mined and sediment re-deposited is expected to be equally low.

59. I note that the PPA and immediately adjacent areas are very exposed, high energy, highly dynamic sandy environments and are thus constantly subjected to frequent episodic disturbances from storm and wave events and river inputs

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[61] Nga Motū Marine Reserve Society; New Zealand Rock Lobster Industry Council; Parliamentary Commissioner for the Environment; Te Kahui o Taranaki; Taranaki Regional Council; South Taranaki Underwater Club; Evidence of N Sitarz for Royal Forest and Bird Protection Society of New Zealand; Evidence of T Anderson for Kiwis Against Seabed Mining and Greenpeace Aotearoa.

during high rain-fall events. Consequently, the existing benthic community in wider STB, including the PPA, is dominated by short-lived, opportunistic and early successional or colonisation stages, with a very low abundance of longer-lived organisms. This STB community is well-adapted to disturbance and will in time recover once the immediate disturbance has ceased at a particular mining site within the PPA.

60. However, the time it will take for the benthic community to recover is not able to be stated with precision as recovery experiments on the seafloor in the STB proved impossible due to sand movement. Therefore, recovery rates need to be inferred from studies undertaken in more sheltered inshore and deeper locations.

61. There is information available in New Zealand and overseas on benthic community recovery rates in more sheltered locations following sediment plume and sedimentation events as a result of dredging and other activities. For example, Port Otago studies have shown that it took up to 6 months for a disposal site in Blueskin Bay, outside the Otago harbour entrance, to recolonise and have a similar community to a site protected from disposal[62].

62. Recolonisation following sand disposal, which is the main type of material to be considered with the TTR application, was much quicker with the community being similar to pre-deposition on a time scale of weeks.

63. This is consistent with experimental studies undertaken in Menai Strait, North Wales that showed clean sand communities had the most rapid recovery rate following disturbance, whereas communities from muddy sand habitats

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[62] James, M.; Probert, K.; Boyd, R.; Sagar, P. (2009). Biological resources of Otago Harbour and offshore: assessment of effects of proposed dredging and disposal by Port Otago Ltd. NIWA Client Report HAM2008-152, Project: POL08201.

had the slowest physical and biological recovery rates (Dernie, et al. 2003)[63].

64. Newly published research indicates relatively rapid recovery (~1 year) of a deep sea (~450 m water depth) benthic community on the Chatham Rise after experimental disturbance[64]. Similarly, recently published research undertaken in the Kaikoura canyon indicates remarkable recovery of a diverse deepwater benthic population after being completely buried by the avalanche of sediments released by the 2016 Kaikōura earthquake[65,66]. The results show that all fauna dramatically decreased immediately after the turbidity flow event, and by four years after the disturbance the benthic communities were similar to, but not yet the same as, the pre-event communities. Full recovery was modelled to take as little as 4.5 years or up to 12 years.

65. In the warmer, shallower sandy waters of the STB where disturbance by storm events and land derived sediments is common, recovery of the sea floor community, once mining in the immediate area has stopped, should occur within a year for most species, faster than in the deep, cooler, less

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63 Dernie, KM; Kaiser, MJ; Warwick, RM (2003). Recovery rates of benthic communities following physical disturbance. Journal of Animal Ecology 72: 1043–1056.

64 Hale et al. (2025) Effects of an experimental in situ seabed disturbance on deep-sea benthic ecosystem function and macro-infaunal community structure on the Chatham Rise, Southwest Pacific, New Zealand Journal of Marine and Freshwater Research, 59:5, 1496-1529, DOI: 10.1080/00288330.2025.2461333

65 Bigham KT, Rowden AA, Bowden DA, Leduc D, Pallentin A, Chin C, Mountjoy JJ, Nodder SD and Orpin AR (2023) Deep-sea benthic megafauna hotspot shows indication of resilience to impact from massive turbidity flow. Front. Mar. Sci. 10:1180334. doi: 10.3389/fmars.2023.1180334

66 Katharine Bigham (2023). Resilience of deep-sea benthic communities to turbidity flows following the 2016 Kaikōura Earthquake. PhD thesis, Te Herenga Waka—Victoria University of Wellington. https://openaccess.wgtn.ac.nz/articles/thesis/Resilience_of_deepsea_benthic_communities_to_turbidity_flows_following_the_2016_Kaik_ura_Earthquake/24646104

frequently disturbed, waters of the Kaikōura Canyon and the Chatham Rise. The recovery of the seafloor communities will in turn provide favourable foraging areas for the highly mobile seafloor foraging fish species.

66. Generally, seafloor communities associated with sand in high energy environments are very frequently disturbed and are likely to be continually in an early transitional stage. The longer lived invertebrate species in these communities, such as large starfish (which were found at low densities of six per ha in the PPA), could take several years to fully recover in the area where sands are extracted and re-deposited. But there is the potential for some movement of these mobile species into the area immediately after the mining activities move to the next block.

67. I note that the post-commencement seabed monitoring to be carried out as part of the on-going EMMP is proposed to start as soon as the mining operations have moved 2km away from the initial mining site (Conditions 7 & 8) and that the final recovery monitoring process will take place for 5 years once all mining has ceased (Condition 57-58).

68. Overall, I consider that in light of the above research, seafloor communities in the PPA are likely to recover within 1 year for most species and within a few years for the larger, longer lived starfish and gastropods, this recovery will be suitably monitored and confirmed by the proposed monitoring plans and the concerns raised by submitters will not eventuate and can be set aside.

Cumulative effects

69. The EPA and other submitters[67] raised concerns that the issue of cumulative effects had not been adequately addressed by TTR.

70. I note that as the ecosystem effects of fishing, mining and other existing human activities or threats vary in magnitude and frequency, spatially and temporally, and different habitats and species respond in different ways to different threats, a single cumulative effects assessment for the STB is problematic. Rather effects should be assessed habitat by habitat.

71. Of relevance here is a study undertaken by MacDiarmid et al. (2012)[68] who carried out an assessment of the relative and combined impact of 65 potentially hazardous human activities, including sand mining and various forms of fishing, that may affect 62 identifiable marine habitats in New Zealand waters. They found that although specific "point" stressors can be key threats in some marine habitats, across all habitats the "press" stressors resulting from the effects of climate change, particularly ocean acidification and seawater temperature rise, proved to have the highest impact. This is because these generic threats impact all habitats, all of the time and are expected to increase.

72. For sand dominated, exposed shelf habitats at depths similar to the PPA, three threats generally dominate being bottom trawling, scallop dredging, and ocean acidification (Table A2.33 in MacDiarmid et al. 2012) with these threats in

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[67] Wanganui Manawatu Sea Fishing Club and Patea & Districts Boating Clubs; Seafood New Zealand; South Taranaki Underwater Club; Evidence of T Anderson for Kiwis Against Seabed Mining and Greenpeace Aotearoa.

[68] MacDiarmid et al. (2012). Assessment of the anthropogenic threats to New Zealand marine habitats. NZ Aquatic Environment and Biodiversity Report 93, 255 p. see https://fs.fish.govt.nz/Page.aspx?pk=113&dk=22981

combination having a moderate impact on this habitat nationwide (Table 9 in MacDiarmid et al. 2012).

73. In the case of the PPA specifically, there is no history of scallop dredging but a long history of bottom trawling and set netting (See MacDiarmid et al. 2024) with ocean acidification an existing and increasing threat (Stats NZ 2022). If the proposed mining goes ahead then about 5% of the PPA is expected to be impacted each year (although this should recover over about a 1-2 year period), and fishing impacts will reduce a little as it will only be excluded from the area of active mining. In summary, in the PPA, if the mining proposal goes ahead, the key threats will remain ocean acidification, bottom trawling, and set netting and, for a period of twenty years, will be joined by seabed mining.

74. In habitats outside the PPA, existing threats will continue to dominate as the principal mining threat which is from the sediment plume will vary in space and time. For example, in sandy habitats elsewhere on the Patea shoals, the key threats will remain ocean acidification, bottom trawling, and set netting (where allowed) resulting in a moderate impact (Table 9 in MacDiarmid et al. 2012).

75. On rocky reefs such as the North and South Traps, the key threats will remain (from Table A2.31 in MacDiarmid et al. 2012) ocean acidification, lobster trapping, increased storminess, increasing sediment loading and associated turbidity from river runoff, line fishing and a recently identified threat of underwater noise to reef fish caused by recreational fishing craft (see Wilson et al. 2023) which in combination have a moderate to major impact (Table 9 in MacDiarmid et al. 2012).

76. On exposed coastal rocky reefs where kai moana gathering is known to occur also, the key threats will remain (from Table A2.24 in MacDiarmid et al. 2012) increased storminess,

increased intertidal temperatures, ocean acidification, increased sea temperature, sea level rise (all a consequence of climate change), sediment loading from rivers, and an increase in UV radiation. MacDiarmid et al. (2012) ranked this habitat as the 5th equal highest impacted marine habitat in New Zealand. Mining derived sediments are not expected to impact this habitat or affect its overall threat ranking, as mining derived sediments will not drive SSC above background levels in this zone.

77. In the offshore bryozoan rubble habitat, the existing threats of ocean acidification and bottom trawling will remain as the most important as the mining derived sediment plume is likely to rarely impact this area (Table A2.29 in MacDiarmid et al. 2012). In combination, existing threats to this habitat indicate it is moderately impacted (Table 9 in MacDiarmid et al. 2012) with no change expected from the proposed mining activities.

78. Overall, I consider that in light of the above information, the existing and ongoing human activities impacting the marine environment in the STB pose a larger and longer lasting threat than that stemming from the proposed mining activity which will be restricted to a particular place, for a period of twenty years, and from which the PPA will quickly recover. In my opinion, the concerns about this matter raised by submitters can be set aside.

CONCLUSION

79. Submitters contend that the Project will have a high impact on the habitats and species of the Patea Shoals and South Taranaki Bight more generally, and there is insufficient (or insufficiently certain or recent) information available to properly evaluate ecological impact. I do not agree and insofar as the issues raised relate to the matters addressed in my evidence, I am satisfied that with the quantity and quality

of the data available the impacts are sufficiently well defined and in adequate detail for me to have confidence that granting consent, subject to the proposed conditions, will avoid material harm, and will favour caution and environmental protection in relation to the effects of the proposed mining operations and resulting sedimentation.

80. I confirm my opinions previously expressed in my previous evidence and confirm the appropriateness of the proposed conditions, acknowledging the amendments and additions proposed in my evidence above.

AB MacDiarmid

Dr Alison MacDiarmid

13 October 2025