Before the Decision-Making Committee of the Environmental Protection Authority At Wellington

Application for Marine Consent by Trans-Tasman Resources Ltd

IN THE MATTER OF	the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
AND	
IN THE MATTER OF	An application by Trans-Tasman Resources Ltd for a marine consent application made to excavate iron sand from the seabed of the exclusive economic zone in the South Taranaki Bight, process that sand to remove iron particles and return the remaining sand to the seabed.
	Kiwis Against Seabed Mining Incorporated (KASM)
	Submitter

Supplementary Evidence of Elisabeth Slooten

On Behalf of Kiwis Against Seabed Mining Incorporated

Dated 22 May 2017

Duncan Currie/Ruby Haazen

21 Shaddock Street

Eden Terrace

AUCKLAND

rghaazen@gmail.com

Ph: 021-144-3457

INTRODUCTION

1. My name is Elisabeth Slooten. I am a Professor in the Department of Zoology at the University of Otago in Dunedin, where I have worked since 1990.

2. I prepared evidence dated 24 January 2017 in these proceedings on behalf of Kiwis Against Seabed Mining Inc. (KASM).

3. I have read the Code of Conduct for Expert Witnesses Environment Court's Consolidated Practice Note (2014). In so far as I express expert opinions, I agree to comply with that Code. In particular, except where I state that I am relying upon the specified evidence of another person as the basis for any expert opinion I have formed, my evidence is within my sphere of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions which I express.

4. The purpose of this evidence is to respond to the further information provided by the applicant in response to Minute 41 of the DMC. In particular, this evidence looks at the evidence and appendices from by Simon Childerhouse.

MARINE MAMMAL DISTRIBUTION IN STB

5. There seems to be some confusion about whether species are absent from areas where no sightings have been made. To clarify, the amount of research survey effort in the STB area is very limited. Where sightings have been made, we can conclude that those species are present (assuming that the sightings were made by scientists or members of public who were competent at identifying the species correctly). In areas where no sightings were made this could be due to the absence of the species in question or (in most cases more likely) a lack of survey effort. Until more marine mammal surveys are carried out, it is not possible to estimate the number of marine mammals (individuals, or even species) that would be affected by noise levels expected to cause injury, and the number of species and individuals that would be affected to the point of responding by changing their behaviour (e.g. moving away, not being able to hear other whales in the area). This is a requirement of obtaining similar resource consents in other countries (e.g. USA).

MARINE MAMMAL RESPONSES TO NOISE

6. Measurements of hearing sensitivity have been made for a very limited number of marine mammal species, often of a small number of captive individuals. This means that noise predictions weighted by the hearing sensitivity of marine mammals are highly uncertain. To find out how marine mammals respond to this kind of noise, in realistic natural conditions, requires field observations (e.g. to provide a realistic assessment of behavioural responses). Data gathered in the absence of mining ("before mining" data) would be needed in order to detect responses to mining, including changes in the number of marine mammals (population size) and their distribution (e.g. marine mammals avoiding the mining area). If the EPA approves a resource consent for the proposed mining, population size and distribution of marine mammals will be needed to detect changes potentially caused by the mining operation. These pre-mining data (e.g. population sizes and habitat use of marine mammals before mining starts) would be extremely valuable for the EPA now, before it takes its decision whether or not to grant a resource consent.

NOISE PREDICTIONS

7. The additional information on potential noise propagation provided by TTR is an improvement on information provided previously. The map of noise propagation in the AECOM report is very useful in visualising the potential noise levels at a range of distances from the proposed mining site. Currently, very little information is available on the input data needed for the noise propagation model, both for ambient noise and the noise that would be produced by the proposed mining operation. For example, a noise level of around 171 dB may be appropriate for some of the noise sources, but the louder IVM with DPS thrusters (source level of 177 dB) would exceed 135 dB at 500 m.

8. The information provided by TTR does not adequately represent the uncertainties in the noise predictions, related to this paucity of information on the input data for the model. For example, the seabed in the STB area is not homogeneous, and variations in the acoustic properties of the seabed will affect noise propagation. In addition, there will be seasonal variability in noise propagation, changes relating to weather conditions, etc. All of these will affect the extent to which marine mammal sounds

will be masked by the mining noise, and the behavioural response of marine mammals to the noise in general. Like the sediment plume modelling, a best case, worst case and most likely case approach should be taken. For example, confidence intervals should be added to the noise map in the AECOM report or best, worst and most likely case maps provided. Noise propagation is sensitive to environmental conditions (e.g. water depth, temperature, salinity, seafloor characteristics). In addition to an estimate of the average noise level produced by the mining operation as one number (e.g. 177 dB for a given frequency range) a more scientifically realistic assessment would include the range (minimum to maximum) and 95% conficence interval for the different frequency components of the noise.

9. Another uncertainty relates to the assumptions used for the noise modeling. For example, assuming spherical or geometric spreading is a simplistic approach to noise modeling. Robust data on the acoustic environment off Taranaki would make it possible to construct a more realistic sound propagation model. At a minimum, these current assumptions and model uncertainties should be evaluated by testing more than one model scenario, with different assumptions. This is especially important given the very high level of uncertainty about all of the model inputs. In order to make this noise propagation model more realistic, there is a need to measure ambient (natural, background) noise off Taranaki and seafloor characteristics and other environmental features that will affect noise propagation. Background noise varies with weather conditions, amount of shipping on a particular day, etc. The potential impact of the mining noise will exceed TTR predictions during relatively quiet periods and will cause higher impact for marine mammals and other marine life during those quiet periods. Presenting one (average) scenario for noise propagation fails to take into account natural variation in ambient noise and in the noise expected to be produced by the proposed mining operation. The options right now are either to broaden the range of plausible noise levels and noise propagation, or to collect more data on mining noise, ambient noise and the acoustic environment (affecting noise propagation) off Taranaki. If not further data are collected before the EPA makes its decision, a range of plausible noise scenarios need to be developed, with a precautionary decision based on the most conservative (worst case) scenario. A less risk averse approach would require much more data (including data on marine mammals and noise). At this stage,

we only best case noise predictions. Worst and most likely case scenarios are needed to provide more information on the potential impacts of the proposed mining activity.

10. Noise predictions weighted by the hearing sensitivity of marine mammals are problematic due to the poor information on hearing sensitivity, as explained above. Sensitivity analyses should be conducted to test the sensitivity of the predictions about noise levels and marine mammal responses to assumptions about hearing sensitivity, environmental variability, etc. A stationary, more or less continuous source of noise over a lengthy time period (several decades) is more serious in terms of habitat degradation than shipping noise caused by ships moving through the area relatively quickly. As explained in van Helden's evidence, there are several examples of marine mammals abandoning their habitat for lengthy periods in response to noise.

11. In order to assess the potential impact of noise on marine mammals it would be very useful to add marine mammal distributions to the noise map. i.e. A marine mammal distribution "layer" added to the noise map. A simple GIS map of this sort would help the DMC evaluate the potential impacts of different noise levels on marine mammals. To make a start on this, it would be useful to plot data on blue whales (low frequency specialists), Hector's and Maui dolphins (high frequency specialists) and one or two marine mammal species that make mid frequency sounds.

CONDITION 12

12. There is no justification for the proposed noise condition of 135 dB at 500 m. This is an arbitrary cut-off level, not supported by research on injury or behavioural responses of marine mammals to noise. The reason for TTR continuing to propose this condition seems to be that two of the three marine mammal experts involved in the 2014 pre-hearing discussions were reasonably happy with the condition. However, the information that the noise condition was based on is now out of date. Since 2014, much more information has become available on marine mammals and the effects of noise on marine mammals. In addition, more data on marine mammals in the South Taranaki Bight (STB) has been gathered during this period and presented during the hearing and pre-hearing discussions in 2017. Taken together, the new information contradicts the assumption that 135 dB at 500 m would ensure that impact on marine mammals stays below a sustainable or acceptable level. For example, a review published in 2016 concluded that whale and dolphin responses to noise were highly

variable and not predictable on the basis of simple acoustic exposure (e.g. received sound level). Rather, differences among species and individuals along with contextual aspects of exposure (e.g. behavioral state) affect whale and dolphin responses.

13. The second supplementary evidence of Anton van Helden on 19 May 2017 indicates that Professor Wursig (one of the three marine mammal experts involved in the 2014 expert discussions) no longer supports the proposed 135 dB condition. In addition to the new information that has become available, the proposed condition was based on measurements of ambient noise off Taranaki that proved to be erroneous and have been withdrawn. Two of the three marine mammal experts involved in the 2014 hearing (Professors Wursig and Slooten) do not support the condition. The only marine mammal expert who still does support it is TTR's expert Dr Childerhouse. Likewise, at this hearing three of the four marine mammal experts (Slooten, Torres and van Helden) do not support the proposed condition. TTR's marine mammal expert (Childerhouse) is the only marine mammal expert who still supports this proposed condition. The other four marine mammal experts that have been involved with this resource consent application ((Slooten, Torres, van Helden and Wursig) do not support the proposed condition, after consulting with other marine mammal experts including marine mammal acoustic experts (including Professor Chris Clark).

MONITORING

14. The acoustic monitoring proposed is inadequate for providing accurate, comprehensive information on the noise produced by all of the components of the operation under normal operating conditions and routine, expected problems with the operation (e.g. blowing and replacing an o-ring, other routine maintenance). In general, the TTR proposal does not meet international best practice standards of monitoring and avoiding noise impacts (such as outlined by Southall and Nowacheck's 2016 resource guide for managing risk of seismic survey noise).

CURTIN UNIVERSITY REPORT

15. The report provided by Duncan, McCauley and Erbe from Curtin University confirms the problems raised by marine mammal experts at the 2014 and 2017 hearings, and pre-hearing discussions. The Curtin University report provides an evaluation, by leading acoustic experts, of the key problems with the evidence provided by TTR on noise and the potential impacts of noise on marine mammals.

16. In summary, the underwater noise predictions are inadequate and insufficient as a basis for a biological risk assessment. Insufficient information is available at this time to estimate the noise levels that would be experienced by marine mammals in the area ("received" levels). Noise produced by several components of the mining operation have been underestimated by AECOM (e.g. crawler source levels and frequency spectra) due to a variety of errors that are detailed in the Curtin University report.

17. Correcting these errors, together with a consideration of measured levels from dredging operations, indicates that the crawler source levels are likely to be around 10 dB higher than the 171 dB re 1 µPa @ 1m estimated by AECOM. The average noise levels produced by the integrated mining vessel are likely to be at least 10 dB higher than the 171 dB estimated by AECOM for TTR. The highest noise levels (e.g. during offloading), may be another 7 dB higher. The noise propagation modelling carried out by AECOM for TTR assumes a softer, less reflective seabed than the seabed geology data (e.g. Orpin 2013) indicate. This is likely to result in under-estimating noise levels experienced by marine mammals by several dB.

18. Taken together, these errors mean that the noise levels experienced by marine mammals will be at least 9 dB higher than predicted by TTR. The proposed condition of 135 dB at 500 m, is likely to be exceeded most of the time except for short periods of time when there is little mining activity. Noise levels typically have large fluctuations depending on the activities being undertaken. Considering all of these sources of uncertainty about noise levels, it is important that noise levels should be presented statistically (e.g. average level with 95% conficence interval). The range of expected noise levels, including typical and maximum noise, should cover the potential range of environmental conditions (e.g. weather, seafloor composition) and mining activities.

19. The underwater noise modelling needs to be re-calculated using estimates of all potential noise sources, to provide typical and worst case sound fields (such as presented in the noise map at the end of the AECOM report) in the vicinity of the mining operations out to background, ambient noise conditions. From these sound field estimates, zones of potential biological impact types should be defined for marine mammals and other species in the region.

20. The Curtin University report recommends that these impact zones are overlaid on marine mammal densities to give estimated risk assessments (probability and consequence of threat, such as hearing loss or avoidance of mining area) for the major marine mammal groups. This is a standard approach in other countries. For New Zealand, it would require marine mammal population surveys to estimate the marine mammal densities required for this exercise.

CONCLUDING COMMENTS

21. Sample sizes are low for all of the data sources (e.g. noise from the mining operation, marine mammal survey effort, number of marine mammal species and individuals tested for hearing sensitivity). All of these data are highly variable, with seasonal trends and sensitivity to environmental conditions. This makes it even more important to provide confidence intervals for the estimates of noise level.

Elizabeth Slooten

22 May 2017