Ministry for Primary Industries
Manatū Ahu Matua

24 July 2018

Richard Johnson
Environmental Protection Authority
Private Bag 63002
WELLINGTON 6140

Dear Mr Johnson

Request for advice under section 56 of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 regarding the Coastal Resources Limited Application - EEZ100015

As per your request dated 6 July 2018, MPI is providing advice on specific biosecurity questions in relation to a marine dumping consent application lodged by Coastal Resources Limited.

This advice addresses EPA's question #1 and associated subparts:

1. Request for assessment of risk of invasive species establishing populations offshore or in coastal areas identified in Appendix 5 of Coastal Resources Limited's application.

a) An assessment of the invasive species trajectory modelling undertaken by MetOcean Solutions, and its applicability to the invasive species identified in Bioresearches' report.

i. Confirmation that the invasive species identified in Bioresearches' report are, in MPI's opinion, the relevant species likely to be associated with this marine dumping application.
MPI advises that the non-indigenous species identified in the Bioresearches report include the relevant invasive species likely to be associated with this marine dumping application.

ii. Assessment of whether MetOcean Solution's model is a fit-for-purpose approach to modelling invasive species movement from the dumping site, including neutral buoyancy of particles.
MPI advises that the MetOcean Solutions model is fit for the purpose of modelling invasive species movement from the dumping site. Neutral buoyancy of particles is an appropriate parameter for a conservative (i.e., worst-case) modelling scenario.

iii. Assessment of the assumptions of the model used by MetOcean Solutions, as it relates to the invasive species highlighted by the applicant.
The model assumes zero mortality of particles over time, which is acceptable for a conservative (i.e., worst-case) modelling scenario.

iv. Any other observations on the trajectory modelling that may assist the decision-makers to understand the model and its outputs.
This modelling approach tracks the potential dispersal of neutrally buoyant particles as a proxy for tracking the spread of an introduced species. The model is a useful tool for identifying geographic areas where a species could spread to, but it does not provide information about the *likelihood* of invasive species establishment. The model is conservative (worst-case) in that it doesn't account for

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the series of stages in the dispersal process that need to be met for successful establishment to occur:

1) reproductively competent individuals are present in the dredge spoil and survive transit to the dump site,
2) individuals are released into the water column and release gametes (e.g., stress spawning) or brooded larvae,
3) fertilised eggs develop into larvae,
4) larval survival during dispersal,
5) appropriate settlement habitat is reached during the larval period, and
6) sufficient numbers settle and survive to reproductive maturity.

Attempting to model these aspects of dispersal scenarios isn't tractable, as there are substantial unknowns about rates of larval mortality and settlement, as well as variation in larval density over space and time. Because of these unknowns, it's appropriate to use a conservative dispersal modelling approach.

The percentage beached calculations (Table 4.1) are likely to be overestimates given that the model does not account for:

- physical and biological processes that diminish propagule numbers over time, and
- settlement habitat suitability (e.g., *Sabella spallanzanii* occurs in sheltered subtidal waters to depths of 30 m, and in New Zealand it is known to settle on man-made structures (pilings, moorings, vessels, etc.)).

b) Information on the status of each of the invasive species identified in Bioresearches' report (and any additional invasive species identified by MPI) that may reach the coast, for the coastal areas identified in MetOcean Solution's trajectory modelling.

i. The biosecurity status of each invasive species identified by Bioresearches in their report or identified by MPI as additional species.

Bioresearches identified eight non-indigenous species (Table 1) relevant to the dumping application:

*Table 1 -- Non-indigenous species identified by Bioresearches as relevant to the CRL dumping application. Unwanted Organisms are in **bold**. Under the Biosecurity Act 1993, Unwanted Organism means any organism that a chief technical officer believes is capable or potentially capable of causing unwanted harm to any natural and physical resources or human health.*

Taxon name	Common name	Organism type
Arcuatula (Musculista) senhousia	Asian date mussel	bivalve
Charybdis japonica	Japanese shore crab	crab
Eudistoma elongatum	Australian droplet tunicate	colonial sea squirt
Magallana (Crassostrea) gigas	Pacific oyster	bivalve
Sabella spallanzanii	Mediterranean fanworm	polychaete worm
Styela clava	clubbed tunicate	solitary sea squirt
Theora lubrica	window shell	bivalve
Watersipora arcuata	N/A	bryozoan

ii. The status of these invasive species in the coastal waters and exclusive economic zone in and around Auckland, the Coromandel, and Great Barrier Island.
Of the non-indigenous organisms identified by Bioresearches (Table 2), only *Eudistoma elongatum* and *Sabella spallanzanii* have regional distributions that do not extend into the eastern Coromandel / western Bay of Plenty.

Table 2 – Distributional status of non-indigenous species identified by Bioresearches as relevant to the CRL dumping application. Regional distribution refers to the coastal waters in and around Auckland, the Coromandel, and Great Barrier Island.

Taxon name	Year established in New Zealand	Regional distribution
Arcuatula (Musculista) senhousia	1978	Hauraki Gulf, Bay of Plenty
Charybdis japonica	pre- 2000	Hauraki Gulf, Bay of Plenty
Eudistoma elongatum	2005	Auckland, east coast of Northland
Magallana (Crassostrea) gigas	1961	Widespread
Sabella spallanzanii	2008	Hauraki Gulf, western Coromandel
Styela clava	2004	Hauraki Gulf, Bay of Plenty
Theora lubrica	1971	Widespread
Watersipora arcuata	pre- 1957	Widespread

The non-indigenous species of biosecurity concern are the tunicate *Eudistoma elongatum*, and the Unwanted Organism *Sabella spallanzanii*. Although *E. elongatum* is not an Unwanted Organism, it's a priority marine pest in the Bay of Plenty[1] and slowing its spread within New Zealand (e.g., into the eastern Coromandel and the Bay of Plenty) is a matter of general biosecurity best practice.

iii. The likelihood of each of the invasive species that disperse from the dump site or dumping vessel arriving at and establishing populations in and around Auckland, the Coromandel, and Great Barrier Island in:

- *The exclusive economic zone or continental shelf*
- *The territorial waters, and*
- *On Coastlines.*

All of the identified non-indigenous species are limited to coastal habitats. The likelihood of these taxa establishing beyond the coastal zone and at the dump site is negligible.

[1] Bay of Plenty Regional Council (2015) Bay of Plenty Marine Biosecurity Management Plan. Environmental Publication 2015/05. 49 pp.

Within coastal habitats, the species of concern are the tunicate *Eudistoma elongatum* and the fanworm *Sabella spallanzanii*. The other six species are broadly distributed across the Hauraki Gulf and the western Bay of Plenty.

A key limitation on dispersal distances is the length of the larval stage, which ranges widely among organisms and can last from hours to weeks. During the larval stage, marine organisms seek out and settle on suitable habitats, and then metamorphose to the adult life stage. If suitable settlement habitat isn't available by the end of this stage, larvae become metabolically depleted and die in the water column.

Of the dispersal scenarios (surface, mid-depth and near-bottom), the mid-depth models are likely to be the most applicable for *Eudistoma elongatum* (hereafter, *Eudistoma*): the dredged material falls rapidly through the water column (0.6–1.0 m/s; Appendix 4 of the application), and the majority of any propagules present are expected to be entrained in the material. From the dumping site, the minimum time for particle beaching via mid-depth currents is 12–16 days. Based on these timeframes, there's a negligible likelihood that *Eudistoma* will successfully reach appropriate coastal habitats, as this species has a larval duration of < 24 hours.

The near-bottom dispersal scenario is likely to be the most applicable for the fanworm *Sabella spallanzanii* (hereafter, *Sabella*). Fertilisation occurs within female tubes, and the eggs are then released into the water column. Eggs are negatively buoyant, and free-swimming larvae develop in 24–36 hours[2]. This 24–36-hour period of negative buoyancy means that the majority of any fertilised *Sabella* eggs present in the dredged material will sink to near-bottom depths before any larvae develop. Minimum beaching times for near-bottom dispersal scenarios are 33–42 days, whereas *Sabella* has a larval duration of ~ 14 days, hence there's a negligible likelihood that *Sabella* will successfully disperse to coastal areas via near-bottom currents.

Of the activities associated with this permit application, the most likely pathway for the spread of *Eudistoma* and *Sabella* to the eastern Coromandel Peninsula, Western Bay of Plenty and Great Barrier Island is via hull fouling of project vessels and barges.

The effectiveness of hull antifouling systems depends upon hydrodynamic flows over the coating, which produce a constant release of biocide that prevents organisms from settling and attaching to a hull. Long stationary periods, infrequent vessel movements and slow cruising speeds (< 10 knots) all have a negative effect on the performance of antifouling coatings, and vessels with these operational profiles are therefore highly prone to biofouling accumulation—this is especially so for barges, which are typically not antifouled because their long idle periods tend to render antifouling coatings ineffective.

Eudistoma is present in Sandspit Marina, and *Sabella* is a high-density fouling organism throughout much of the Waitemata Harbour. The slow-moving vessels and barges likely to be associated with the activities under this permit will almost certainly be susceptible to fouling by these organisms, and MPI advises that best biofouling management practices be employed to mitigate against the translocation of *Eudistoma* and *Sabella* to potential project sites that are currently free of these organisms (e.g., Whitianga).

[2] Giangrande A, Licciano M, Pagliara P, Gambi MC (2000) Gametogenesis and larval development in *Sabella spallanzanii* (Polychaeta: Sabellidae) from the Mediterranean Sea. *Marine Biology* 136: 847–861.

iv. The effects the invasive species arriving at and establishing populations around Auckland, the Coromandel, and Great Barrier Island at:

a. Sites with established populations of the invasive species, and

b. Sites without established populations of the invasive species.

The bivalves *Arcuatula senhousia*, *Magallana (Crassostrea) gigas* and *Theora lubrica*, and the crab *Charybdis japonica* all have larval durations in the range of 2–4 weeks, and therefore larvae of these species dispersing from the dumping site may have the potential to reach appropriate coastal habitats.

These species are widespread in the Hauraki Gulf and also occur in the eastern Coromandel. As indicated for question 1.a.iv, the physical and biological processes associated with the different stages of the translocation/dispersal process progressively reduce propagule numbers, and the number of recruits derived from dumping activities would almost certainly be substantially less that those originating from local coastal populations. If propagules released at the dumping site were able to successfully disperse and recruit to coastal habitat, it is unlikely this would make a discernible difference to the species' regional demographics or geographic distributions.

We thank you for the opportunity to comment on this application. I hope this feedback is helpful and assists with the review process. If you have any queries regarding our comments please feel free to contact me.

Yours sincerely

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