Assessing Impacts of Deep Sea Mining in the Water Column
Thursday, 24 September 2020
Webinar Summary

Introduction and Background

The Pew Charitable Trusts and RESOLVE convened a webinar on Thursday, 24 September 2020, to hear from scientific experts about possible impacts of deep seabed mining on the water column. The webinar also provided an opportunity to hear from other panelists about how emerging science and understanding of potential impacts of deep seabed mining will be addressed and considered in the regulation and control of deep seabed mining.

Andrew Friedman, The Pew Charitable Trusts, welcomed webinar participants and noted that the potential effects of mining in the water column are being more closely examined through recent research efforts, such as the opinion paper published in the Proceedings of the National Academy of Science authored by some of the panelists. Mr. Friedman emphasized the need to consider how all emerging science will be taken into account by regulators evaluating plans for work and contractors drafting them. The webinar was facilitated by Paul De Morgan, RESOLVE.

The webinar agenda, slides presented, participant list, and recording are available on RESOLVE's website.

Scientific Perspectives on Potential DSM Impacts in the Water Column

Consideration of midwater ecosystems is required to fully evaluate the environmental risks of deep-sea mining

Dr. Jeff Drazen, University of Hawai'i at Manoa, provided an overview of the potential effects of deep seabed mining on midwater communities and ecosystem services. Dr. Drazen noted that research has, understandably, focused on potential effects of mining on the seafloor, but now there is some urgency to gather knowledge and assess the potential for environmental risk in the water column. Dr. Drazen explained that midwater ecosystems play key roles in carbon export and nutrient regeneration, as well as provisioning of harvestable fish stocks. While mining activities would directly impact the seafloor, the water column would be impacted by noise from mining operations, sediment plumes, and dissolved/chemical plumes. Dr. Drazen noted that current plume models vary greatly in the predicted extent of plume impacts, and these models are largely informed by data only from collector plumes, so further information is needed to understand the potential impacts of dewatering plumes (water discharged from surface vessels as ore is separated from mud and seawater). Dr. Drazen explained that potential effects on individual organisms in the water column (e.g., respiratory distress, reduced feeding, toxicity) could lead to negative outcomes for ecosystem services, such as fisheries and carbon transport. Dr. Drazen recommended that the ISA, government agencies, and stakeholders mandate and fund midwater ecosystem baseline studies in areas to be mined in order to inform the creation of suitable standards and thresholds for mining effects. In order to minimize mining impacts on midwater ecosystems, Dr. Drazen also recommended ISA regulations mandate dewatering plumes be released below the mesopelagic zone (possibly to the seafloor) and minimize activities in the sound-fixing-and-ranging (SOFAR) channel.

The slides associated with Dr. Drazen's presentation are available on RESOLVE's website.

The spatial intersection between high-seas fisheries and deep-sea mining areas

Dr. Jesse van der Grient, University of Hawai'i at Manoa, presented on the possible effects of deep seabed mining on high-seas fisheries. Dr. van der Grient reiterated that mesopelagic species could be negatively impacted by dewatering plumes, leading to reduced body size and reproductive success. Areas where deep seabed mining exploration licenses have been granted fall within areas managed by regional fisheries organizations, including the Inter-American Tropical Tuna Commission, International Commission for the Conservation of Atlantic Tunas, Indian Ocean Tuna Commission, and Western and Central Pacific Fisheries Commission. Dr. van der Grient provided an overview of her research exploring the intersection of mining operations and fisheries as a proxy for conflict, and indicated that most mining areas have a low level of intersection, but the Clarion-Clipperton Zone is an exception, with moderate levels of intersection. Dr. van der Grient noted that intersection varies by country, and developing nations may experience disproportionate effects from mining, irrespective of the size of their catch. Dr. van der Grient recommended high-seas fisheries be included as stakeholders while mining regulations are developed.

The slides associated with Dr. van der Grient's presentation are available on [RESOLVE's website](#).

Potential effects of mining on the bathypelagic

Dr. Steven Haddock, Monterey Bay Aquarium Research Institute and University of California, Santa Cruz, presented on the possible effects of deep seabed mining in the bathypelagic. Dr. Haddock described the different ways sediment plumes move through the water column and how those processes could impact bathypelagic communities as discharged material drifts horizontally through the water column and settles vertically in the water column. According to Dr. Haddock, one of the biggest gaps in our understanding of potential deep seabed mining impacts is how plumes will drift through the water column, including how they are impacted by deep currents in regions leased for mining. Dr. Haddock explained bioluminescence is a predominant feature of that organisms in the water column, and it is relied upon for defense, offense, and communication. Further, sediments impair the ability of blue light to transmit through the water column, reducing the effectiveness of bioluminescence upon which bathypelagic organisms rely. In addition to impaired bioluminescence, Dr. Haddock noted that there is a diversity of potential impacts on bathypelagic organisms from advected, sinking, or benthic sediment plumes.

The slides associated with Dr. Haddock's presentation are available on [RESOLVE's website](#).

Perspectives on Addressing and Considering Emerging Science

Ms. Michelle Walker, Deputy Solicitor General, International Affairs Division, Attorney General's Chambers of Jamaica and chair of the ISA's Legal and Technical Commission (LTC), opened her remarks by noting that revised recommendations for contractors regarding the assessment of the possible environmental impacts arising from deep seabed mining were released on March 30, 2020 (under Exploration Regulations), and these revised recommendations expand the area of focus beyond the benthos to more fully consider impacts in the water column. The first opportunity for the LTC to see how the new recommendations influence contractors' operations will be in the 2021 annual reports produced by contractors, which are anticipated to be available to the LTC in July 2021. Ms. Walker indicated, under the exploitation regulations, contractors must undergo 5-year periodic reviews of their operations, and the LTC considers water column studies conducted by contractors as part of this review process. In addition, guidelines for environmental impact assessments and environmental impact statements are

being developed by the LTC through a Technical Working Group (currently working intersessionally). These guidelines are being expanded to include a description of the water column environment (e.g., oceanography, chemistry, ecology), as well as specification of impacts and management measures to mitigate impacts. Ms. Walker emphasized that LTC documents are not static and will respond to changes as the state of knowledge evolves.

The slides associated with Ms. Walker's presentation are available on RESOLVE's website.

Emerging Science and Contractors

Dr. Tomohiko Fukushima, Deep Ocean Resources Development, opened his remarks by indicating they are reflective of his personal opinion. Dr. Fukushima observed that it is the contractors' duty to keep up with current science and keep their stakeholders informed, which is challenging given the rapid pace of scientific progress. Dr. Fukushima emphasized the iterative nature of the scientific process and the limitations of an inductive approach. Dr. Fukushima noted that contractors and administrators, such as the ISA, have a common need for clear and solid standards and evidence, which is inherently challenging given the evolving nature of scientific knowledge. Dr. Fukushima recommended that decision makers consider emerging information in their decision making processes while also acknowledging the limitations of new information.

The slides associated with Dr. Fukushima's presentation are available on RESOLVE's website.

Questions from Participants

During the panelists' presentations, webinar participants were invited to share questions through the Zoom Question and Answers pod. The questions posed and panelist responses are included below (please note, although there was insufficient time to answer all questions and comments submitted by participants, a synthesis of those is captured in Appendix I).

> Q: *Baseline information seems to be critical to monitoring and controlling pelagic impacts. What is the most important baseline information that should be collected for the pelagic realm and who is ultimately responsible for collecting it?*

Dr. Drazen indicated a baseline of the midwater community structure, including how it is structured vertically, would be important, but did not weigh in on who should be responsible for collecting that information. Dr. Haddock indicated better information on how ocean currents and plumes will interact would be important information for understanding how sediment plumes will spread and impact midwater communities. Ms. Walker explained that the exploration regulations require contractors to collect some baseline data for environmental monitoring purposes, and the specific processes and procedures for collecting baseline data are to be detailed in the standards and guidelines for contractors.

> Q: *How much do we know about plumes, including from models, and what assumptions are we making at this point about their dispersion, composition, and variability in different oceanic environments? What gaps do we have in that knowledge? And while we are focused on the pelagic realm today, what assumptions are we making about their impacts on benthic communities?*

Dr. van der Grient explained that, in order to properly model plume dispersion, modelers need baseline information that includes oceanographic data, which can vary widely across the large regions leased for mining. She indicated that biologists and modelers can collaborate effectively by flagging important questions and sharing relevant knowledge from differing disciplines to inform model development. Dr. Fukushima indicated contractors can provide additional data to improve plume modeling (e.g., discharge depth, quality of waste water (or plume), quantity of discharge). Dr. Fukushima also noted that in order to incorporate the model results into the rules or regulations, modelers should be clear about their degree of certainty in model predictions.

During the exchange between panelists, a related question submitted by another participant was added to the discussion – specifically, the Panel was asked whether the midwater plume assumptions being described were realistic? Noting that Dr. Tom Peacock, MIT, was on the webinar, the Panel asked him to share his thoughts through the comment field. Dr. Peacock indicated there is a good understanding of the dynamics of midwater plumes and there are now models, validated by field data, under review. He also added that aggregation will not be a significant factor and the midwater plume may never actually settle, just dilute; that it would not necessarily be a good thing to try and release a plume near the bottom; and the key unknowns are thresholds and midwater turbulence levels for determining the extent of impact of the plumes.

> Q: *How do we assess and account for variability in the midwater column over time, including long-term effects like climate change?*

Dr. Drazen indicated that data sets of the system across time are needed to assess and parameterize variability, but that this is a challenge given that contractors are seeking to establish baseline data sets over a 1-2 year period before submitting applications for exploitation. Such a short time period for data collection may capture seasonal variability in the water column, but it is unlikely to capture annual changes without decades-long data sets. Dr. Drazen explained that valuable climate change-related models look at how changes in environmental drivers (e.g., food supply, temperature) impact biological aspects of systems in order to predict some effects of climate change. Such an approach may be a useful way to assess the impacts of climate change in these deep seabed mining contexts.

> Q: *How does the LTC reconcile its desire to ensure Recommendations reflect the most current knowledge while also ensuring that they provide a stable regulatory regime that is not constantly changing? Are the contractors required to apply the updated Guidelines for baseline assessments? How many are going back to study the water column? How the ISA will make sure that contractors adapt their technologies and comply with the best available evidence and emerging science?*

Ms. Walker explained that contractors are required to apply updated recommendations and guidelines as they continue their work, so annual reports submitted by contractors in 2021 will be assessed against the revised recommendations. If annual reports demonstrate that there are gaps between the recommendations and the contractor's operations, then contractors will be made aware through the ongoing feedback process with the LTC and through regional workshops. Ms. Walker pointed to the most recent regulatory revisions as an example of how the ISA engaged contractors and other stakeholders in a series of workshops as a way to consult with them and develop the necessary revisions based on available information. She pointed to ongoing consultation as way to ensure compliance with an evolving regulatory framework.

Closing Remarks and Next Steps

Mr. Friedman closed the webinar by thanking the panelists and participants and inviting participants to share thoughts on topics for future webinars in the series of substantive discussions Pew will sponsor before the next meeting of the ISA Council. As noted above, there was insufficient time to answer all questions submitted by participants, these additional questions are captured in Appendix I, and Pew and RESOLVE will be considering steps to explore these in the future.

In an effort to ensure wide participation of stakeholders in different time zones, the timing for future webinars will be staggered, and sessions will be recorded and shared. Please visit RESOLVE's website for more information on future webinars in this series on draft regulations for seabed mining.

Webinar Participation

Panelists

- Jeff Drazen, University of Hawai'i at Manoa
- Tomohiko Fukushima, Deep Ocean Resources Development
- Steven Haddock, Monterey Bay Aquarium Research Institute and University of California, Santa Cruz
- Jesse van der Grient, University Of Hawai'i at Manoa
- Michelle Walker, Attorney General's Chambers of Jamaica and ISA's Legal and Technical Commission

Participants

- Erika Ablett
- Victoria Assad
- Juan Azofeifa
- Tiffany Bachtel
- Maria Baker
- Samira Bowden
- Susan Casey
- Alexus Cazares
- Julia Chavarry
- Anela Choy
- Malcolm Clark
- Guido Corno
- Emma Critchley
- Duncan Currie
- Bronwen Currie
- Alden Denny
- Rosa Mar Dominguez
- Sally Dowd
- Michael Dowd
- Cherisse Du Preez
- Elva Escobar
- Jacqueline Evans
- Jason Everett
- Aria Finkelstein
- Jessica Fitzsimmons
- Kristina Gjerde

- Harriet Harden-Davies
- Bobby Hayden
- Becky Hitchin
- Eri Ikeuchi
- Mark Irvine
- Zino Izourar
- Jun Jiang
- Megan Jungwiwattanaporn
- Naohisa Kanda
- Andrei Karkar
- Yota Kawai
- Hajime Kawamura
- Jennifer Kennedy
- Nicholas Kirkham
- Agata Kozłowska-Roman
- Astrid Leitner
- Emma Lennox
- Lisa Levin
- Susanna Lidström
- Dhugal Lindsay
- Yaqin Liu
- Estela Mercedes Mansogo
- Phil McCabe
- Kate McKessar

- Helena McMonagle
- Elisabetta Menini
- Liz Miller
- Jumpei Minatoya
- Thabo Molefe
- Erika Montague
- Clement Yow Mulalap
- Carlos Munoz Royo
- Jared Naimark
- Kelvin Passfield
- Thomas Peacock
- Jessie Perelman
- Steve Persall
- Kim Picard
- Dr. Samuel Olatunde Popoola
- Monty Priede
- Lucinda Quigley
- Moagabo Ragoasha
- Louisa Rio
- Tom Rudolph
- Vasser Seydel
- Hannah Sharman
- Ana Silva
- Rebecca Simpson
- Samantha Smith

- Jason Smith
- Dale Squires
- Gabrielle Stedman
- Atsushi Suzuki
- Masahiro Suzumura

- Tomoko Tauchi
- Michal Tomczak
- Ayumi Tsukasaki
- Verena Tunnicliffe
- Siosiua Utoikamanu

- Cindy Van Dover
- Steven Vandenborre
- Marjo Vierros
- Karen Wishner
- Emily Young

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- Laura Bartock, RESOLVE
- Maya Breitburg-Smith, RESOLVE
- Anindita Chakraborty, The Pew Charitable Trusts
- Paul De Morgan, RESOLVE
- Andrew Friedman, The Pew Charitable Trusts

Appendix I – Additional Questions

Given the breadth and depth of questions posed during the 24 September webinar, Assessing Impacts of Deep Sea Mining in the Water Column, there was not time to address all of them during the event. Pew and RESOLVE have synthesized some of the key issues raised as a basis for possible future discussions.

Plumes:

Several questions concerned the status of ongoing plume-related research and specifically the nature and impact of plumes. Participants asked for further detail regarding:

1. What standards and thresholds might be, or are currently being, applied to plumes. Would these standards or thresholds focus on mitigation techniques (like a specific height or mechanism for discharge) or outcomes (like limitations on sediment dispersal or toxicity)?
2. The major gaps in our knowledge about plumes and research efforts underway to address those gaps. Particularly, what field testing has been conducted and what has it shown? What have they revealed about the possible spread and composition of the plume?
3. How temporal (including seasonal and multi-annual) and spatial variability in midwater conditions factors into models or estimates about plumes.
4. Potential plume impacts on mid-water biology, particularly migratory species (both horizontal and vertical).
5. Whether there is an acceptable threshold for impacts from a midwater plume, and how might it be defined.
6. Restoration and its role in addressing water column impacts (and whether "restoration" is even feasible for mid-water impacts).

Regulations and Decision-making:

Other questions focused on how increased awareness of mid-water impacts and other emerging scientific evidence might factor into decision-making frameworks for the ISA and other stakeholders, seeking further detail on:

1. What ISA tools and options exist to identify and address environmental damage in the water column during mining operations.
2. How the ISA will integrate new information and knowledge into an evolving regulatory regime while still providing some stability and predictability.

Some participants looked beyond water column to ask about general aspects of the environmental regime. Specific details were sought regarding:

1. How to assure/encourage compliance with non-binding guidelines on mid-water impacts; and what would be the implications of non-compliance.
2. How to facilitate participation in decision-making by other marine users of the water column; and whether RFMOs and the general public each have a role to play.