

Deep Sea Mining: A brief summary of potential impacts on marine mammals



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Deep Sea Mining

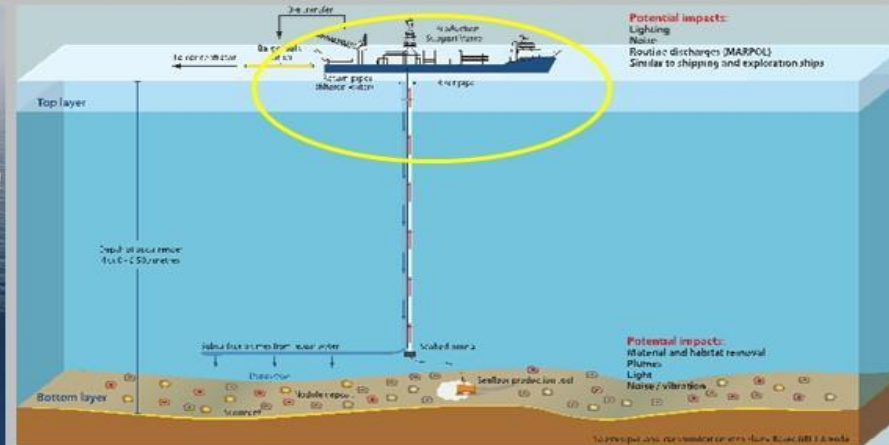
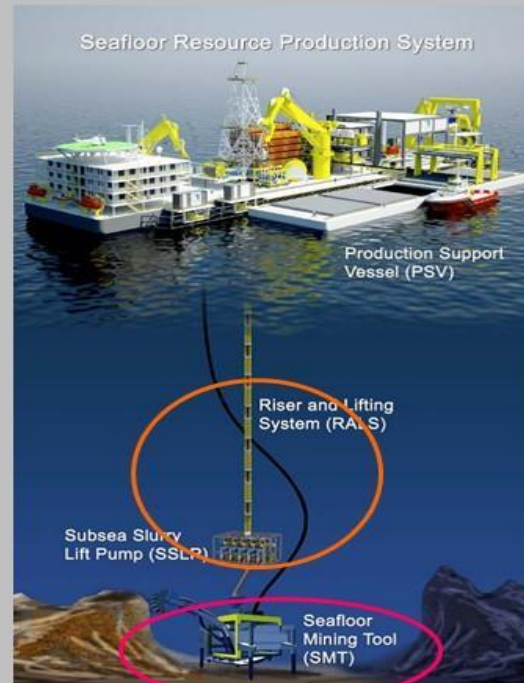
- Marine mammals: whales, dolphins, seals, dugongs
- It is a relatively new technology globally with considerable uncertainty regarding the potential for environmental impacts
- In most mining locations, the biological environments are often poorly understood by comparison to terrestrial environments
- There are currently no recognised international best practice guidelines for minimising or mitigating environmental impacts
- Regulators, therefore, may apply the precautionary approach in the absence of any empirical data
- Effects: Environmental, Ecological, Physiological, Underwater noise



Deep Sea Mining



Deep-sea mining impacts



Effects are 3 dimensional

Surface: ships, barges, lights

Midwater: riser pipes, discharges

Seafloor: mining tools, sediment



Potential effects on marine mammals

CAVEAT: Potential effects will vary considerably in their nature and extent across areas and species subject to a range of factors:

- Their usage of the area (e.g. breeding, feeding, migrating)
- Importance of the mining area (e.g. are marine mammals able to undertake those activities elsewhere or not?)
- Sensitivity (e.g. can they tolerate increased sedimentation, noise, or switch prey and/or areas)
- Threat status (e.g. endangered vs. non-threatened)
- The exact nature and extent of the operation and effect (e.g. sedimentation highly localised; operational noise only a little above ambient)



Potential Environmental Effects

Seafloor:

- Physical destruction
- Injury or capture of marine mammals in mining equipment
- Sediment smothering
- Toxic effects from sedimentation
- Loss and/or alteration of habitat
- Noise (i.e. from benthic operations such as pumps, sonar on crawler units)
- Light pollution





Potential Environmental Effects



Water column:

- Sediment plume can lead to ecological effects and reduced foraging success for visual predators
- Displacement and/or mortality of species (e.g. fish)
- Seabed toxins released and can accumulate in food webs
- Potential physiological and/or reproductive impacts
- Oxygen depletion
- Noise (i.e. from riser and discharge pipes)
- Entanglement risk (e.g. anchor lines, riser and discharge pipes & lines)

Potential Ecological Effects

- Covers a wide array of possible effects
- Generally due to:
 - Direct modification/destruction of sea floor habitat from actual mining activity
 - Sediment plume in water column
 - Deposition onto the sea floor
- Ecological effects
 - Displacement and/or mortality of marine mammal prey
 - May lead to changes in food webs and can be indirect
 - Indirect effects can alter parts of the web that flow onto marine mammal prey





Potential Ecological Effects

- In general, poorly understood and theoretical
- Few examples of a comprehensive evaluation of effects on food webs. Most assessments will rely on generalised ecological theory
- Few locations will have sufficient data to reliably estimate any potential effects
- Almost no examples of actual ecological effects from deep sea mining other than direct habitat destruction
 - Lack of baseline data and any monitoring of existing operations
- Risk varies considerably by operational configuration, composition and extent of sediment plume and local biodiversity

Potential Physiological Effects

- Seabed toxins can be released and may accumulate in food webs including biomagnifying in higher order predators such as marine mammals
- Potential effects can include increased mortality and/or reduced reproductive performance
- Is a direct function of the elements in the discharge and the sensitivity of marine mammals in the area of the discharge/plume
- Concerns around release of elements such as radioactive compounds
- Very poorly understood in most instances





Potential Noise Effects

Noise from mining operations is generated throughout the water column including from sources such as:

- Surface - processing vessel, support vessels
- Water column - riser and discharge pipes, pumps
- Sea floor - mining units

Magnitude and nature of noise varies but it is primarily a function of the operational configuration

Major noise sources include:

- Pumps for moving material to and from the processing vessel
- Machinery associated with processing vessel and processing equipment
- Surface vessel traffic
- Mining units – pumps, sonar, extraction tools



Potential Noise Effects

Marine mammals are generally very sensitive to underwater noise.

Sensitivity to noise varies significantly between species, sexes, behavioural state and even temporally

- Different frequencies will affect species differently

Potential effects may include:

- Displacement of prey and/or marine mammals
- Temporary or Permanent hearing threshold shifts
- Alteration of behaviour
- Effects on communication, navigation and prey finding





Knowledge gaps

- Understanding of the real impacts of deep sea mining
- Understanding of the effectiveness of any proposed mitigation strategies
- In most mining locations, the biological environments are often poorly understood by comparison to terrestrial environments
- Spatial and seasonal distribution and abundance of marine mammals - especially offshore in deep water environments
- Knowledge of locations that are important for core biological functions, such as marine mammal breeding, feeding and resting areas, and migration routes



Concluding remarks

- Potential impacts of deep sea mining on marine mammals include:
 - Environmental, ecological and physiological effects
 - effects of sound on behaviour (including communication, foraging, migration, reproduction and predator avoidance),
 - auditory factors that affect behaviour (including perception, sensitivity, and auditory masking),
 - the biological significance (population-level effects) of these changes including long-term cumulative effects
- Finally, while impacts on marine mammals are possible, the severity of impacts will be driven on a site by site basis and could vary from negligible to highly significant depending on the location

