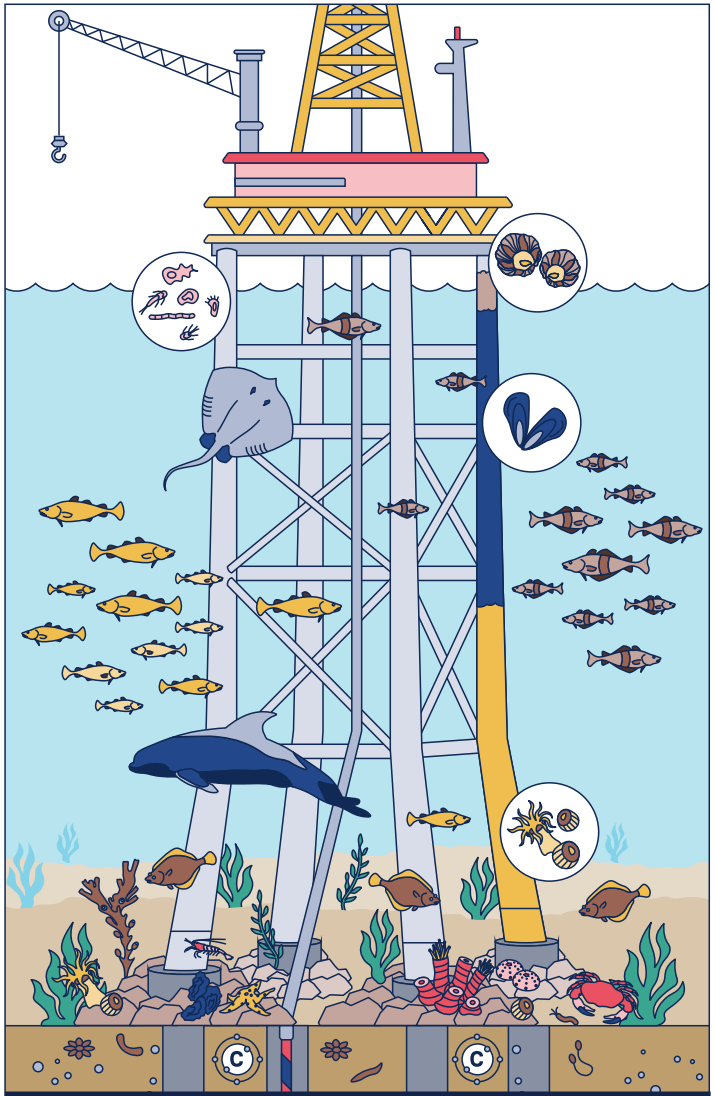
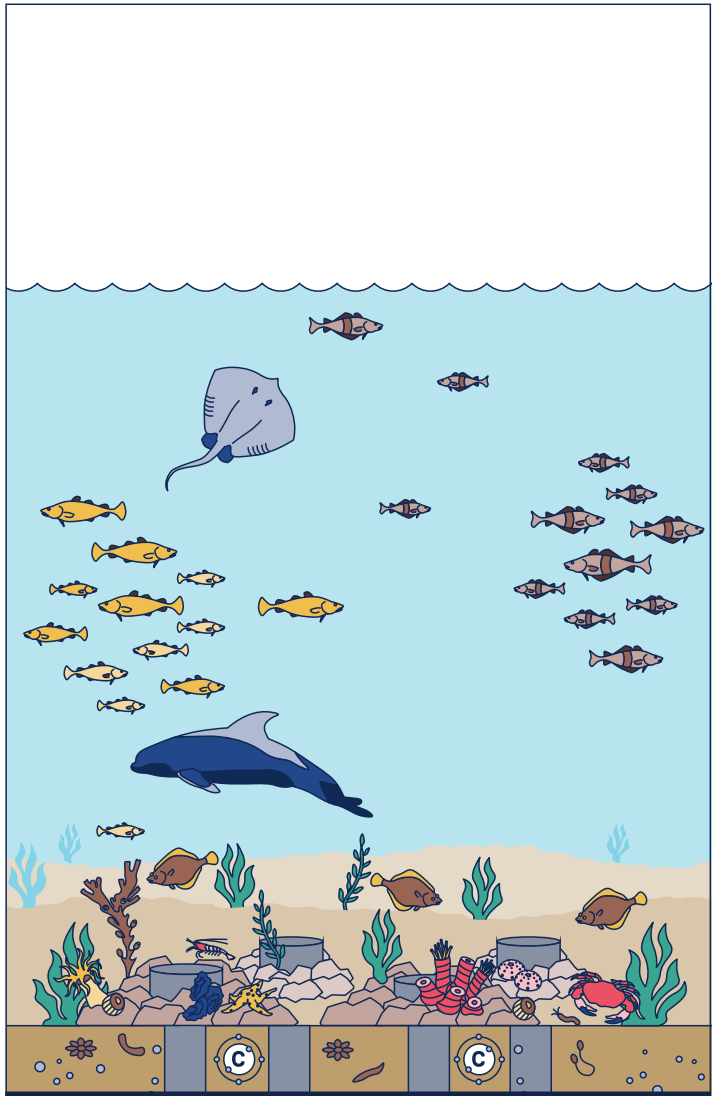
Effects of Decommissioning Offshore Platforms

Scenario-based Environmental Effects

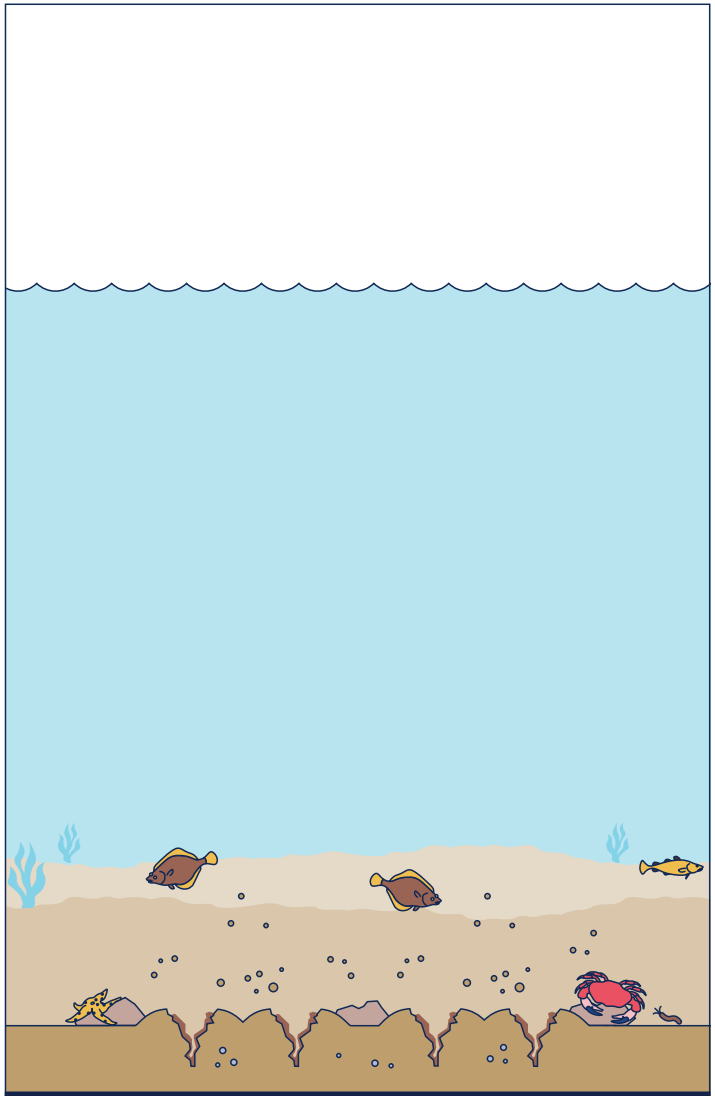
The information provided offers a general overview and is not intended to be exhaustive. The concepts and environmental drivers described will vary depending on local conditions. Therefore, decommissioning decisions should always be made on a case-by-case, site-specific basis and supported by thorough in-situ assessments. Furthermore, the decommissioning scenarios discussed are theoretical options that may currently lack regulatory approval or proven technical feasibility.



Pre-Decommissioning End-of-Life



Partial Removal Scenario



Full Removal Scenario

Illustration & graphic design: Kate Snow Design

Effects of Decommissioning Offshore Platforms

Pre-Decommissioning End-of-Life

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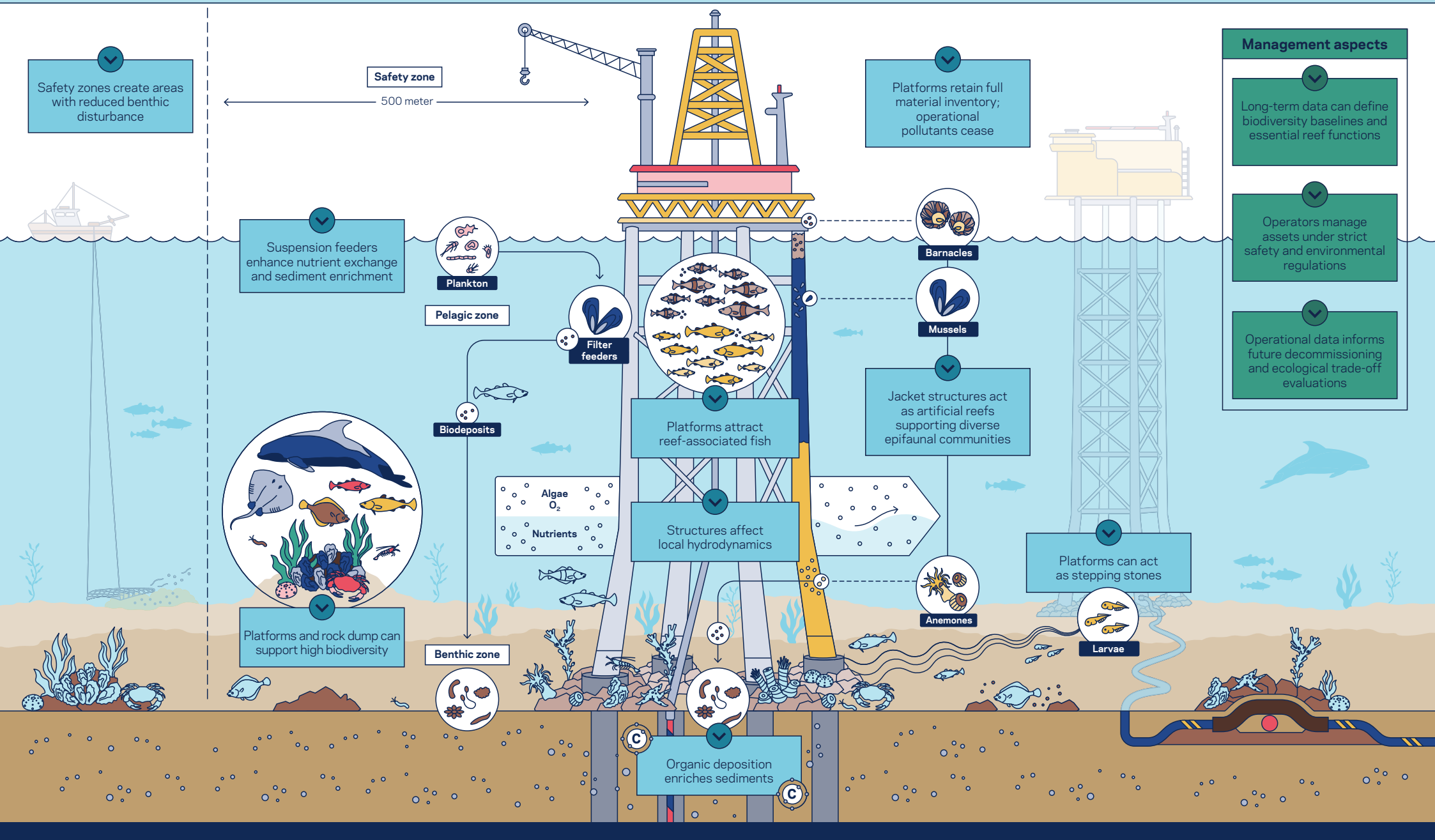

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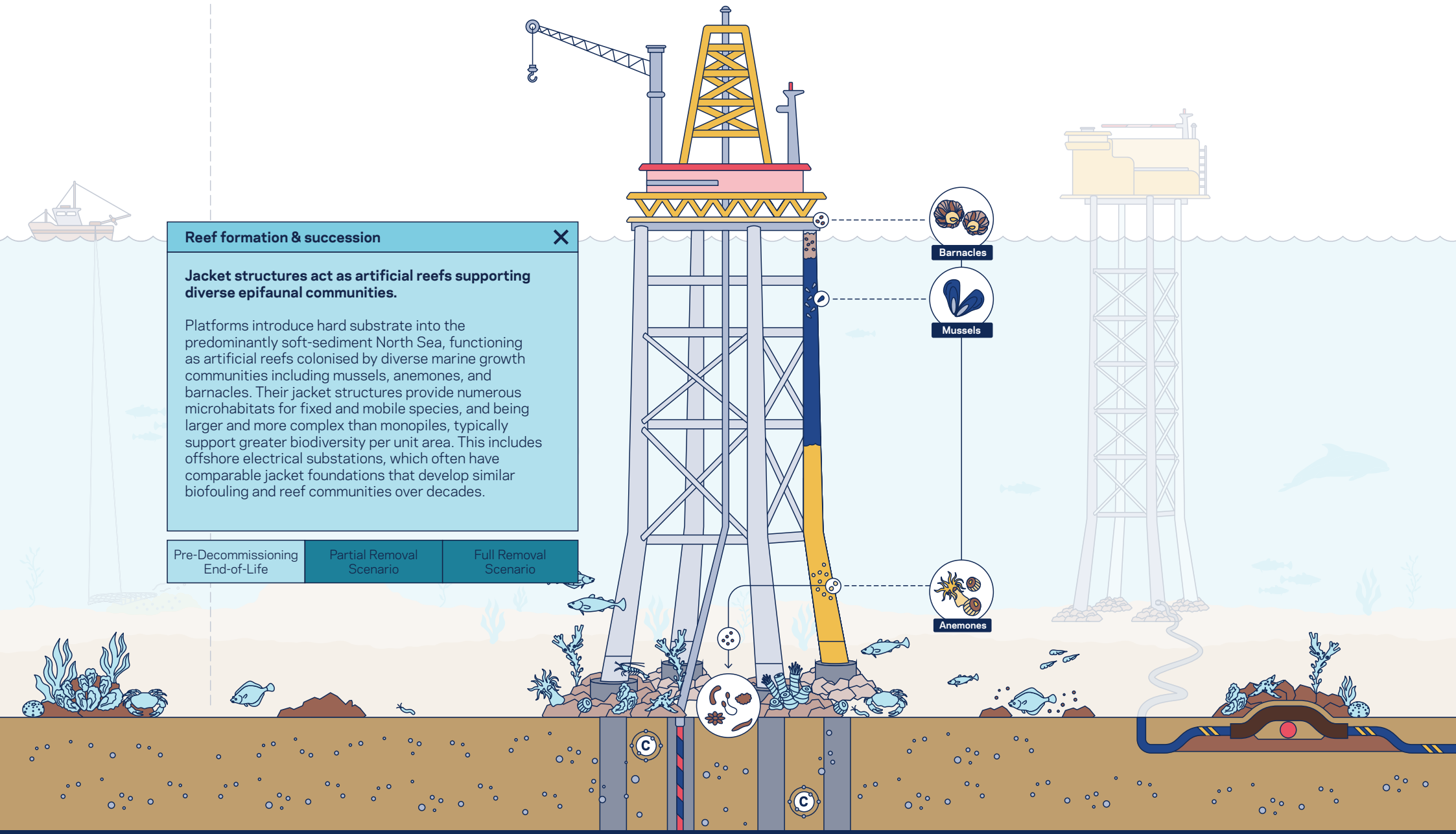

Reef formation & succession

Jacket structures act as artificial reefs supporting diverse epifaunal communities.

Platforms introduce hard substrate into the predominantly soft-sediment North Sea, functioning as artificial reefs colonised by diverse marine growth communities including mussels, anemones, and barnacles. Their jacket structures provide numerous microhabitats for fixed and mobile species, and being larger and more complex than monopiles, typically support greater biodiversity per unit area. This includes offshore electrical substations, which often have comparable jacket foundations that develop similar biofouling and reef communities over decades.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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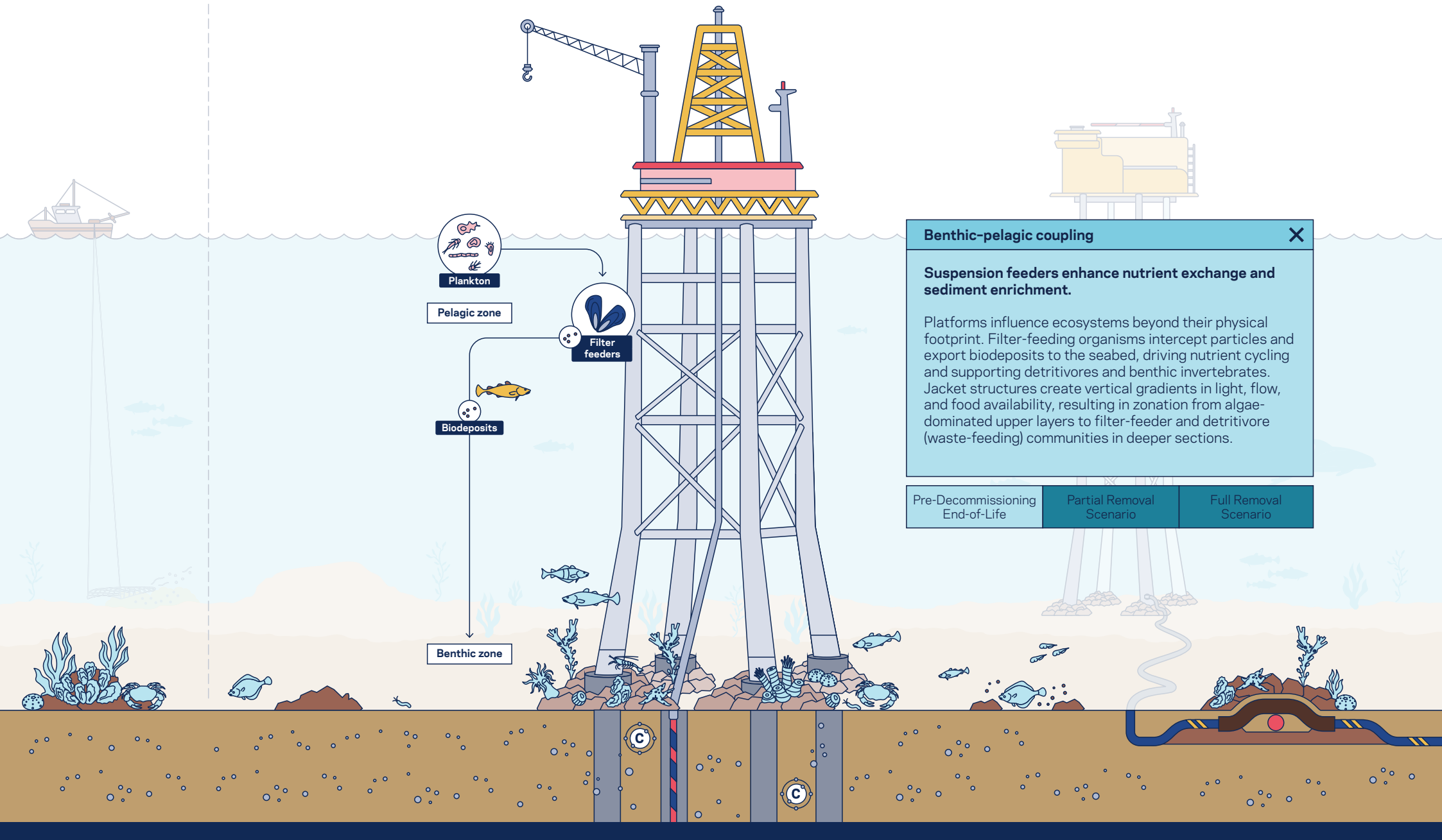

Benthic-pelagic coupling

Suspension feeders enhance nutrient exchange and sediment enrichment.

Platforms influence ecosystems beyond their physical footprint. Filter-feeding organisms intercept particles and export biodeposits to the seabed, driving nutrient cycling and supporting detritivores and benthic invertebrates. Jacket structures create vertical gradients in light, flow, and food availability, resulting in zonation from algae-dominated upper layers to filter-feeder and detritivore (waste-feeding) communities in deeper sections.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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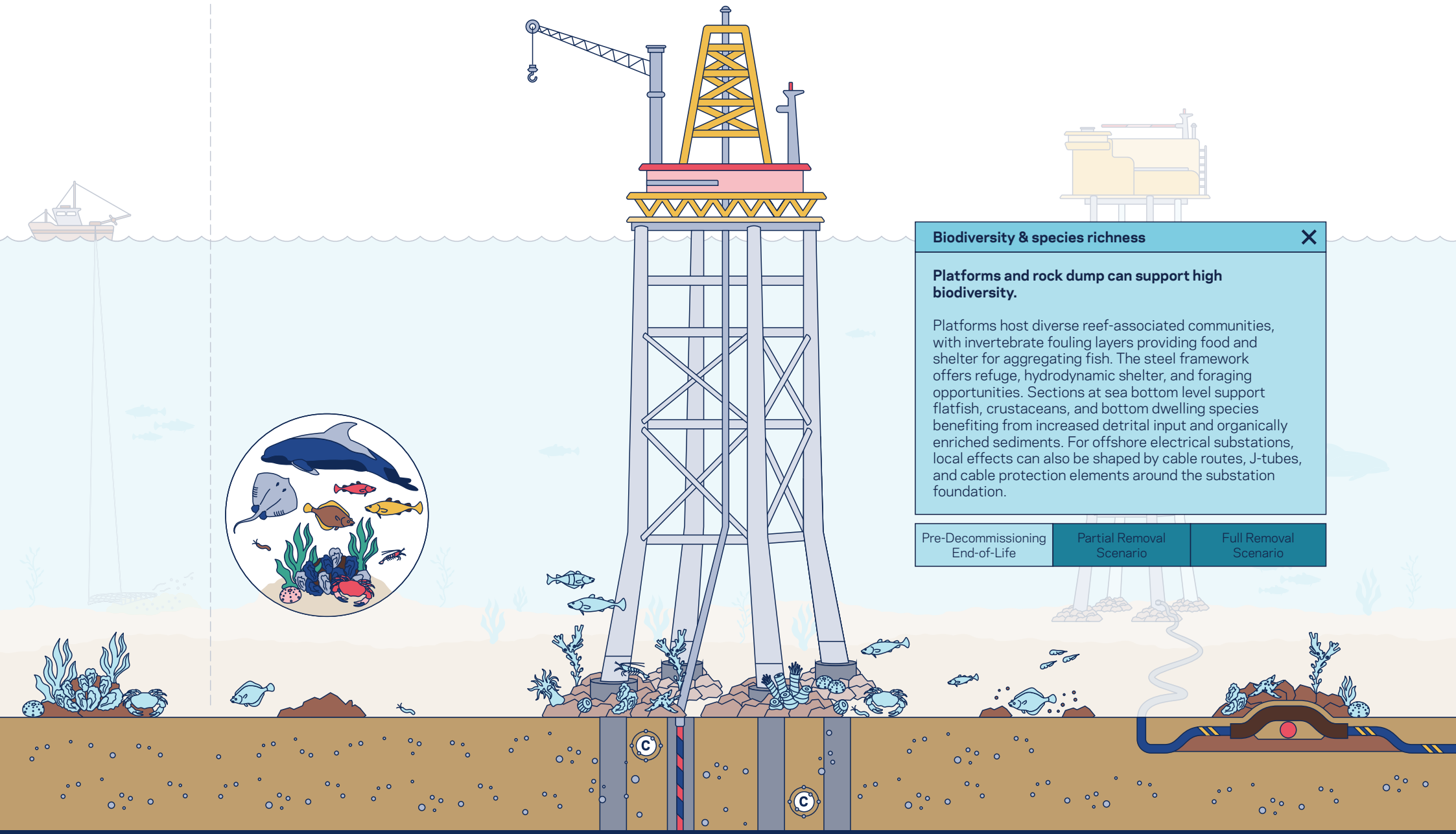

Biodiversity & species richness

Platforms and rock dump can support high biodiversity.

Platforms host diverse reef-associated communities, with invertebrate fouling layers providing food and shelter for aggregating fish. The steel framework offers refuge, hydrodynamic shelter, and foraging opportunities. Sections at sea bottom level support flatfish, crustaceans, and bottom dwelling species benefiting from increased detrital input and organically enriched sediments. For offshore electrical substations, local effects can also be shaped by cable routes, J-tubes, and cable protection elements around the substation foundation.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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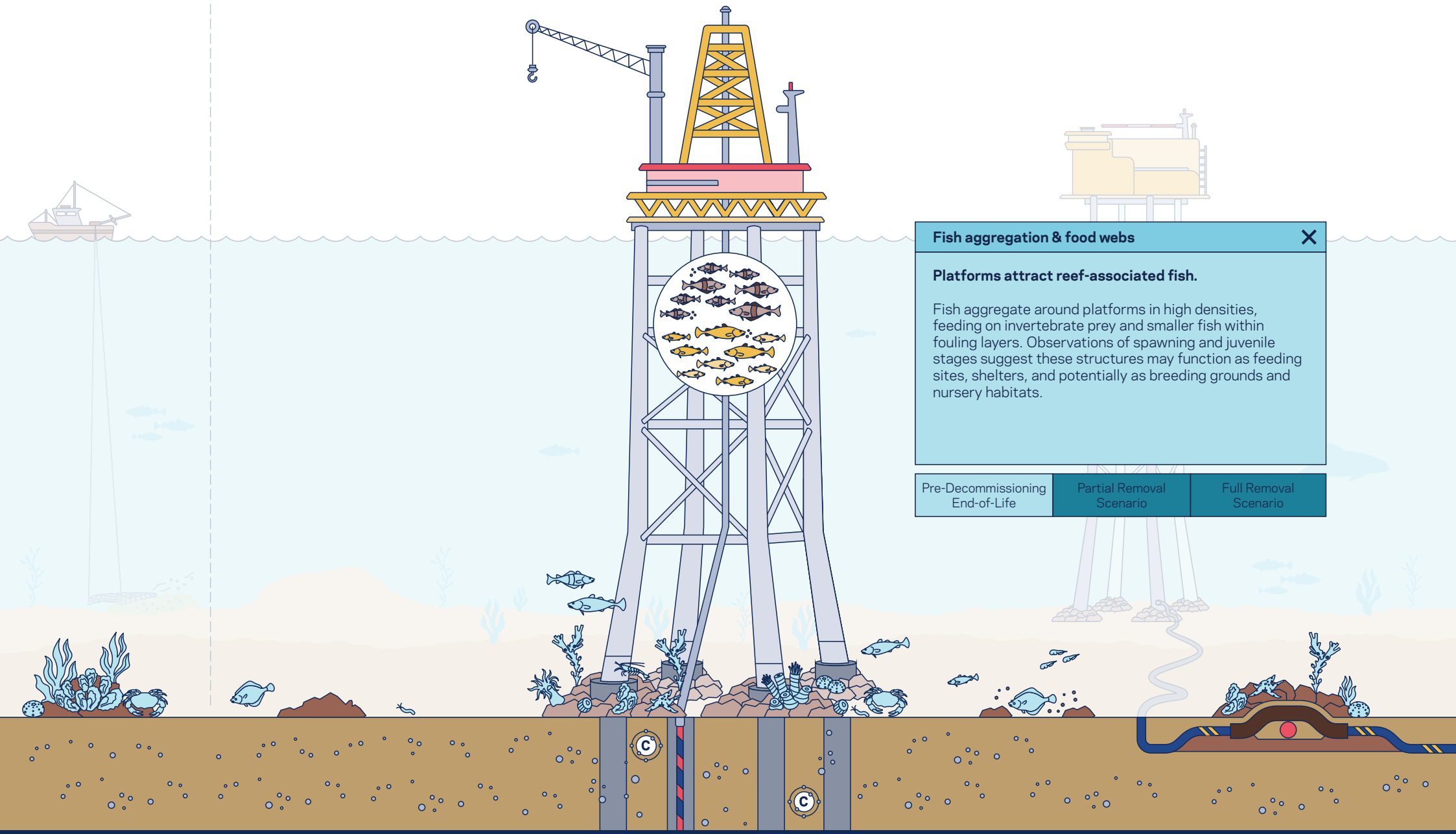

Fish aggregation & food webs

Platforms attract reef-associated fish.

Fish aggregate around platforms in high densities, feeding on invertebrate prey and smaller fish within fouling layers. Observations of spawning and juvenile stages suggest these structures may function as feeding sites, shelters, and potentially as breeding grounds and nursery habitats.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

Effects of Decommissioning Offshore Platforms

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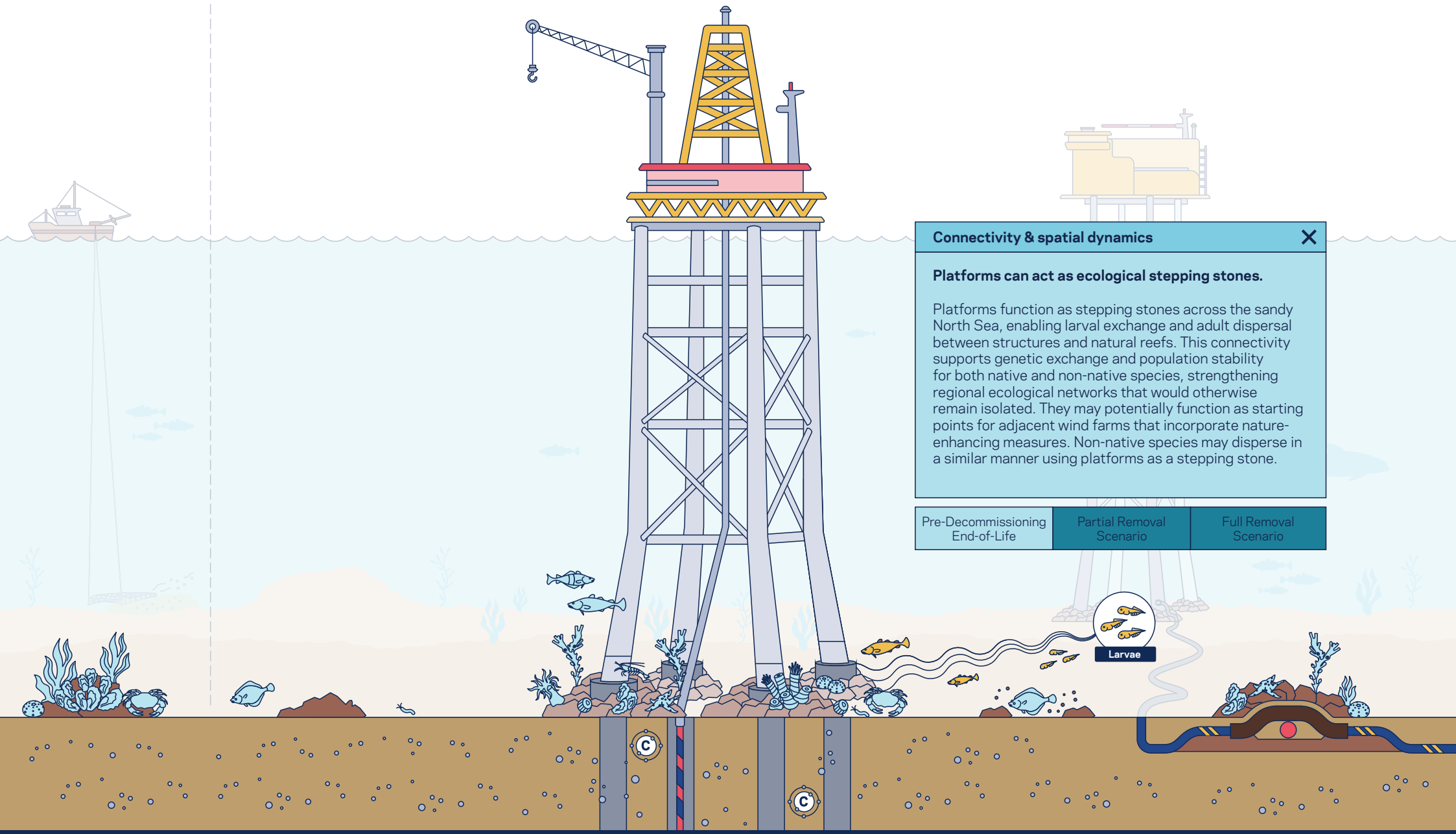

Connectivity & spatial dynamics

Platforms can act as ecological stepping stones.

Platforms function as stepping stones across the sandy North Sea, enabling larval exchange and adult dispersal between structures and natural reefs. This connectivity supports genetic exchange and population stability for both native and non-native species, strengthening regional ecological networks that would otherwise remain isolated. They may potentially function as starting points for adjacent wind farms that incorporate nature-enhancing measures. Non-native species may disperse in a similar manner using platforms as a stepping stone.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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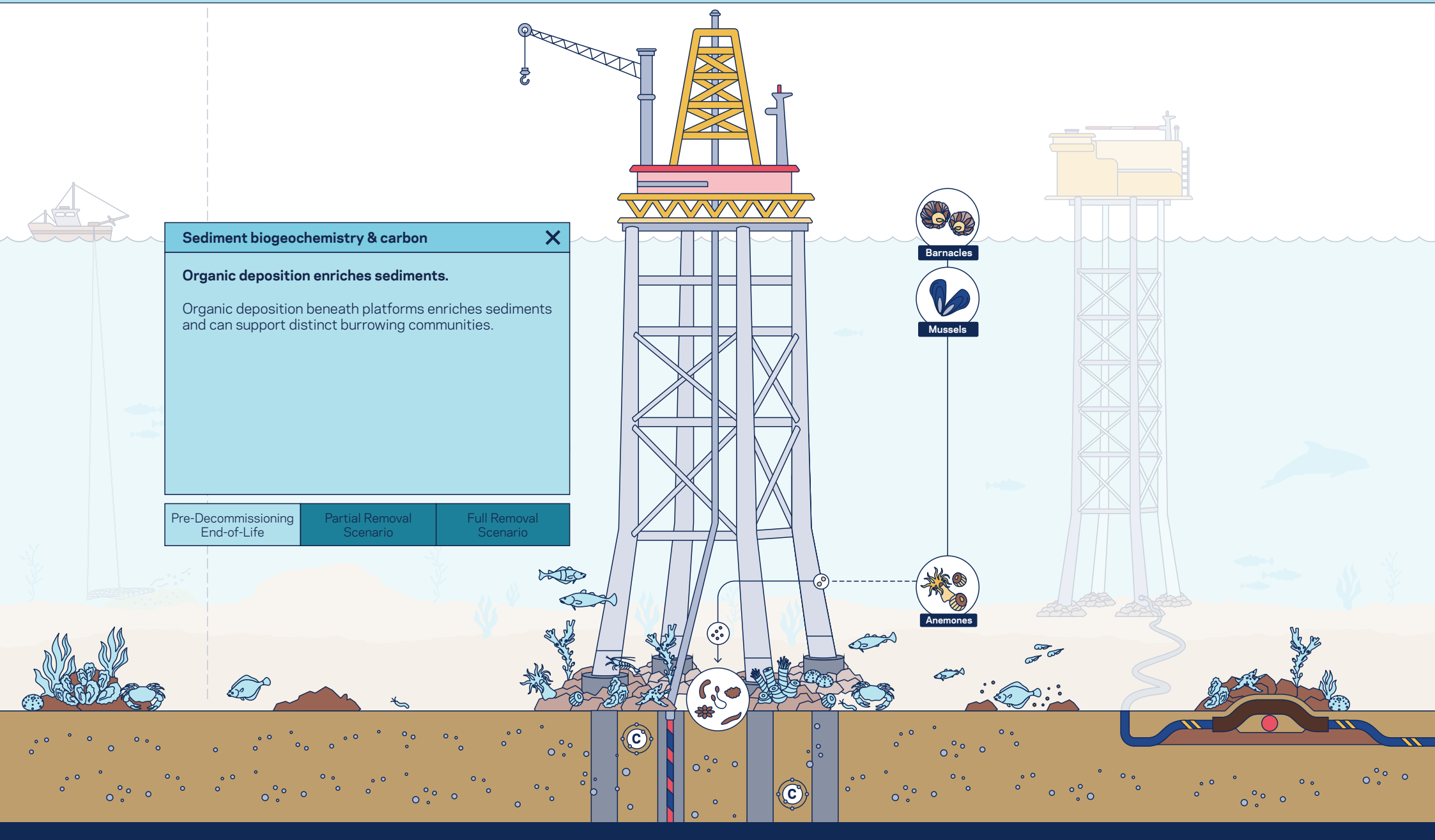

Sediment biogeochemistry & carbon

Organic deposition enriches sediments.

Organic deposition beneath platforms enriches sediments and can support distinct burrowing communities.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

Effects of Decommissioning Offshore Platforms

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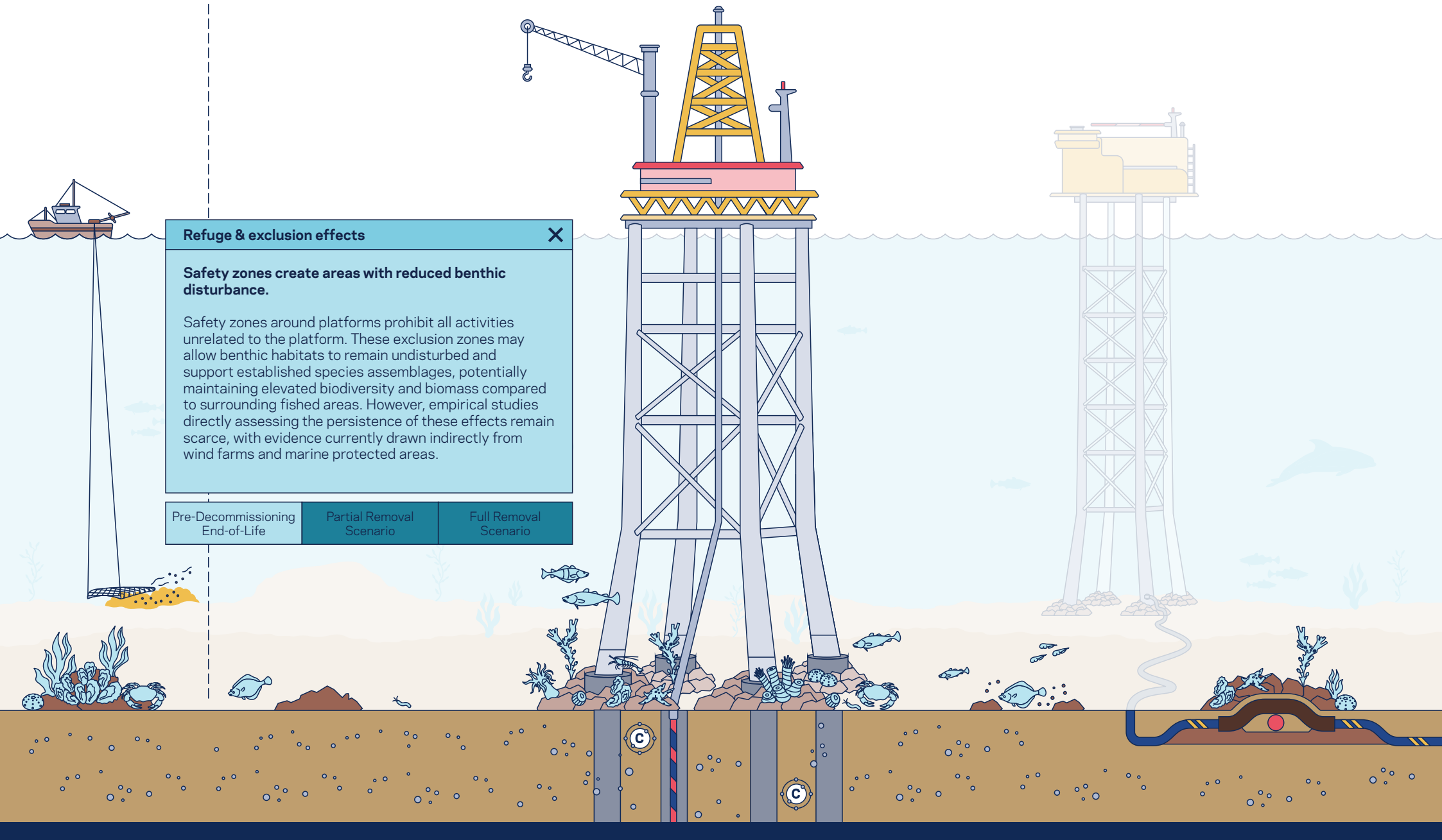

Refuge & exclusion effects

Safety zones create areas with reduced benthic disturbance.

Safety zones around platforms prohibit all activities unrelated to the platform. These exclusion zones may allow benthic habitats to remain undisturbed and support established species assemblages, potentially maintaining elevated biodiversity and biomass compared to surrounding fished areas. However, empirical studies directly assessing the persistence of these effects remain scarce, with evidence currently drawn indirectly from wind farms and marine protected areas.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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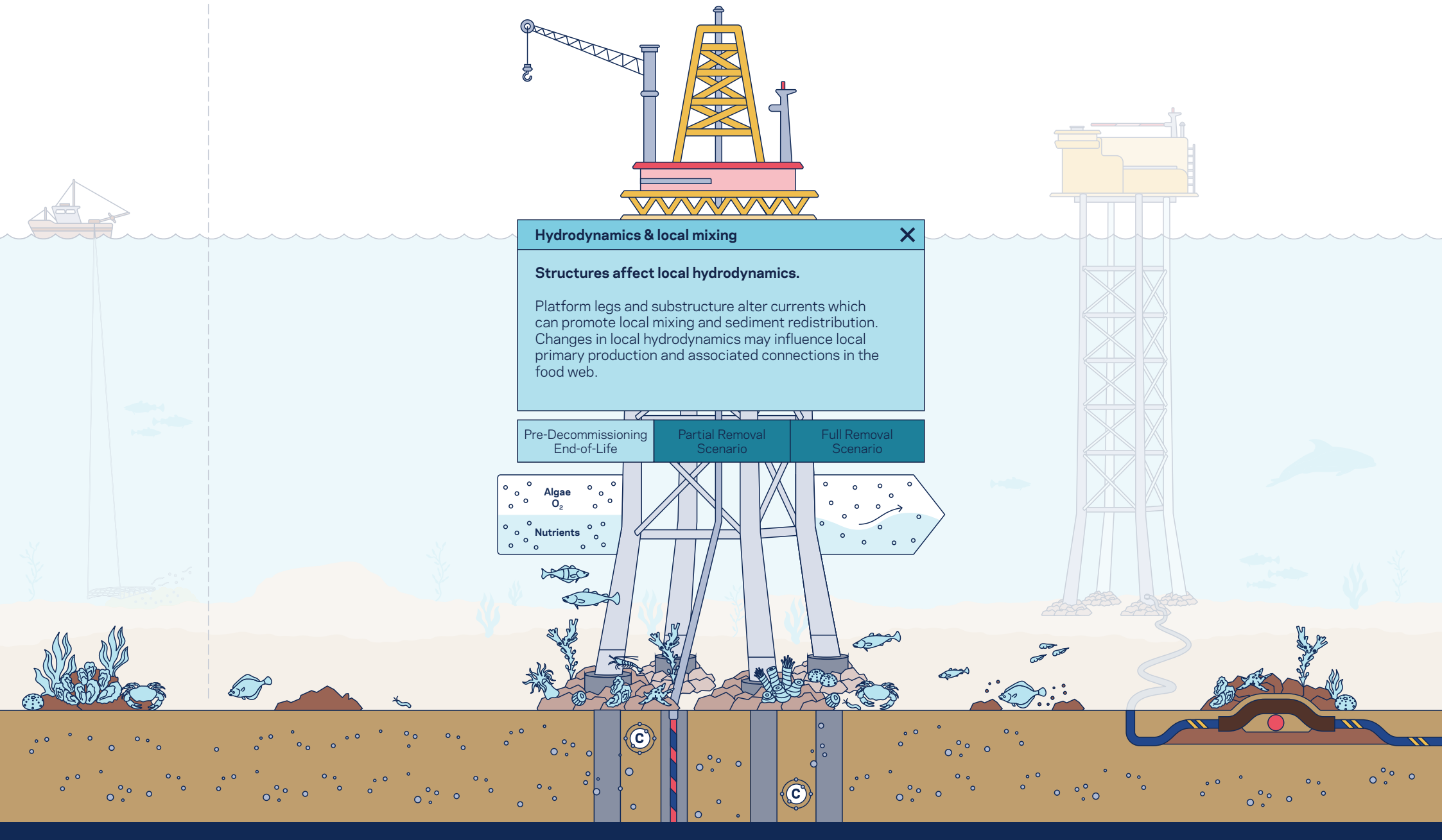

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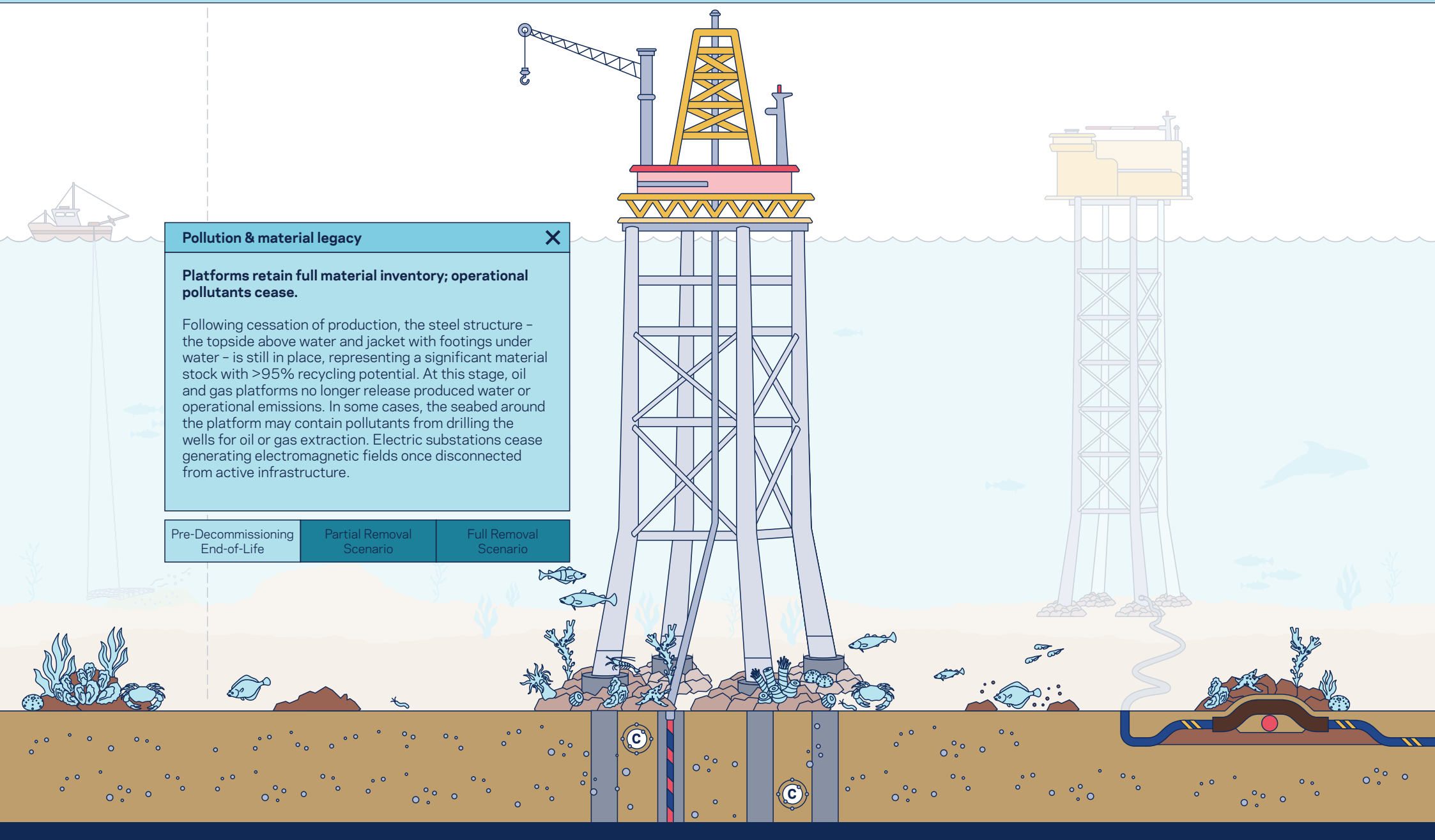

Pollution & material legacy

Platforms retain full material inventory; operational pollutants cease.

Following cessation of production, the steel structure – the topside above water and jacket with footings under water – is still in place, representing a significant material stock with >95% recycling potential. At this stage, oil and gas platforms no longer release produced water or operational emissions. In some cases, the seabed around the platform may contain pollutants from drilling the wells for oil or gas extraction. Electric substations cease generating electromagnetic fields once disconnected from active infrastructure.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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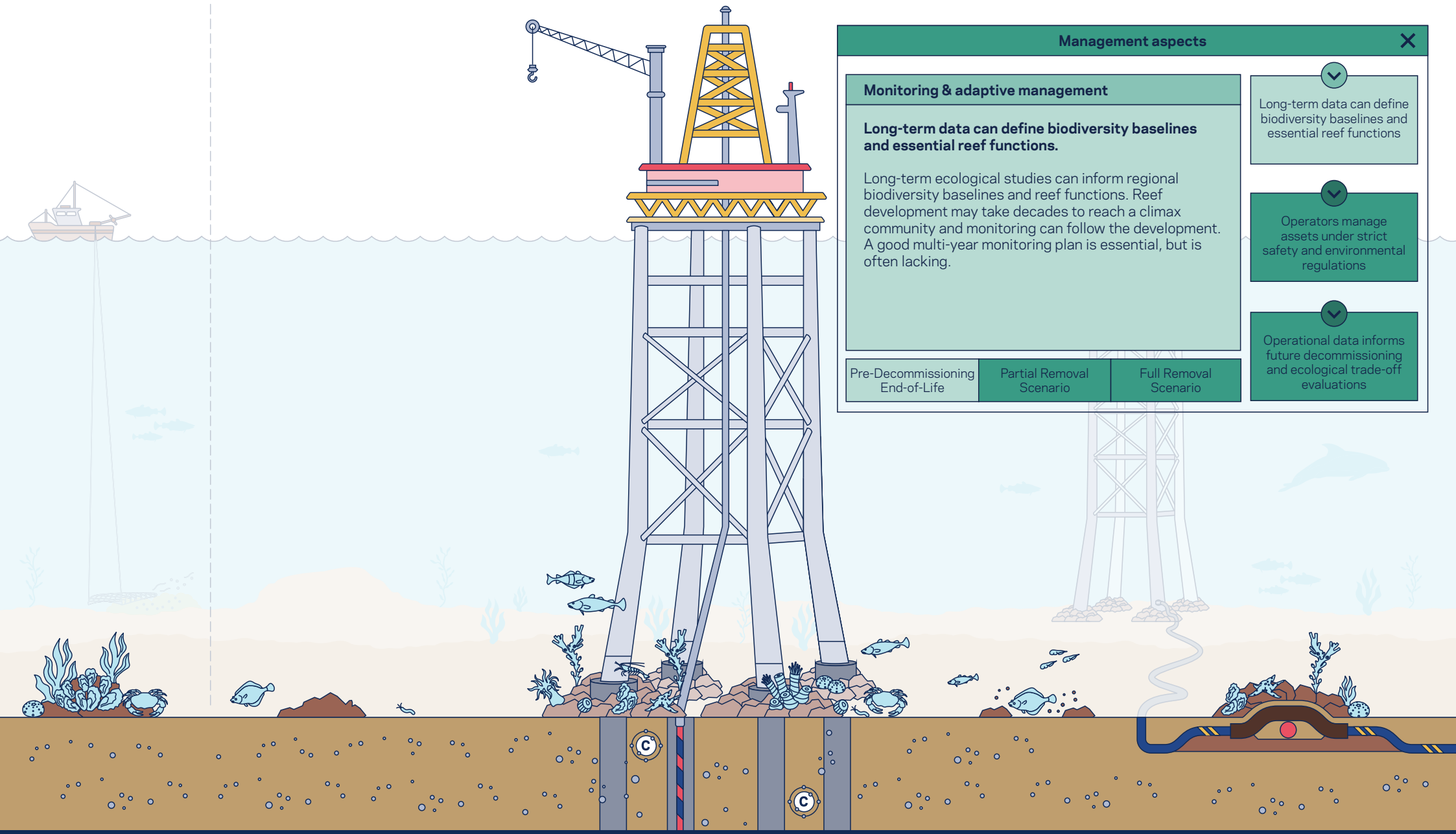

Management aspects

Monitoring & adaptive management

Long-term data can define biodiversity baselines and essential reef functions.

Long-term ecological studies can inform regional biodiversity baselines and reef functions. Reef development may take decades to reach a climax community and monitoring can follow the development. A good multi-year monitoring plan is essential, but is often lacking.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

- Long-term data can define biodiversity baselines and essential reef functions
- Operators manage assets under strict safety and environmental regulations
- Operational data informs future decommissioning and ecological trade-off evaluations

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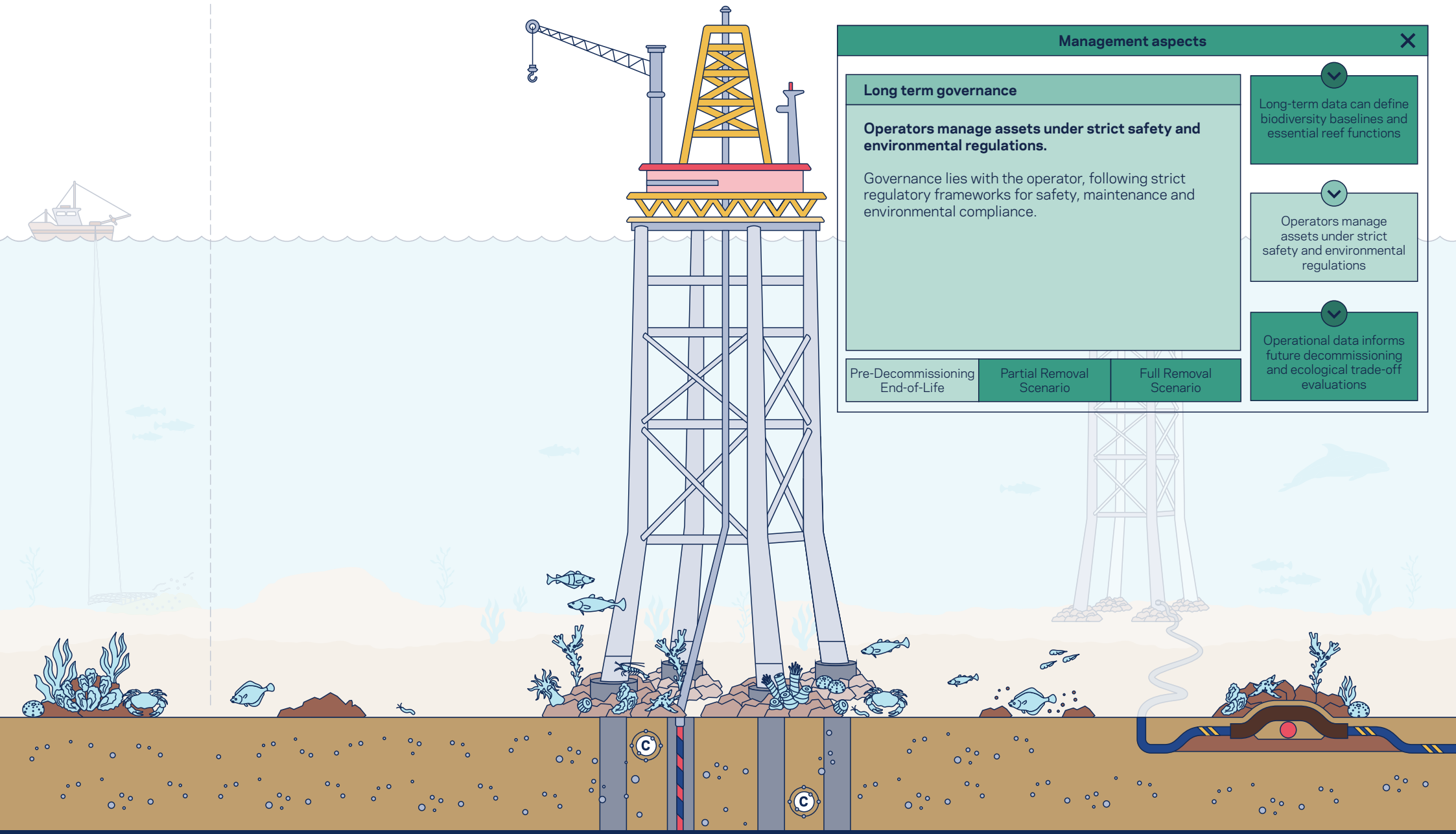

Management aspects

Long term governance

Operators manage assets under strict safety and environmental regulations.

Governance lies with the operator, following strict regulatory frameworks for safety, maintenance and environmental compliance.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

Long-term data can define biodiversity baselines and essential reef functions

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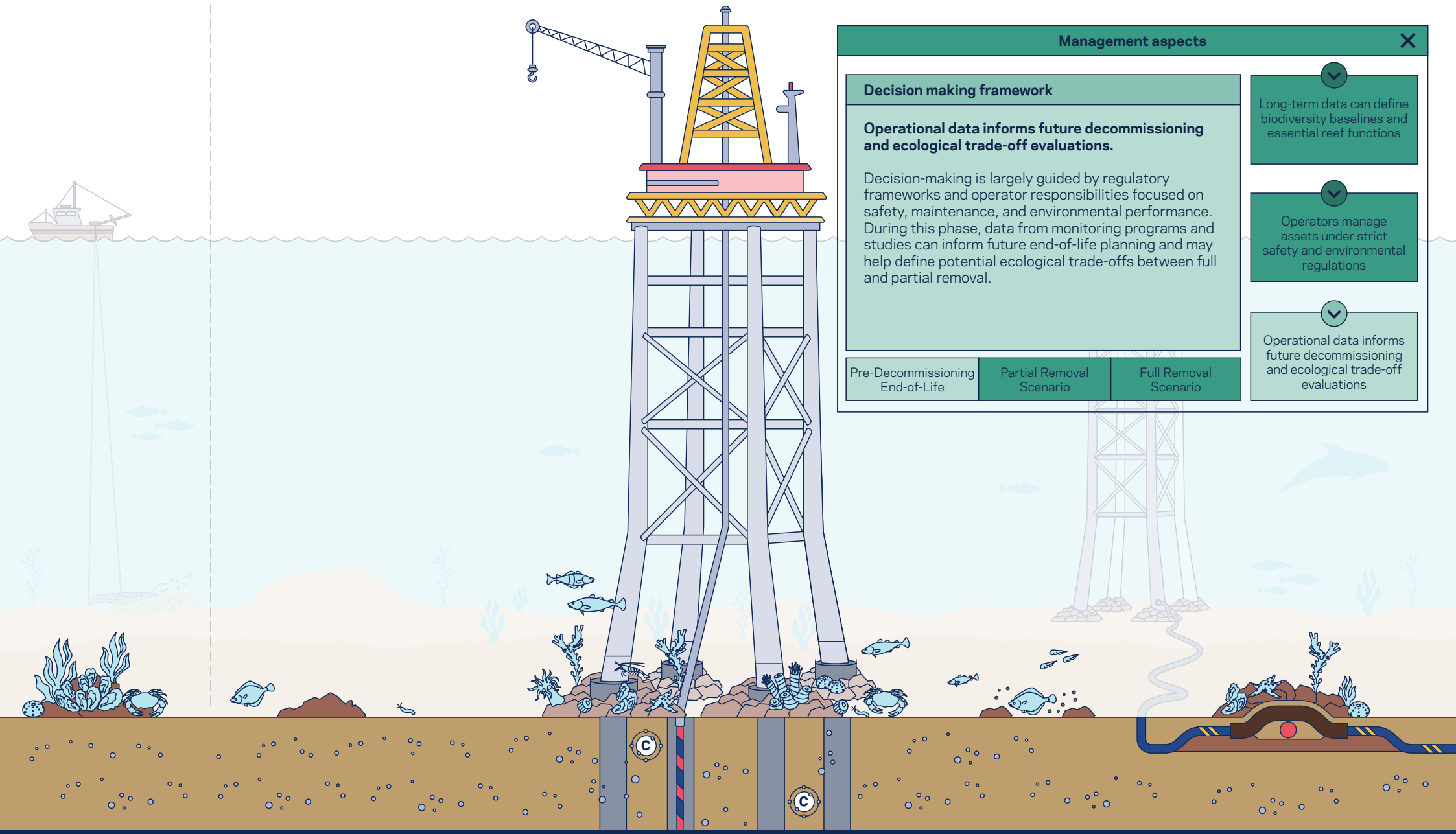

Management aspects

Decision making framework

Operational data informs future decommissioning and ecological trade-off evaluations.

Decision-making is largely guided by regulatory frameworks and operator responsibilities focused on safety, maintenance, and environmental performance. During this phase, data from monitoring programs and studies can inform future end-of-life planning and may help define potential ecological trade-offs between full and partial removal.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

- Long-term data can define biodiversity baselines and essential reef functions
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Effects of Decommissioning Offshore Platforms
Partial Removal Scenario

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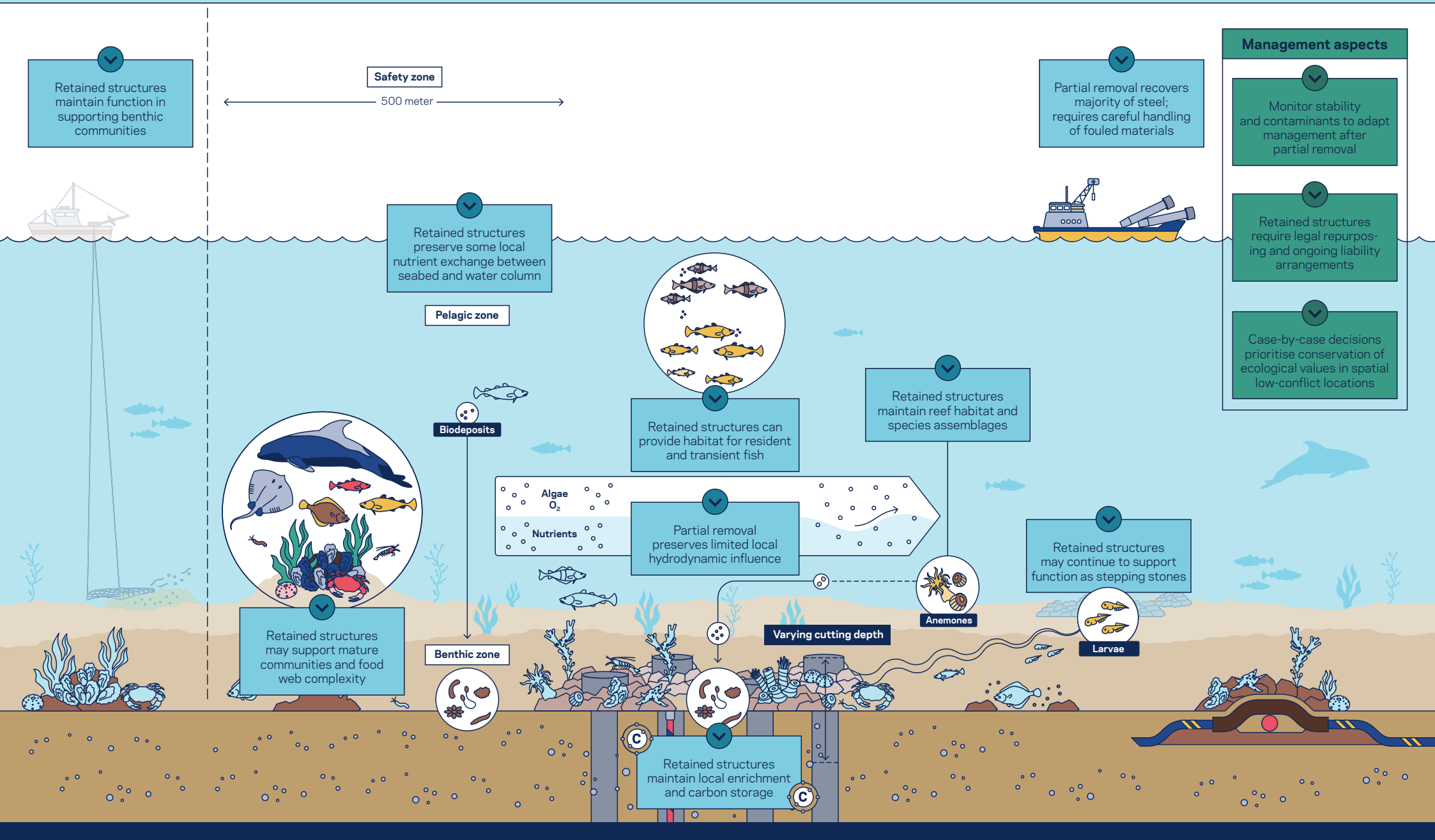

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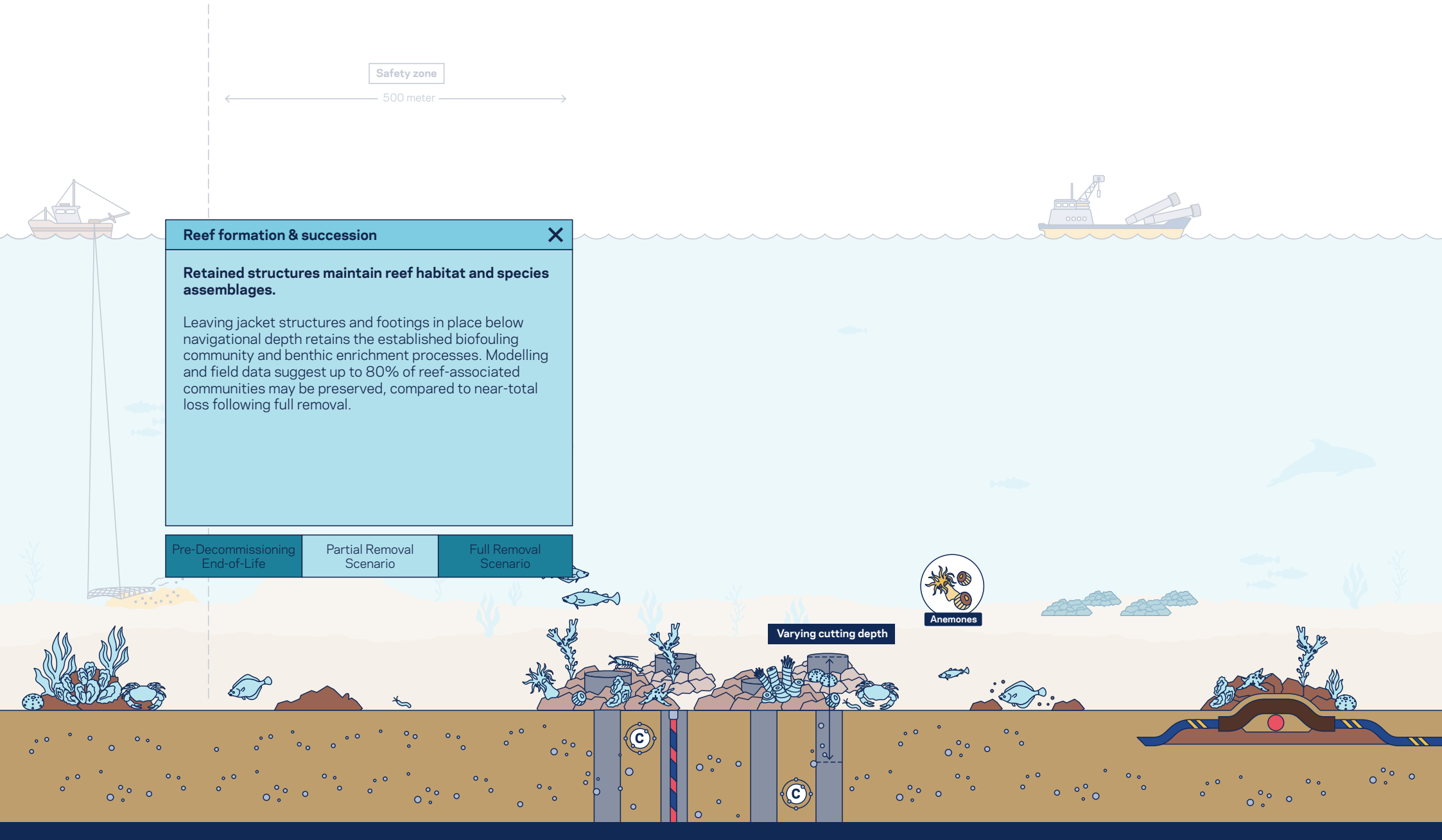

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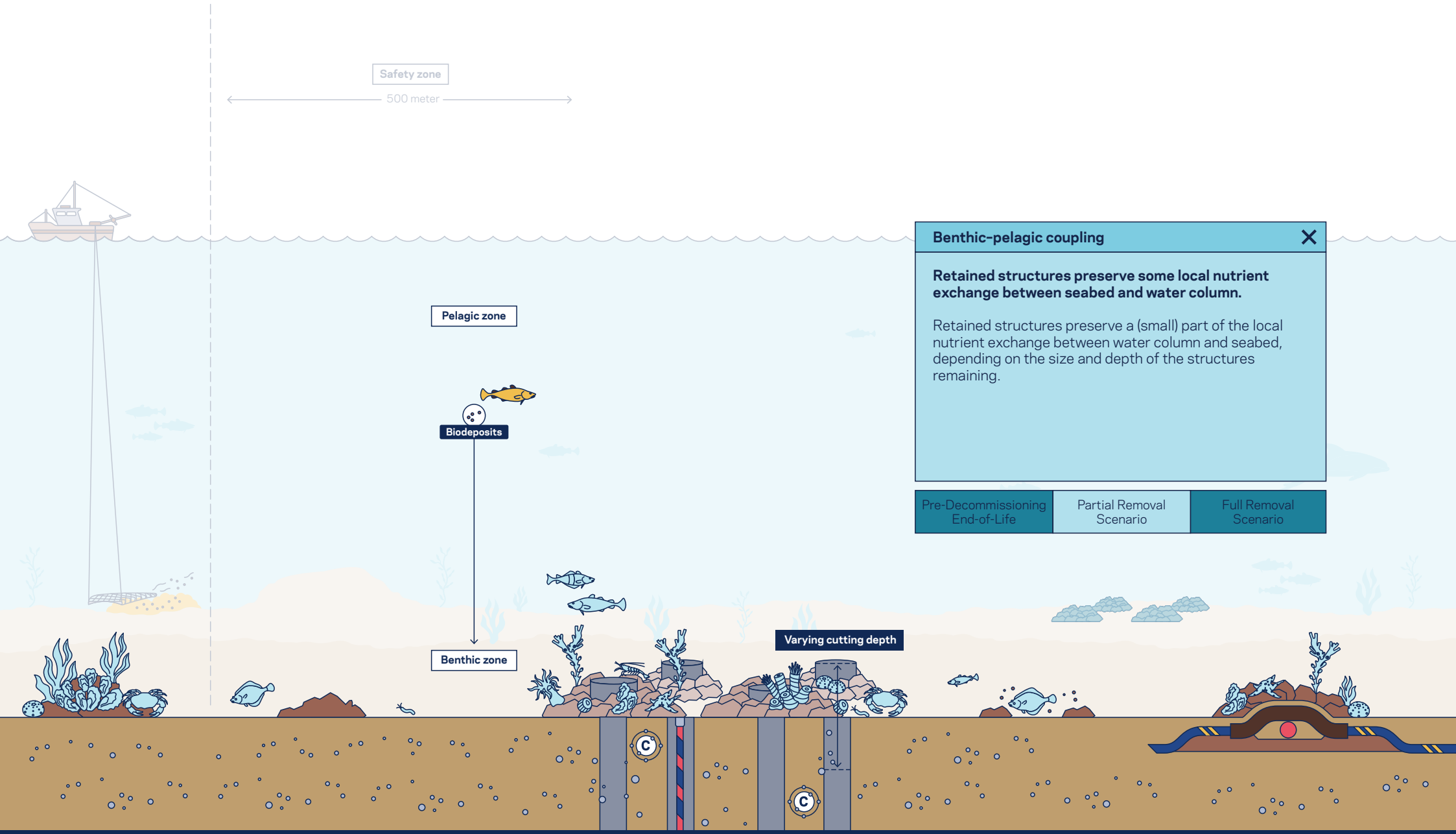

Benthic-pelagic coupling

Retained structures preserve some local nutrient exchange between seabed and water column.

Retained structures preserve a (small) part of the local nutrient exchange between water column and seabed, depending on the size and depth of the structures remaining.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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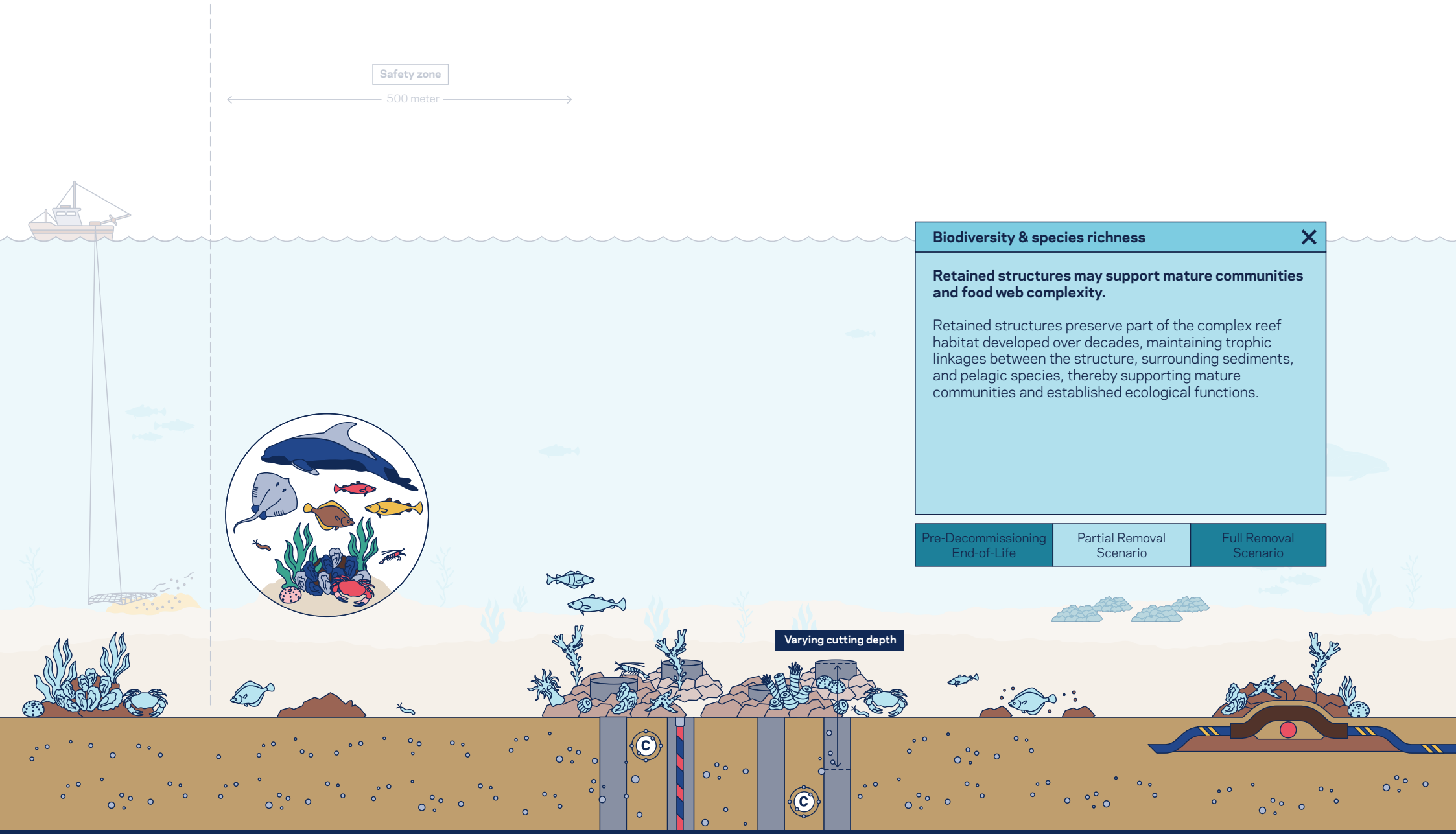

Biodiversity & species richness

Retained structures may support mature communities and food web complexity.

Retained structures preserve part of the complex reef habitat developed over decades, maintaining trophic linkages between the structure, surrounding sediments, and pelagic species, thereby supporting mature communities and established ecological functions.

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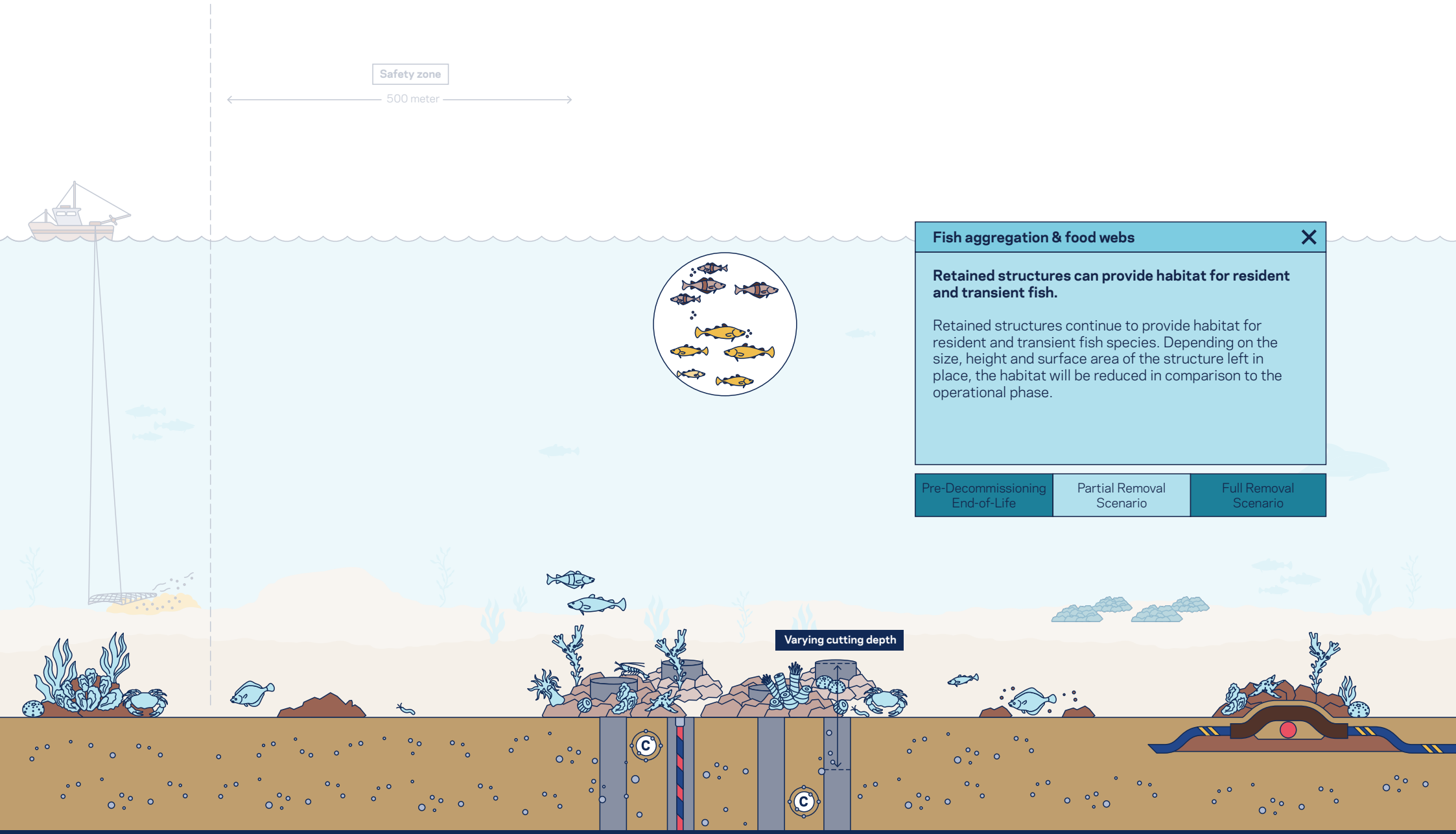

Fish aggregation & food webs

Retained structures can provide habitat for resident and transient fish.

Retained structures continue to provide habitat for resident and transient fish species. Depending on the size, height and surface area of the structure left in place, the habitat will be reduced in comparison to the operational phase.

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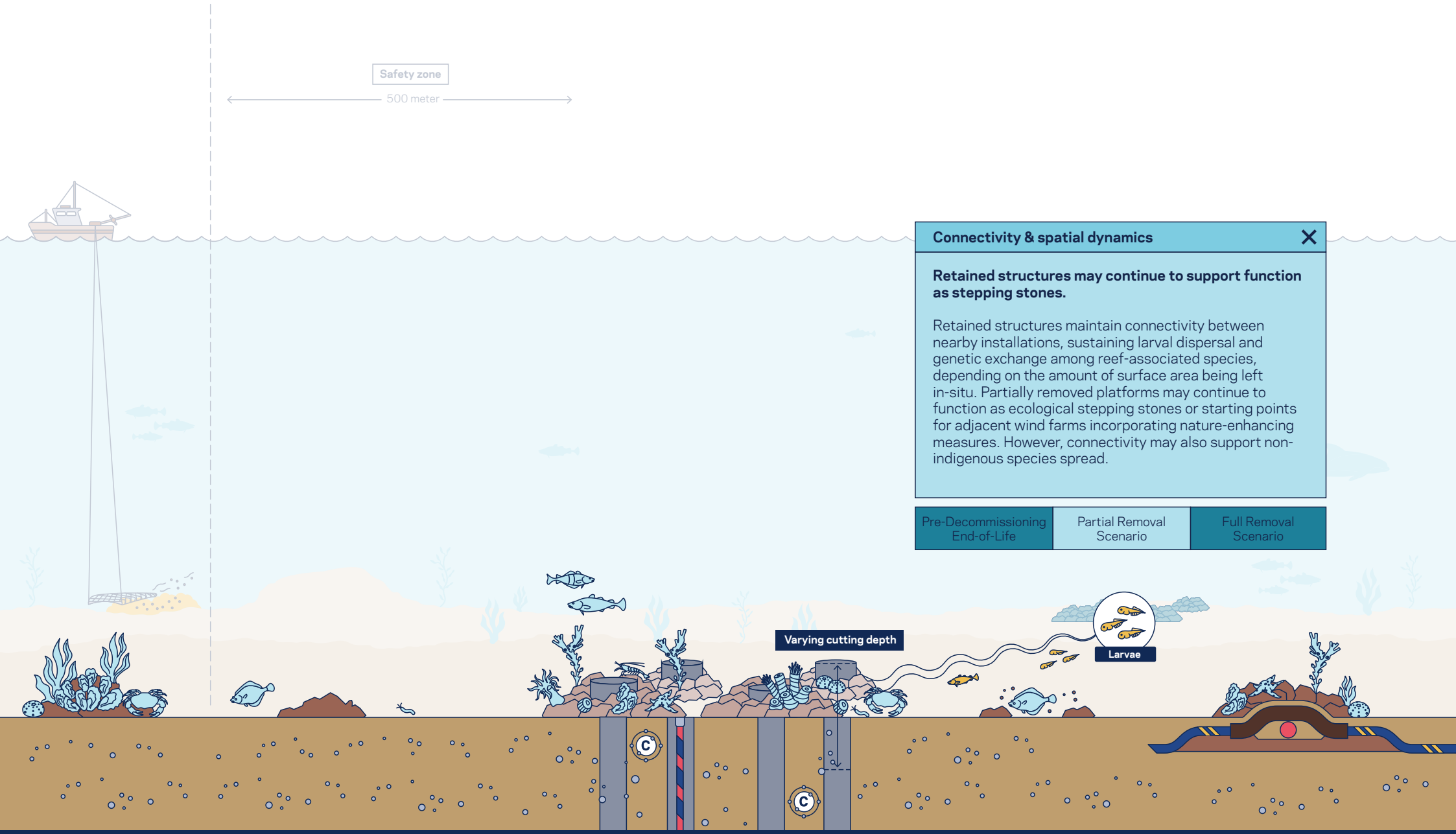

Connectivity & spatial dynamics

Retained structures may continue to support function as stepping stones.

Retained structures maintain connectivity between nearby installations, sustaining larval dispersal and genetic exchange among reef-associated species, depending on the amount of surface area being left in-situ. Partially removed platforms may continue to function as ecological stepping stones or starting points for adjacent wind farms incorporating nature-enhancing measures. However, connectivity may also support non-indigenous species spread.

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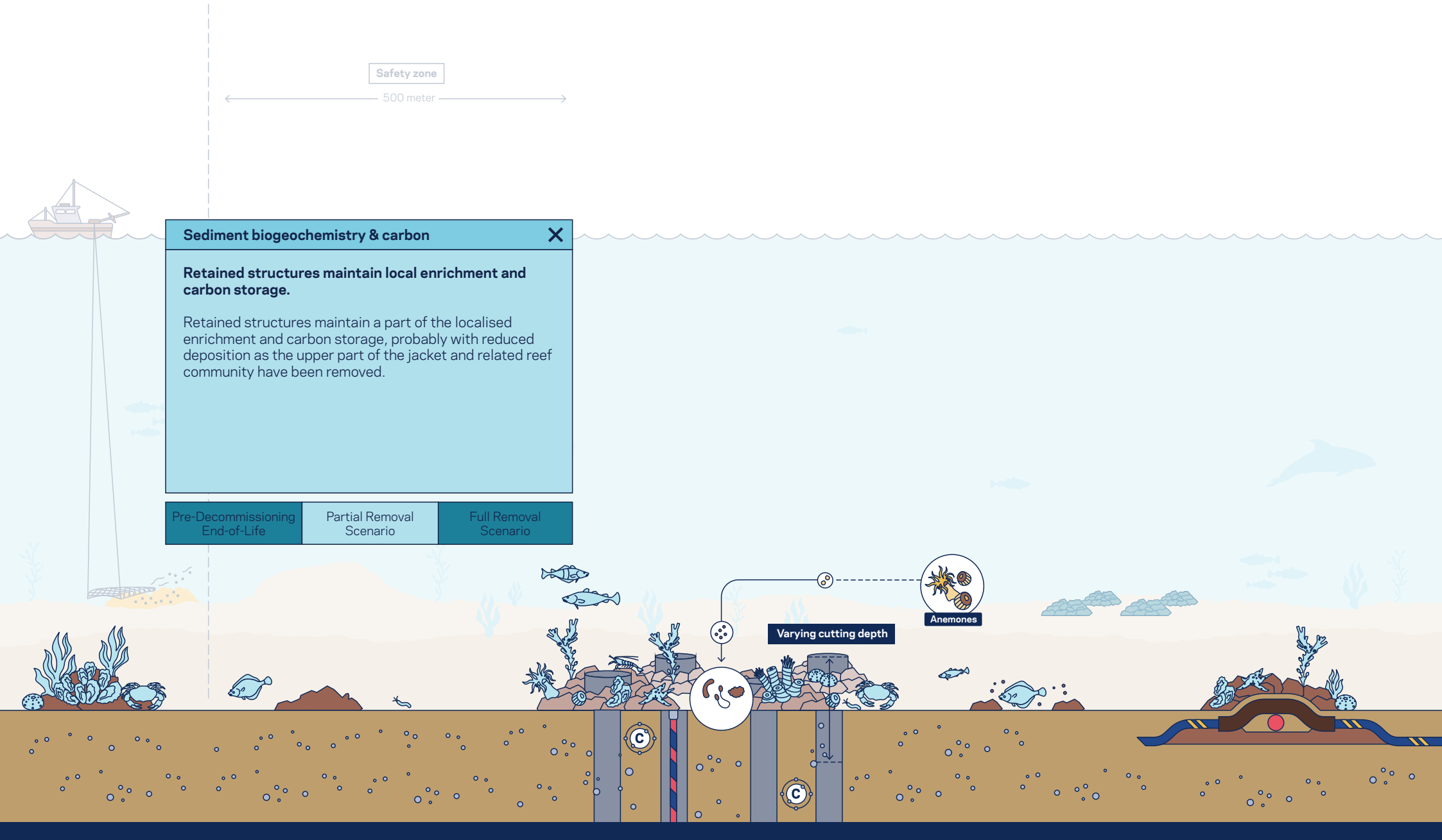

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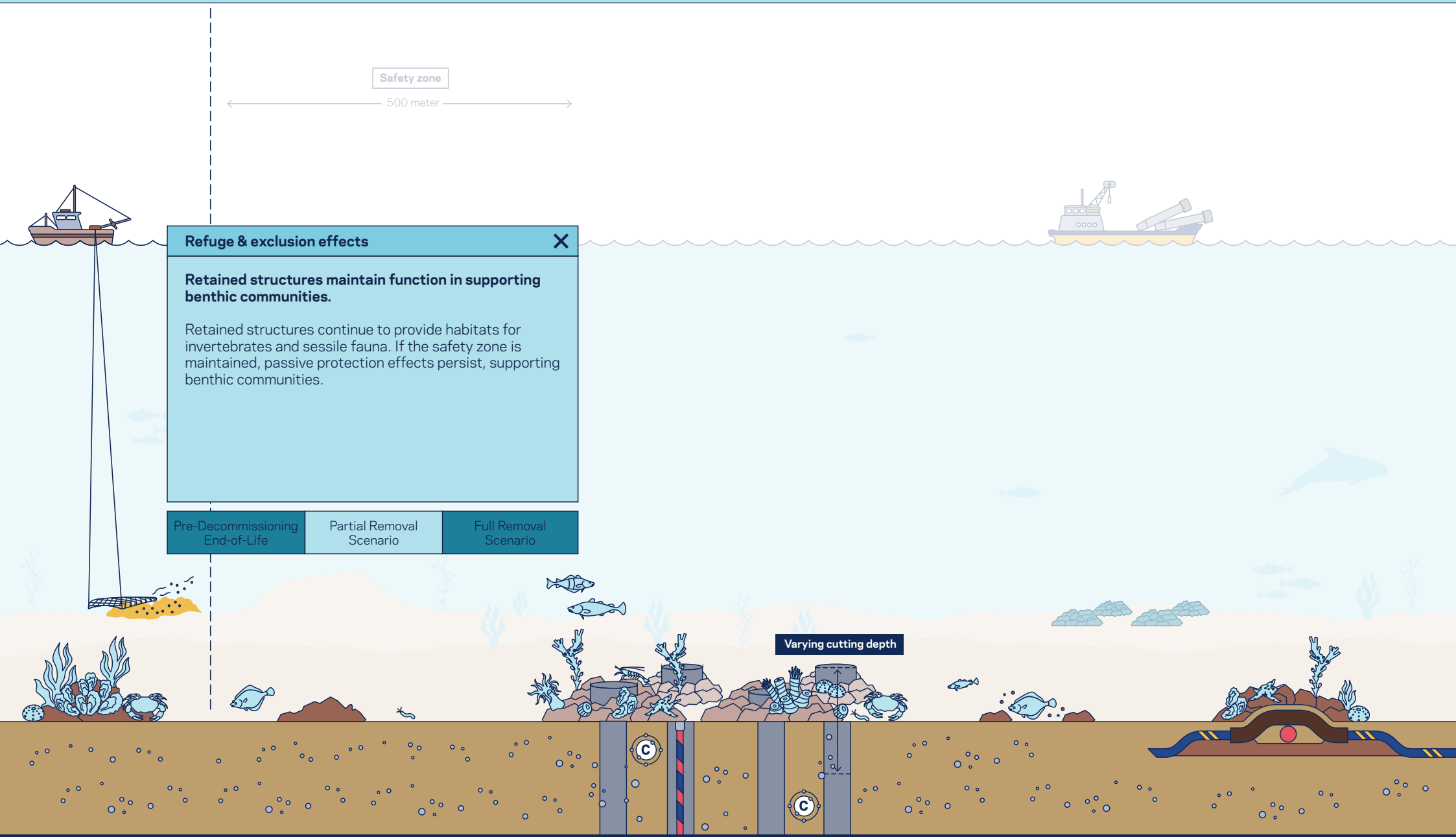

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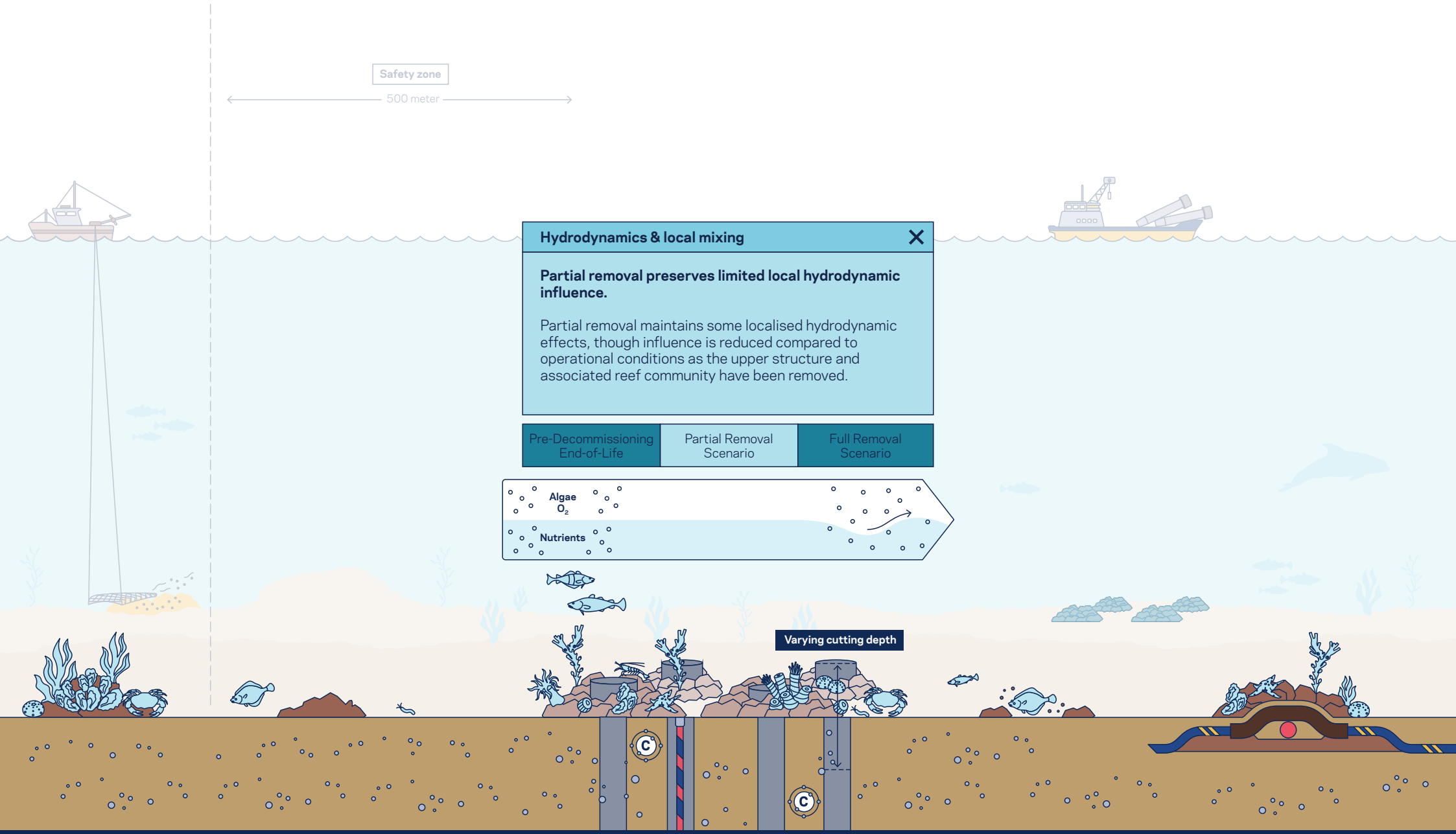

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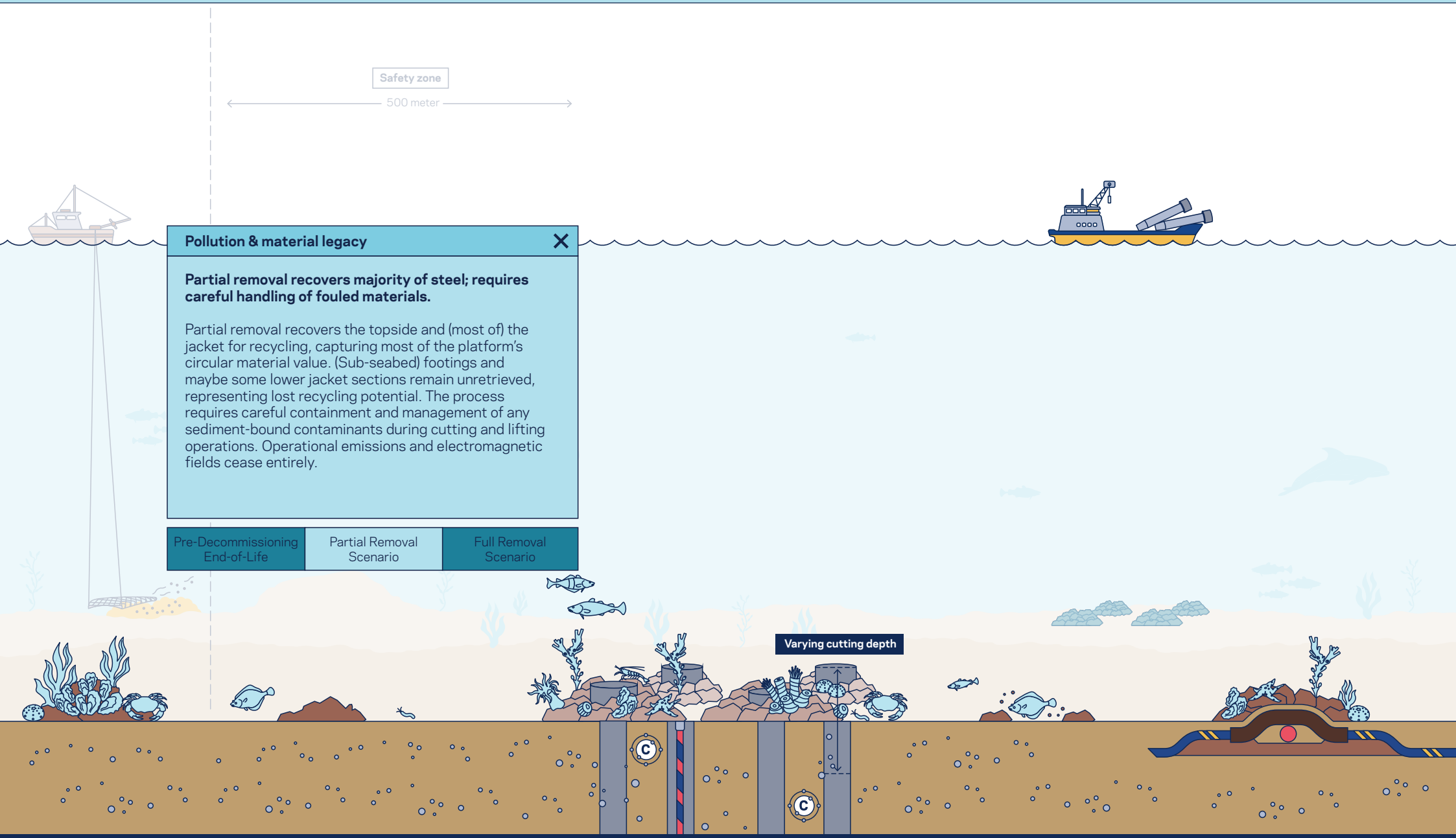

Pollution & material legacy

Partial removal recovers majority of steel; requires careful handling of fouled materials.

Partial removal recovers the topside and (most of) the jacket for recycling, capturing most of the platform's circular material value. (Sub-seabed) footings and maybe some lower jacket sections remain unretrieved, representing lost recycling potential. The process requires careful containment and management of any sediment-bound contaminants during cutting and lifting operations. Operational emissions and electromagnetic fields cease entirely.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

Effects of Decommissioning Offshore Platforms
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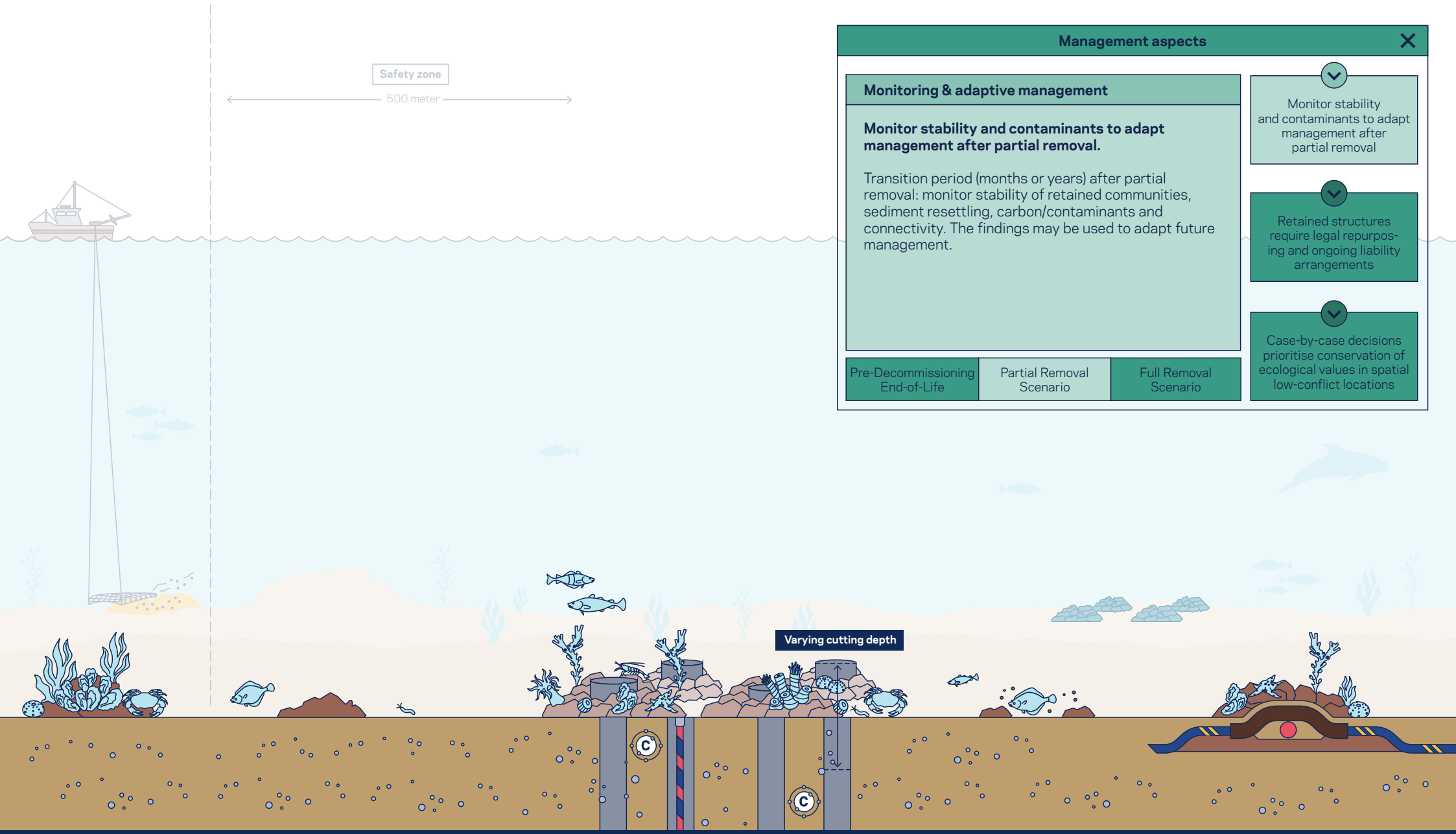


Management aspects

Monitoring & adaptive management

Monitor stability and contaminants to adapt management after partial removal.

Transition period (months or years) after partial removal: monitor stability of retained communities, sediment resettling, carbon/contaminants and connectivity. The findings may be used to adapt future management.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

Monitor stability and contaminants to adapt management after partial removal

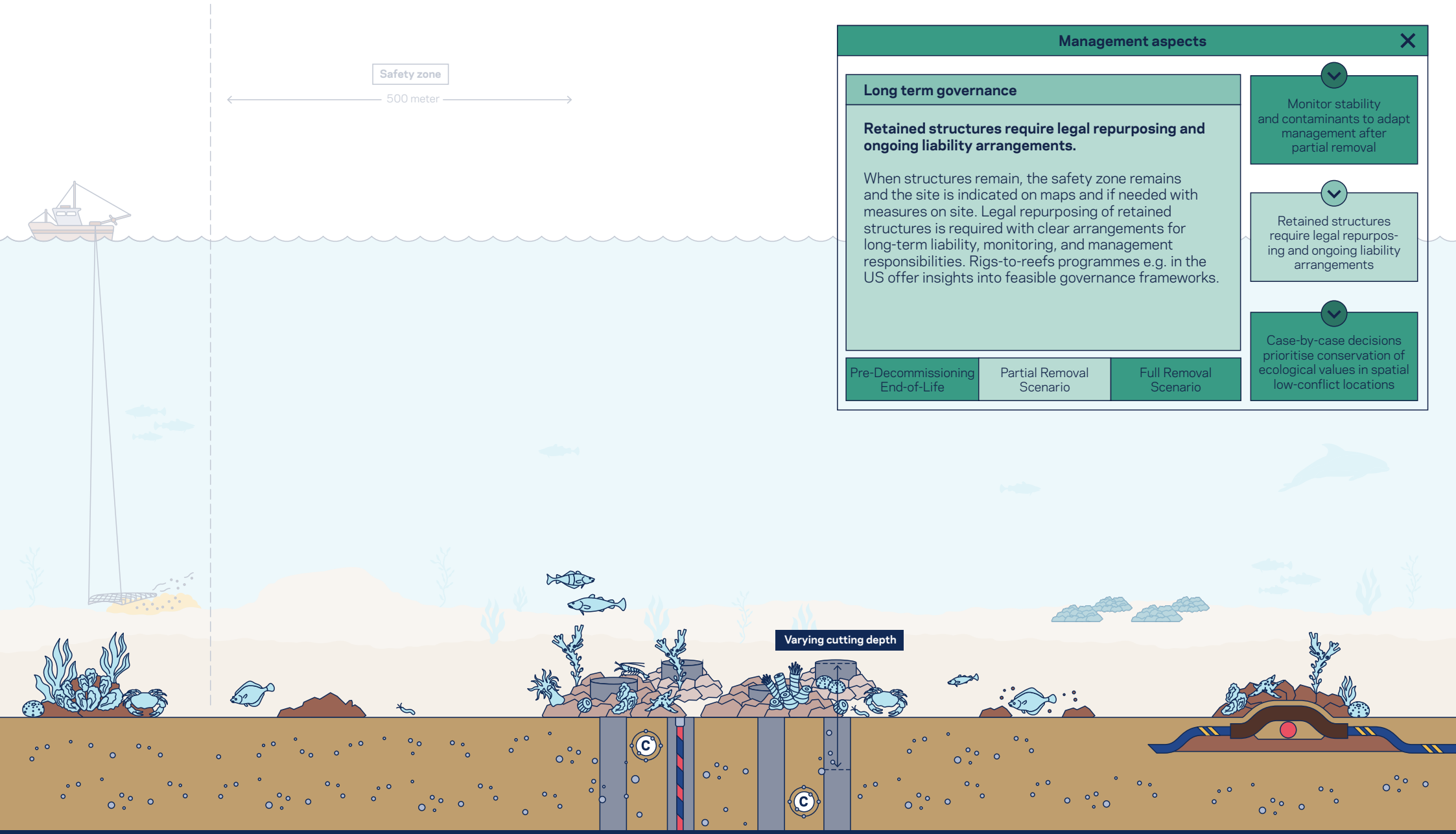
Retained structures require legal repurposing and ongoing liability arrangements

Case-by-case decisions prioritise conservation of ecological values in spatial low-conflict locations

Effects of Decommissioning Offshore Platforms

Partial Removal Scenario

The platform is no longer operational. The topside is removed to shore. Rock dump, matrasses and lower sections of steel jackets and/or footings with ecological value are left in place. Cables are removed for material retrieval (including export/array cables and associated cable protection systems in the case of offshore electrical substations). Decommissioning derogations for abandonment of cleaned oil/gas pipelines can be requested from the competent authority. Oil or gas wells are safely plugged & abandoned.



Management aspects

Long term governance

Retained structures require legal repurposing and ongoing liability arrangements.

When structures remain, the safety zone remains and the site is indicated on maps and if needed with measures on site. Legal repurposing of retained structures is required with clear arrangements for long-term liability, monitoring, and management responsibilities. Rigs-to-reefs programmes e.g. in the US offer insights into feasible governance frameworks.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

- Monitor stability and contaminants to adapt management after partial removal
- Retained structures require legal repurposing and ongoing liability arrangements
- Case-by-case decisions prioritise conservation of ecological values in spatial low-conflict locations

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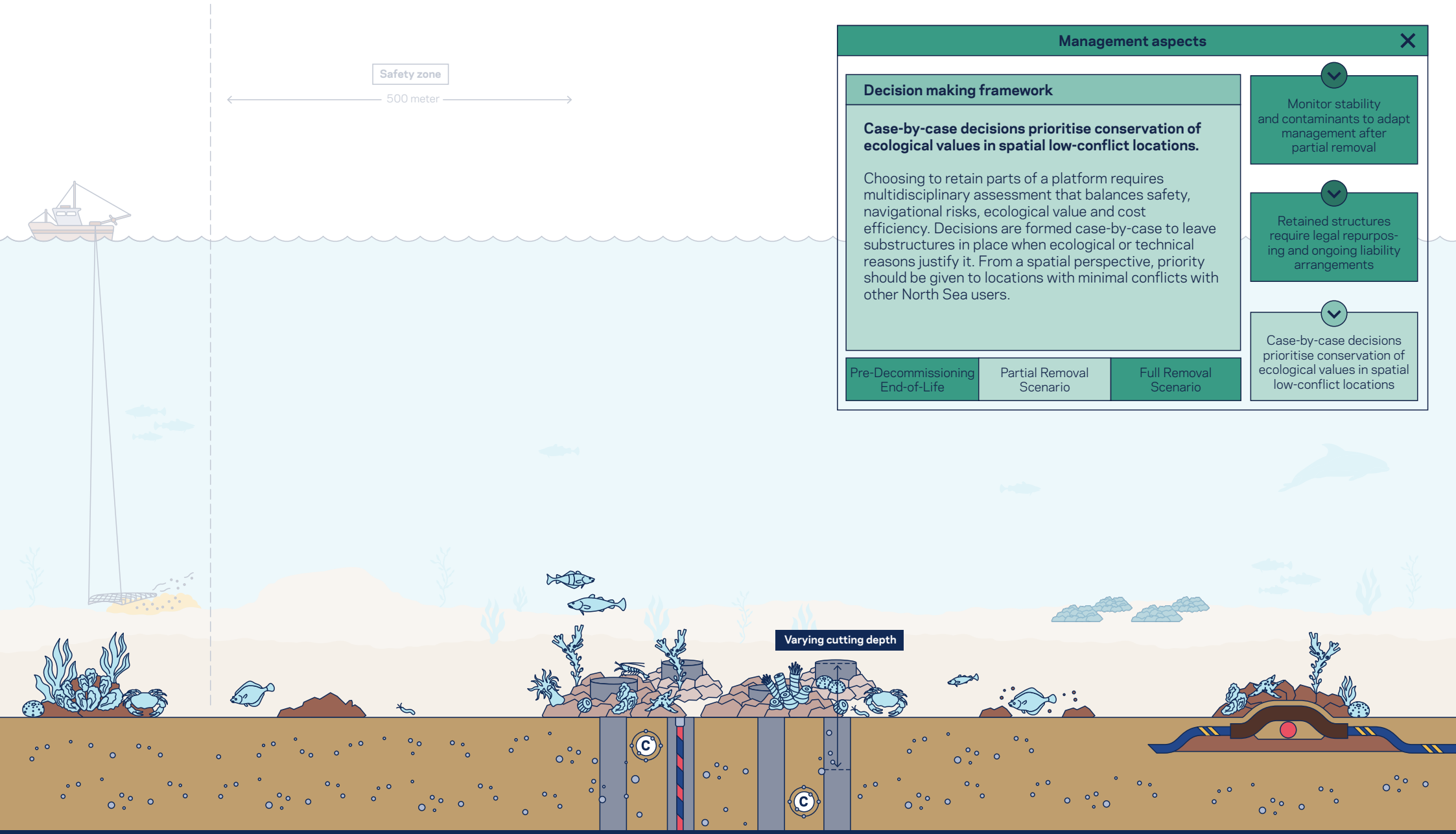

Management aspects

Decision making framework

Case-by-case decisions prioritise conservation of ecological values in spatial low-conflict locations.

Choosing to retain parts of a platform requires multidisciplinary assessment that balances safety, navigational risks, ecological value and cost efficiency. Decisions are formed case-by-case to leave substructures in place when ecological or technical reasons justify it. From a spatial perspective, priority should be given to locations with minimal conflicts with other North Sea users.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

Monitor stability and contaminants to adapt management after partial removal

Retained structures require legal repurposing and ongoing liability arrangements

Case-by-case decisions prioritise conservation of ecological values in spatial low-conflict locations

Effects of Decommissioning Offshore Platforms
Full Removal Scenario

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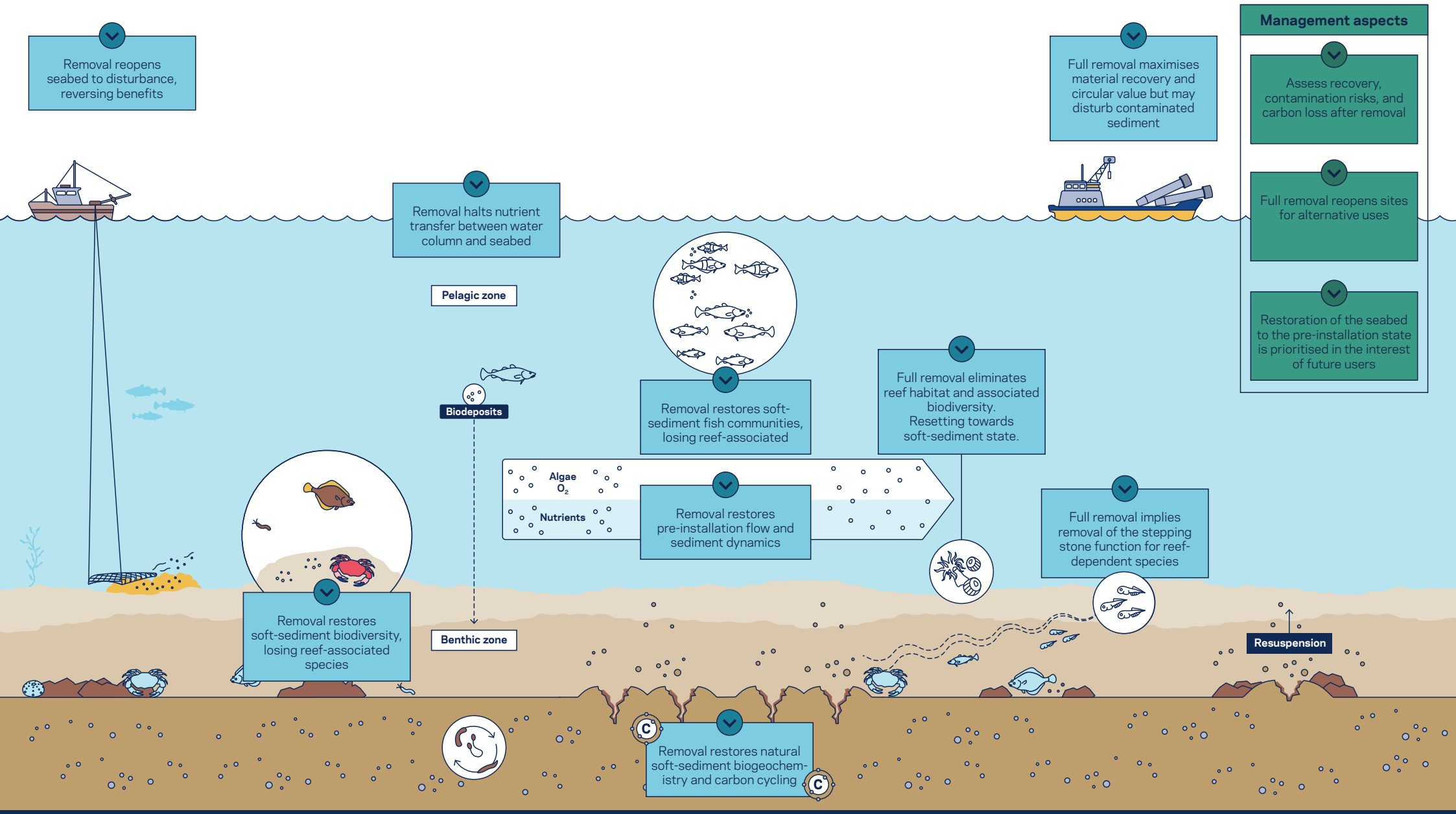

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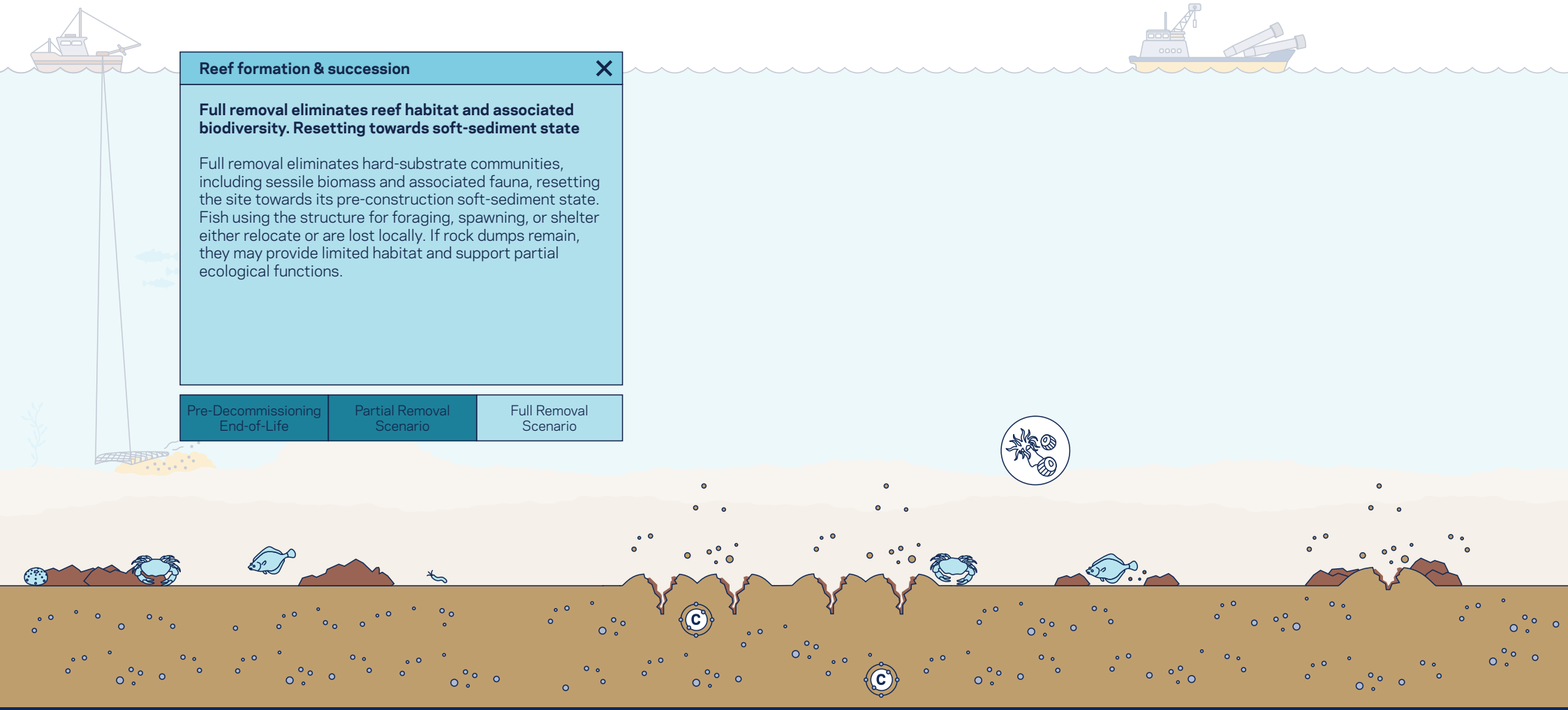

Reef formation & succession ✕

Full removal eliminates reef habitat and associated biodiversity. Resetting towards soft-sediment state

Full removal eliminates hard-substrate communities, including sessile biomass and associated fauna, resetting the site towards its pre-construction soft-sediment state. Fish using the structure for foraging, spawning, or shelter either relocate or are lost locally. If rock dumps remain, they may provide limited habitat and support partial ecological functions.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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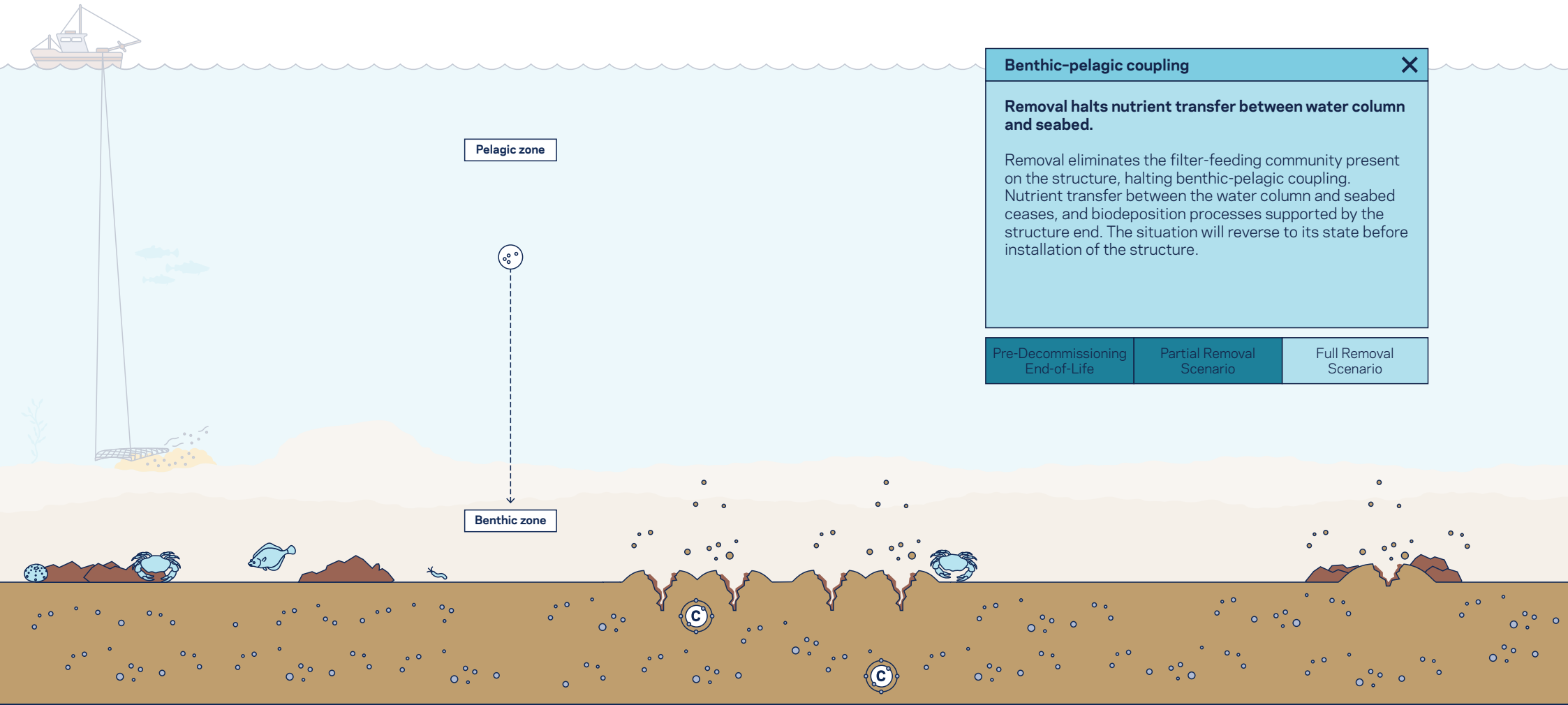

Benthic-pelagic coupling

Removal halts nutrient transfer between water column and seabed.

Removal eliminates the filter-feeding community present on the structure, halting benthic-pelagic coupling. Nutrient transfer between the water column and seabed ceases, and biodeposition processes supported by the structure end. The situation will reverse to its state before installation of the structure.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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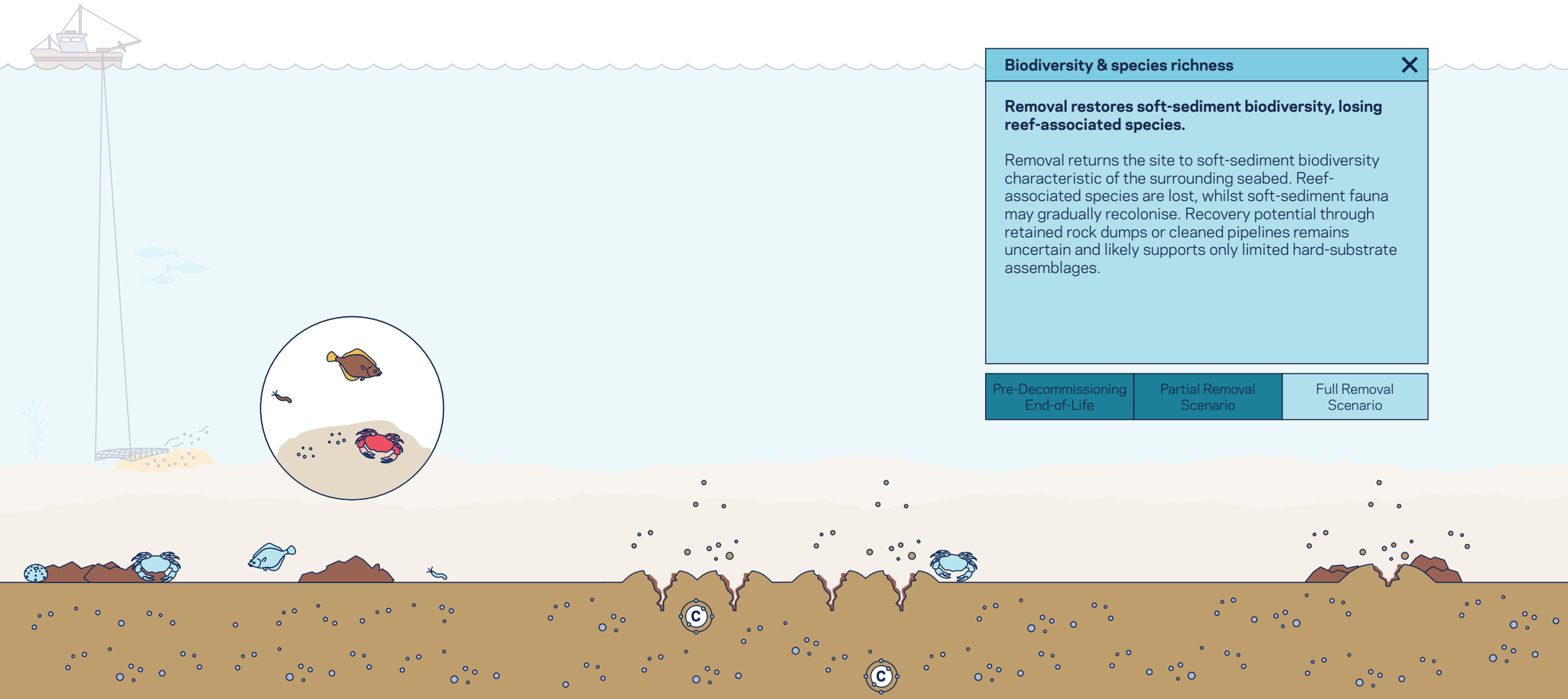

Biodiversity & species richness

Removal restores soft-sediment biodiversity, losing reef-associated species.

Removal returns the site to soft-sediment biodiversity characteristic of the surrounding seabed. Reef-associated species are lost, whilst soft-sediment fauna may gradually recolonise. Recovery potential through retained rock dumps or cleaned pipelines remains uncertain and likely supports only limited hard-substrate assemblages.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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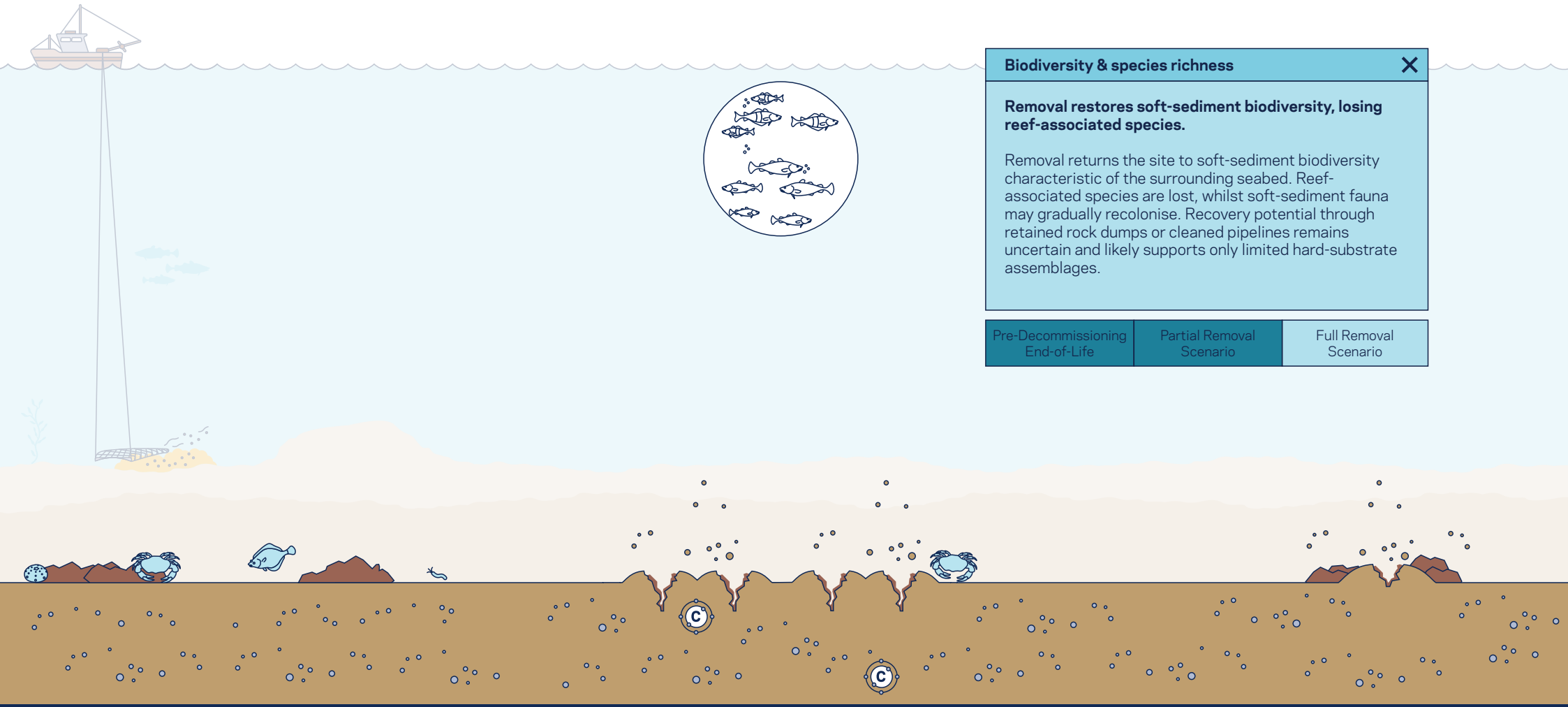

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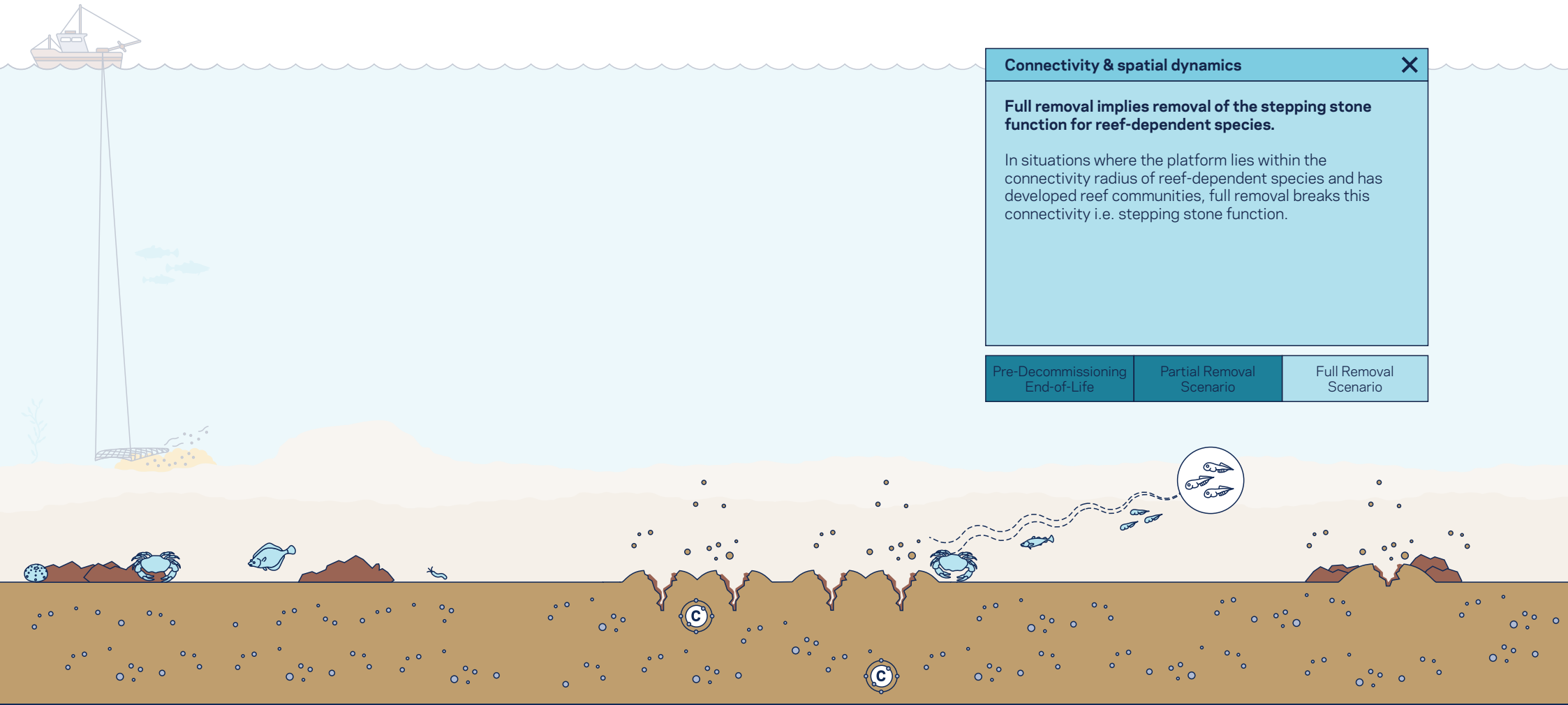

Connectivity & spatial dynamics

Full removal implies removal of the stepping stone function for reef-dependent species.

In situations where the platform lies within the connectivity radius of reef-dependent species and has developed reef communities, full removal breaks this connectivity i.e. stepping stone function.

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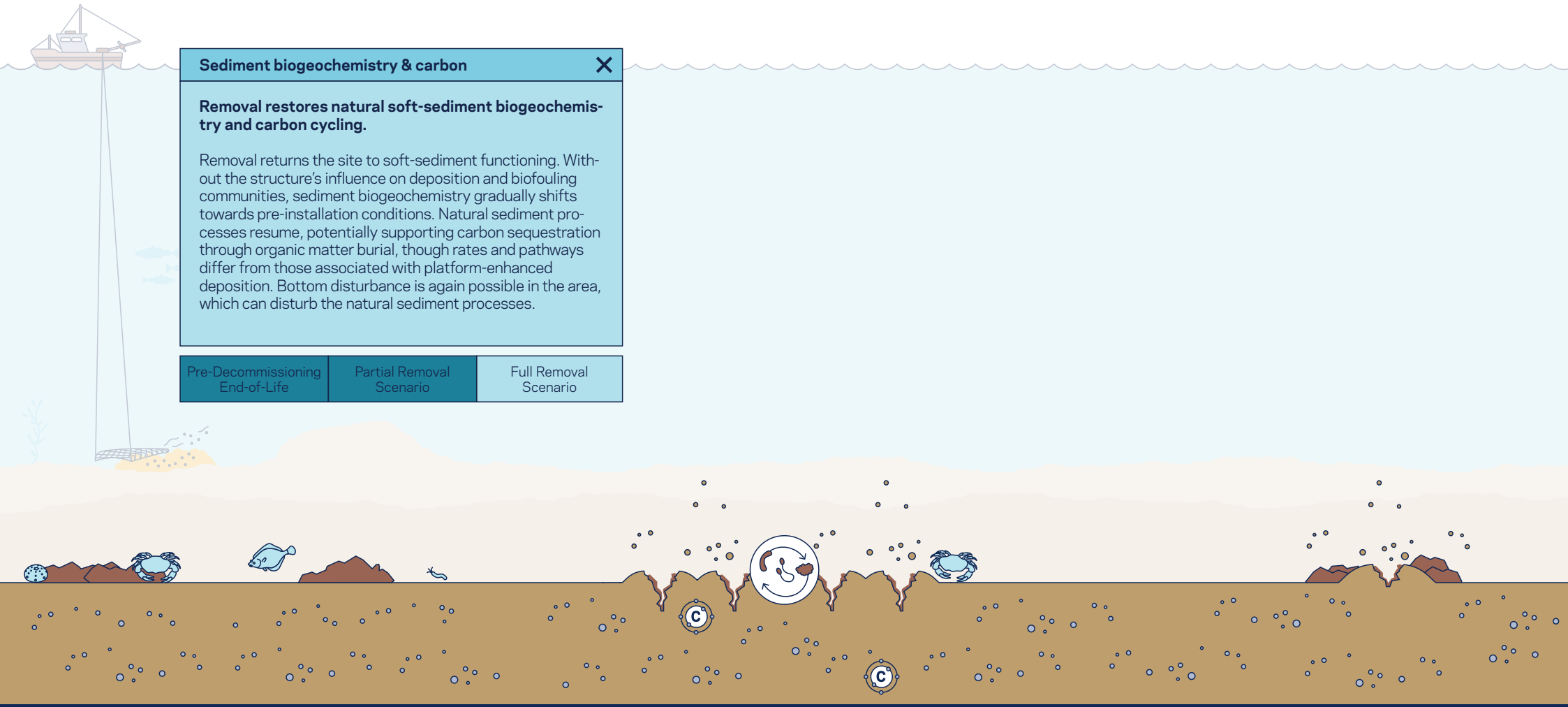

Sediment biogeochemistry & carbon

Removal restores natural soft-sediment biogeochemistry and carbon cycling.

Removal returns the site to soft-sediment functioning. Without the structure's influence on deposition and biofouling communities, sediment biogeochemistry gradually shifts towards pre-installation conditions. Natural sediment processes resume, potentially supporting carbon sequestration through organic matter burial, though rates and pathways differ from those associated with platform-enhanced deposition. Bottom disturbance is again possible in the area, which can disturb the natural sediment processes.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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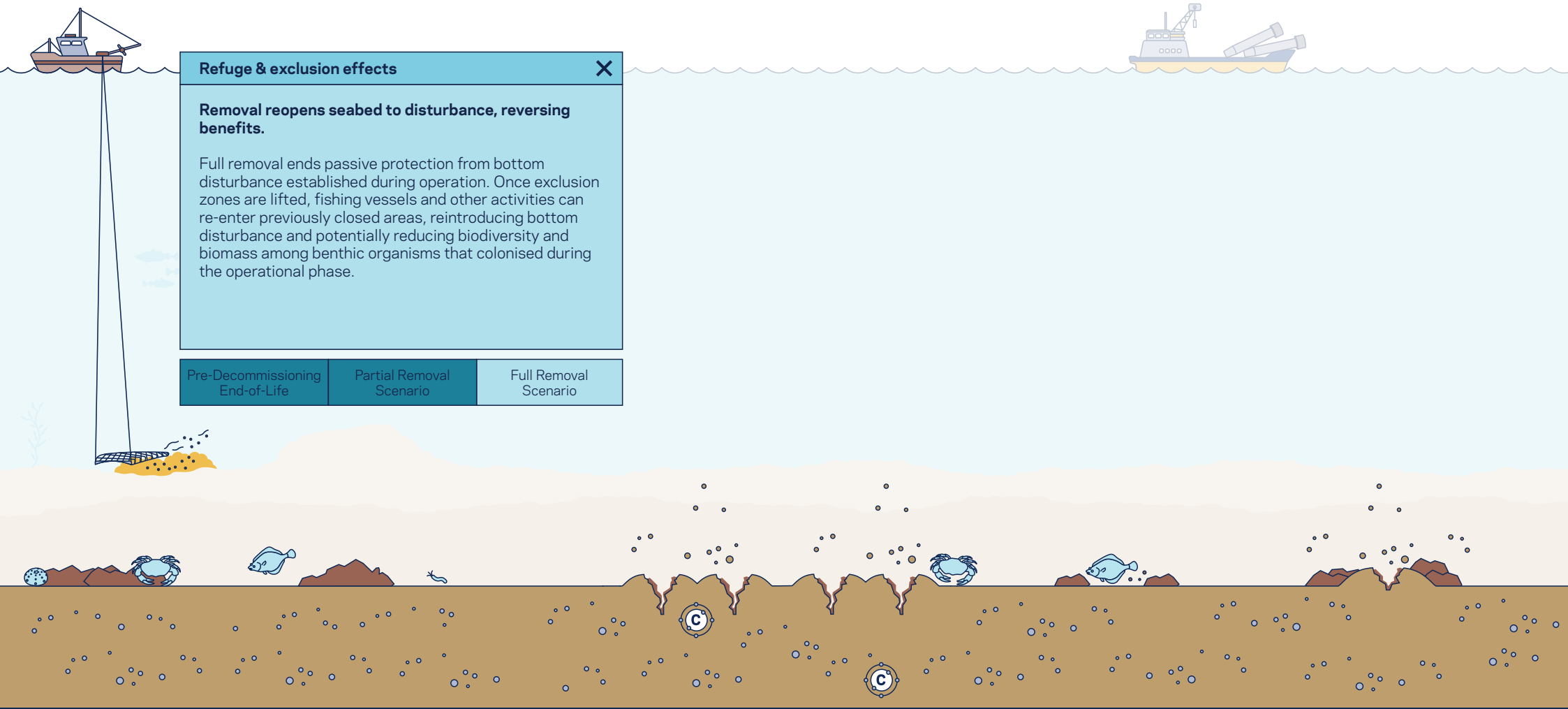

Refuge & exclusion effects

Removal reopens seabed to disturbance, reversing benefits.

Full removal ends passive protection from bottom disturbance established during operation. Once exclusion zones are lifted, fishing vessels and other activities can re-enter previously closed areas, reintroducing bottom disturbance and potentially reducing biodiversity and biomass among benthic organisms that colonised during the operational phase.

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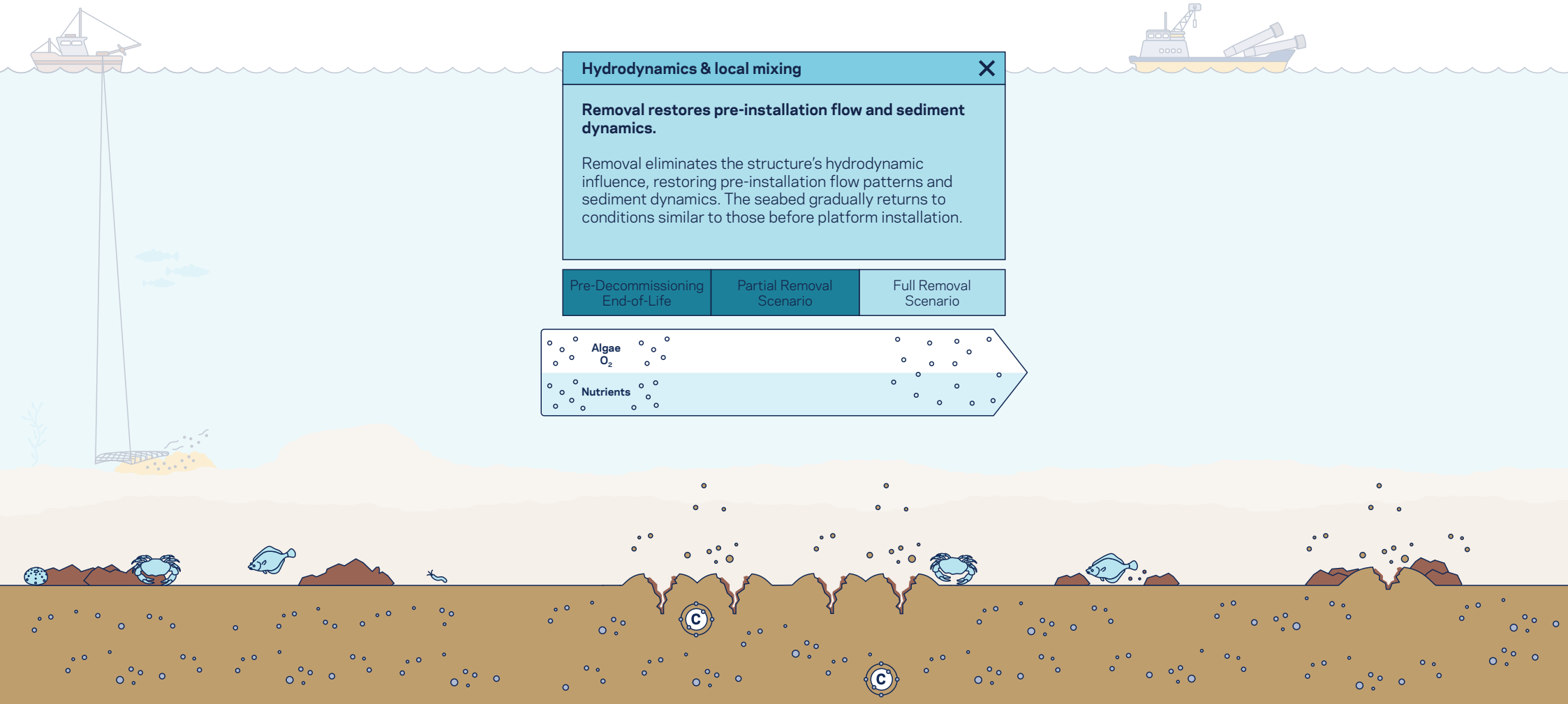

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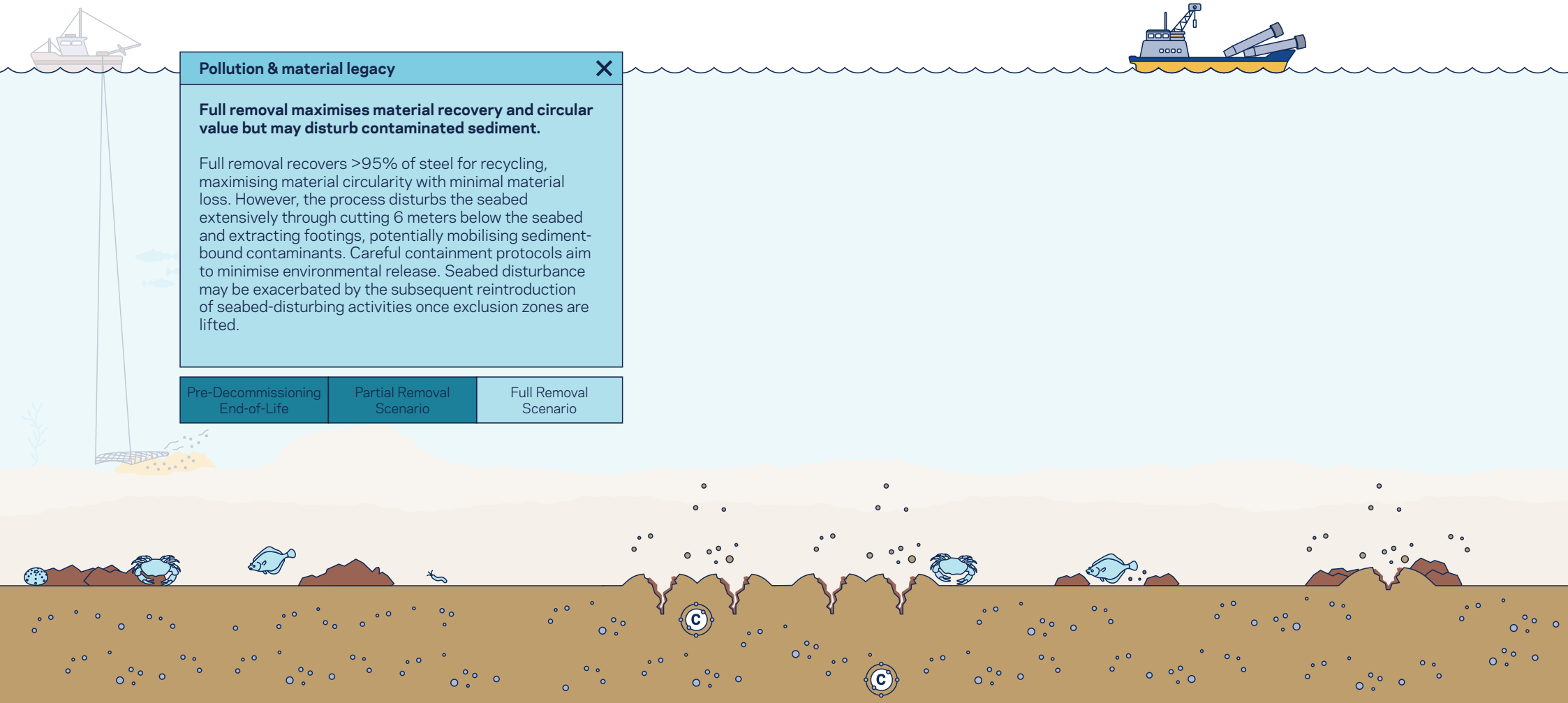

Pollution & material legacy

Full removal maximises material recovery and circular value but may disturb contaminated sediment.

Full removal recovers >95% of steel for recycling, maximising material circularity with minimal material loss. However, the process disturbs the seabed extensively through cutting 6 meters below the seabed and extracting footings, potentially mobilising sediment-bound contaminants. Careful containment protocols aim to minimise environmental release. Seabed disturbance may be exacerbated by the subsequent reintroduction of seabed-disturbing activities once exclusion zones are lifted.

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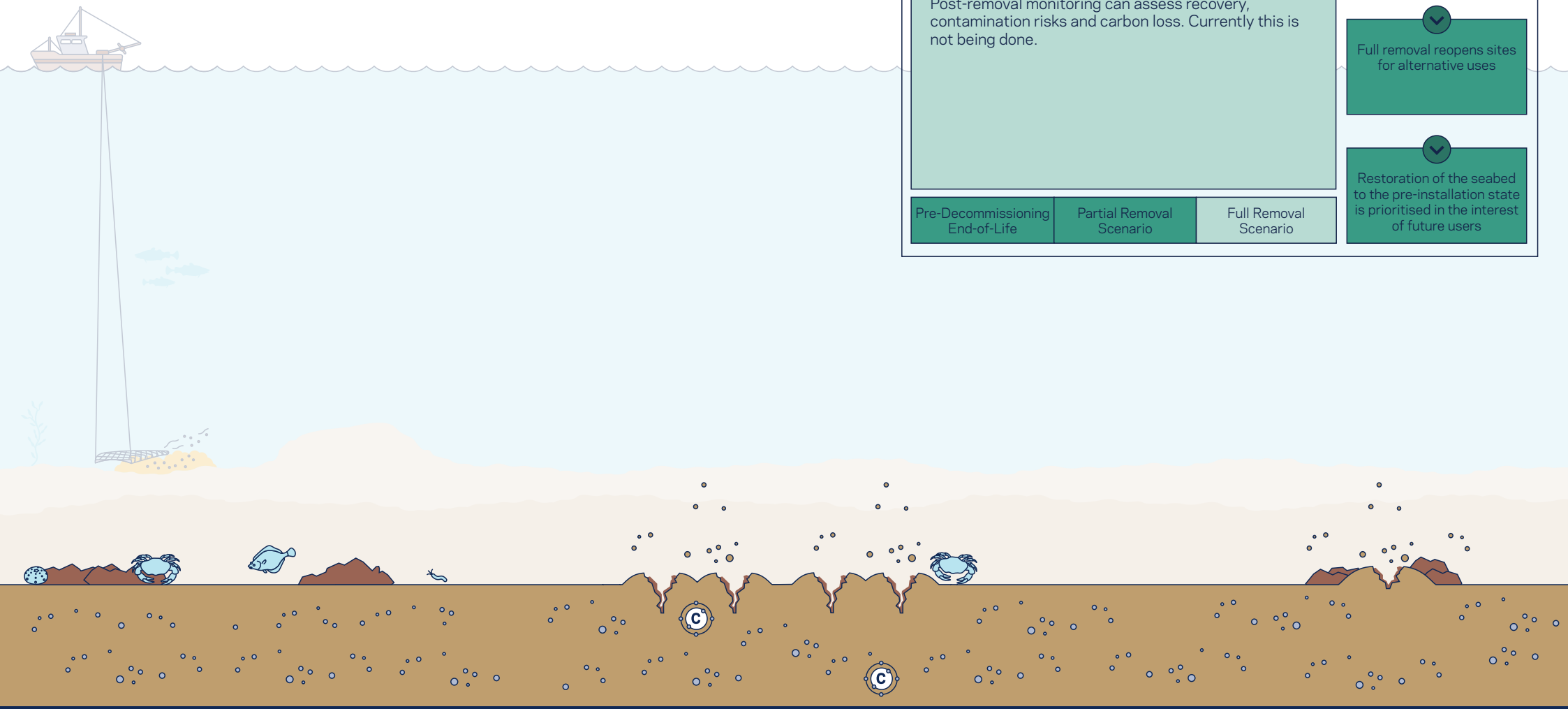

Management aspects

Monitoring & adaptive management

Assess recovery, contamination risks, and carbon loss after removal.

Post-removal monitoring can assess recovery, contamination risks and carbon loss. Currently this is not being done.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

Assess recovery, contamination risks, and carbon loss after removal

Full removal reopens sites for alternative uses

Restoration of the seabed to the pre-installation state is prioritised in the interest of future users

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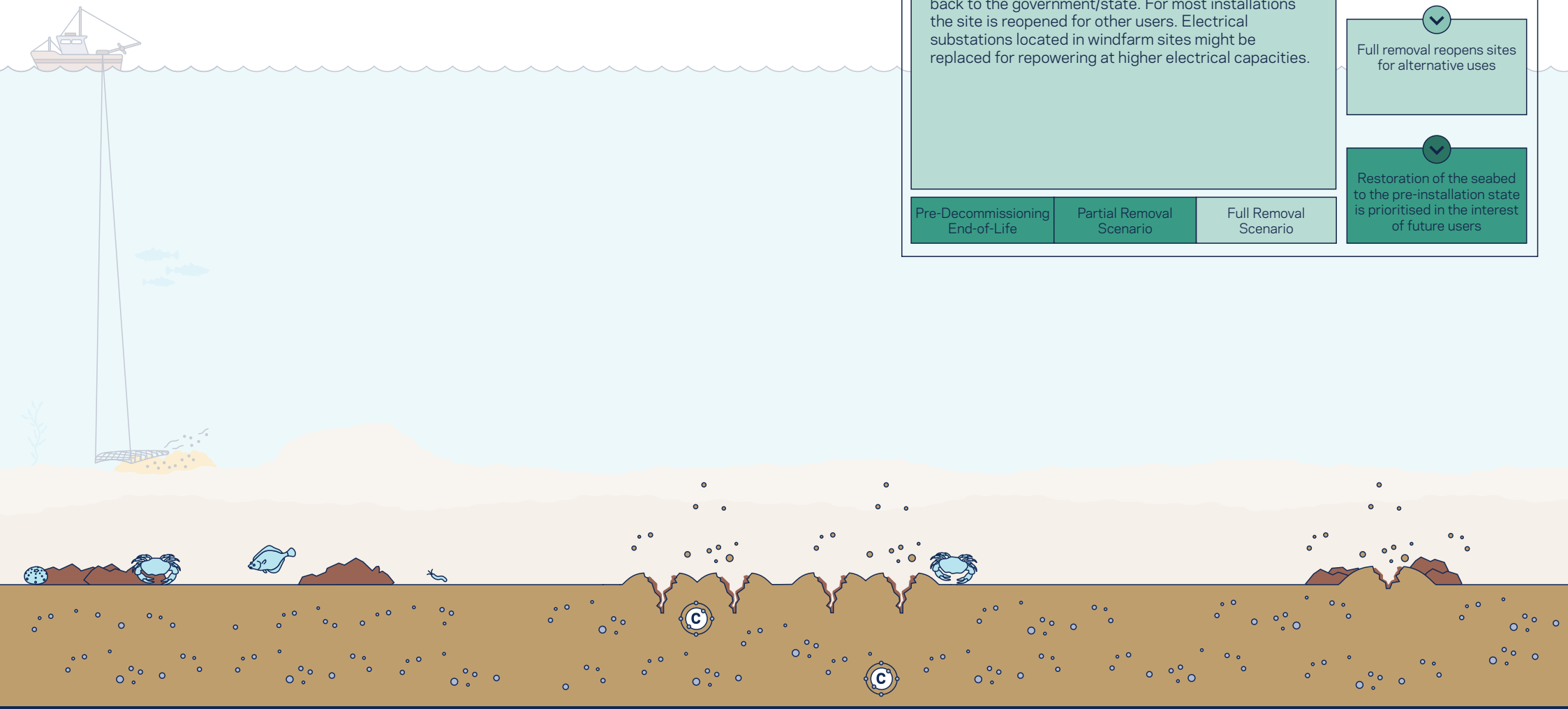

Management aspects

Long term governance

Full removal reopens sites for alternative uses.

Governance shifts after full removal, from operator back to the government/state. For most installations the site is reopened for other users. Electrical substations located in windfarm sites might be replaced for repowering at higher electrical capacities.

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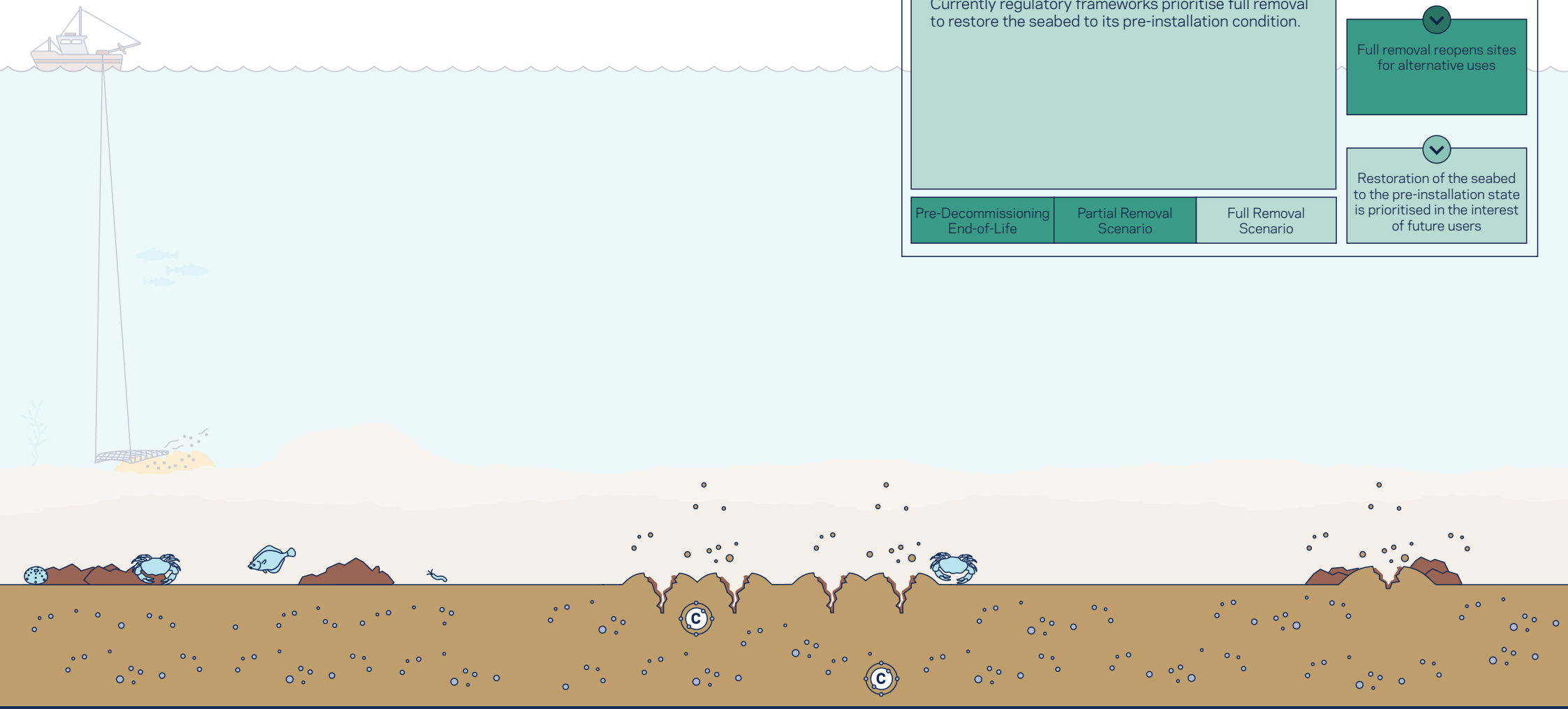

Management aspects

Decision making framework

Restoration of the seabed to the pre-installation state is prioritised in the interest of future users.

Currently regulatory frameworks prioritise full removal to restore the seabed to its pre-installation condition.

Pre-Decommissioning End-of-Life | Partial Removal Scenario | Full Removal Scenario

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