The challenges of conserving marine biodiversity in a context of sustainable development: Traditional perspectives on the management of seabed resources in terms of deep sea mining and its legal context in the Pacific ocean

by

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Abstract

Traditional knowledge and customary approaches are still undervalued in the current legal and regulatory aspect of the management of marine resources and spaces, particularly in the high seas and in the deep environment. In many Pacific islands, local communities had for generations cultural and spiritual attachments to the sea, particularly to specific marine species and areas, processes, habitats, islands and natural formations of the seabed. Traditional knowledge, customary approaches to marine management, and integrated relationships between biodiversity, ecosystems, and local communities support a holistic, sustainable, and equitable resource use, as fostered by contemporary ocean governance. As Pacific island countries are largely governed by indigenous peoples and influenced by traditional knowledge, a traditional governance system is often present. To some extent, the value of community practices and customary law, which has prompted regional cooperation and coordination, is recognized in several Pacific legal systems and in a number of regional and international instruments, however it can certainly be perfected. Based on this analysis, we identify best practices and make recommendations regarding current regulatory frameworks and approaches to managing seabed resources.

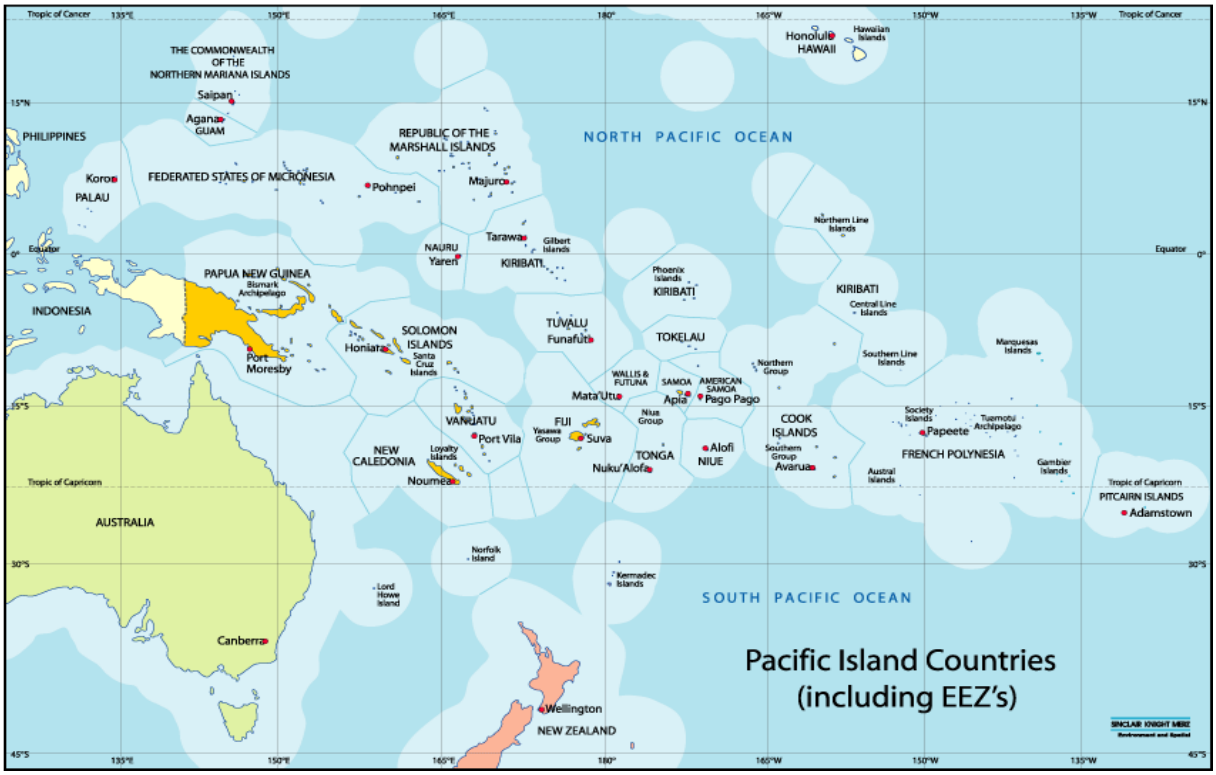

Figure 1. Map of Pacific Island Countries with their 200 nautical mile Exclusive Economic Zones and High Seas Zones (https://asiapacific.anu.edu.au/mapsonline/base-maps/pacific-eez-zones-ll).

Introduction

The oceans, considered the greatest reservoirs of non-renewable resources of biodiversity and biomass, are the main drivers of global climate and are of critical importance for the future well-being of humanity. Due to genomic approaches, knowledge of marine biodiversity is progressing at a sustained pace, making it possible to predict future changes. In addition, the scientific, economic and social exploitation of the oceans is essential to meet the ever-growing needs of the populations of our planet. However, current anthropogenic pressures affect the structure, the productivity and the resilience of marine ecosystems and put a growing number of biocenoses at risk of extinction. A holistic approach to the « sustainable management » of marine resources and areas is based on ecological, economic and social aspects encompassing all ecosystems and human activities. This approach is a priority to keep the planet's oceans functioning sustainably (Ardron et al, 2008; Tilot, 2016).

Is Deep Sea Mining (DSM) an opportunity for the long-term economic sustainability and the social development of the Pacific Island States? Is this a way to limit their dependence on foreign development aid (Childs, 2019 ; Tilot et al, 2021b ; Tilot et al., 2022) ?

The Pacific region has the following characteristics:

- It is subject to multiple stressors including population growth, unsustainable fishing practices, habitat destruction and global climate change (such as extreme weather events, sea level rise, ocean temperature rise, acidification, coral bleaching...),

- The tradition of Pacific communities to preserve and sustainably manage the marine environment and its resources by prioritizing traditional knowledge and cultural heritage is already well established (Bambridge et al., 2019). This would explain the fact that

Pacific nations have opted to establish a moratorium on deep sea mining from 2020 to 2030 in order to allow careful research in the marine areas under national jurisdiction of the Pacific nations (Fiji, PNG, Vanuatu). Similarly, the Cook Islands implement at the national legal level a form of management in the traditional form of "rahui" at certain sites in its extended EEZ which include commercially important areas targeted by mining.

The main natural resources and activities that would be affected by mining are located in coastal waters and beyond the limits of national jurisdiction. In the Pacific Islands, coastal fishing is mainly artisanal and for subsistence, supplying domestic markets while deep sea fishing is most active, targeting export (Pauwels and Fache, 2016). Tuna fishery, the most important fishing activity, takes place in the national waters of the Pacific islands, including those of the States parties to the Nauru Fisheries Agreement of 1982 which is estimated to provide 60% of the tuna catches from the western and central regions of the Pacific Ocean. In the high seas, some large species can be fished at great depths, up to 1,000 m depth for yellowfin tuna, bigeye tuna and swordfish (FAO, 2020, The Western and Central Pacific Fisheries Commission (WCPFC), 2019), 1,500 m for beaked whales or around 3,000 m for sperm whales (Bouchet et al., 2014). The deep-sea ecosystems of the Pacific region provide important ecosystem services and societal benefits, not only for Pacific islanders, but also for those outside the region due to the migratory nature of many marine species. Indeed, the region is part of important migration routes for several species of whales, which not only have strong cultural values for the people of the Pacific region but are also globally appreciated for whale watching. Many Pacific Island countries have joined the international community in signing agreements promoting whale conservation and establishing whale sanctuaries, now covering over 11 million km^2 of the South Pacific Ocean.

Impacts of deep mining on associated fauna

The areas targeted by deep mining are the least explored marine areas on the planet, the greatest reservoirs of non-renewable resources, mostly unknown, and which contribute significantly to planetary biodiversity. In the mesopelagic and bathyal (200-2000m), abyssal (2000-6000m) and hadal (more than 6000m) domains, there is a significant lack of knowledge about species, biodiversity in general and marine ecosystem processes (Tilot, 2006; 2010).

Overall, mining would inevitably impact faunal communities on large spatial and temporal scales with multiple effects due to the complexity and seasonal variations of water masses and ocean circulation, particularly in the open sea (Tilot, 2018). On basis of past and current studies,

- the impact of the mining of polymetallic nodules would be considerable. In the case of the Clarion-Clipperton International Zone (CCZ), in the Pacific, the impact area of a mining operation would be more than 3 million km^2. It would be cumulative when considering simultaneous mining operations in the area as well as additional anthropogenic activity occurring at proximity (or further depending on the level of impact) on the seafloor and in the water column to the surface and the adjoining air layer (ESCO CNRS IFREMER (2014), Tilot, 2010 ; ASOM, 2011 ; Tilot et al., 2018).

- the mining of cobalt-rich crusts would be irreversible on relatively small areas (seamounts, volcanoes), compared to the impact on abyssal plains of nodule fields. It could lead to the extinction of these biocenoses and the cessation of their mode of propagation across the Pacific (ASOM, 2011).

- hydrothermal sulphide mining could impede the gene flow of highly specialized hydrothermal populations, despite the fact that these species are adapted to rapid extinctions and recolonisations due to the relatively the relatively ephemeral presence of hydrothermal vents (ASOM, 2011).

Cumulative impacts must be considered, within the water column and the seabed, with both natural impacts (natural climate variation, El Niño events, earthquakes, tsunamis, underwater volcanism, benthic storms, etc.) and anthropogenic disturbances (pollution, fishing, seabed mining, oil and gas extraction, waste disposal, etc.) generally leading to habitat degradation and habitat homogenization over large areas (Tilot, 2010; Tilot, 2019).

Traditional perspective of marine space

The native art of sailing uses only one's own senses and knowledge passed down through oral tradition from master to apprentice, memorizing the movement of specific stars, reading the shape of clouds, the colors of the sea, the wildlife present (in the sea and the sky), the shape of the waves, the currents and the temperature of the water. Some anthropologists interpret this knowledge as “sensory ecology” (D’Arcy, 2006 ; Lohmann et al., 2008) (Figure 2).

Figure 2. This sculpture refers to star constellations and their relationship to the movements of the shark. (“Kaygasiw Usul”, Aboriginal Art, Australian National Maritime Museum (ANMM) Collection Sydney/Alick Tipoti/AAPN).

For Pacific Islanders, the ocean is of ontological importance (human-nature relations) for their socio-economic development as well as for their rituals, traditions and cosmology (Bambridge, 2016).

It is because of their vital relationship with the marine environment that Pacific Islanders regard their culture and way of life as "the Pacific Way" (Wallace et al., 1998). With a focus on relationships and interconnections, 'the Pacific Way' views the land and its surrounding waters as a continuum, a whole, 'the Vanua', encompassing deities, animals, plants, places and Peoples (Bambridge et al., 2021).

Understanding these complex social and ecological relationships formed the basis of the concepts of "Tapu" and "Rahui" through which traditional leaders managed defined areas of

'Vanua', with a mandate to ensure the continued well-being of the population and its environment (Bambridge et al., 2019) :

- “Tapus” are a complex system of rules and prohibitions regulating the interactions between specific peoples and organisms,
- The "Rahui" are customary rules regulating the spatial temporal access to places or species, taking into account social and ecological events,
- “Mana” involves ecological, social and spiritual aspects perceived as supernatural and sacred and protected by supernatural sanctions.

The “Pacific Way” promotes shared local values, including respect for “Vanua” encompassing the sea. It is based on an “unanimous” mode of decision-making, which stems from the facilitation of dialogue between members of the community. People are therefore closely linked to their “Vanua”, they belong to each other. Even after death, the spirits would not disappear from existence, but rather remained as part of Vanua. These spirits are superhuman in their strength and their deeds even control the moods of the sea. In their polymorphic character, these deities and their myths embody a deep knowledge of ecological relationships and emphasize the interconnections as described by current scientific evidence (Govan et al, 2008, Veitayaki et al., 2011, Bambridge, 2016).

While Western tradition has long considered the resources of the ocean as inexhaustible until the reality of "the Tragedy of the Commons" (Hardin, 1968), the peoples of Oceania have never ceased to develop and appreciate the fragile link that unites them to their marine environment.

To conclude, in most cases, customary marine management practices serve to provide an opportunity for depleted marine resources to recover and to help ensure that the benefits of marine conservation efforts would accrue equitably to local communities by continuing the tradition and spiritual beliefs (Bambridge et al., 2021 ; DOSI, 2021 ; Tilot et al., 2021a ; 2022).

International legal framework

Pacific island states are directly affected by DSM on their own continental shelf and by their proximity to some of the international sites, including the CCZ area, where they also hold significant interests. Therefore, the international legal framework is highly relevant to them, and it is important that this regime incorporates as much as possible the traditional dimensions and human elements of seabed resource management. However, direct references to traditional knowledge have not yet been incorporated into the provisions of the Mining Code published by the International Seabed Authority (ISA) to regulate activities in the area (Tilot et al., 2021a).

One of the most important international legal concepts reflecting traditional visions of collective ownership and embodying the human aspects of the management of seabed resources in the Area is obviously the status of the seabed and its natural resources as Common Heritage of Humanity (CHM)) (Mulalap et al., 2020 ; Willaert, 2020a).

Since DSM activities not only impact the seabed and subsoil, but the water column, at the surface and above, it is also necessary to pay attention to the international legal regime governing the Areas Beyond National Jurisdiction (ABNJ) that have close socio-ecological connectivity with Pacific Small Island States (P-SIDS) and their populations (Mulalap et al., 2020).

The work within the framework of the UNITED NATIONS CONVENTION ON BIOLOGICAL DIVERSITY (CBD, 1992) concerning the identification of Ecologically or Biologically Significant Marine Areas (EBSAs) notably organizes regional workshops where holders of relevant traditional knowledge are invited.

Regional legal framework

Most Pacific Island countries have ratified or acceded to relevant global, regional or sectoral instruments to ensure the protection of the marine environment and biodiversity from DSM activities (Tilot et al., 2021), such as:

- The CBD, 1992,

- the Madang Guidelines of 1999 on principles for the development of national policies relating to offshore minerals (offshore),

- the 1986 Noumea Convention for the protection of natural resources and the environment of the South Pacific region. This convention includes an indirect reference to the cultural value of the areas and the exercise of traditional customary rights in one of its protocols (Protocol Concerning Co-operation in Combating Pollution Emergencies in the South Pacific Region),

- The Nauru Pacific Sub-Regional Agreement for Cooperation in the Management of Fisheries of Common Interest, signed in 1982, highlights the considerable benefits of conservation in the region.

A further step towards collaborative ocean governance in the Pacific was taken with the endorsement of the Pacific Oceanscape Initiative signed in August 2010 by leaders of the Pacific Islands Forum.

Similarly, the Pacific group of the African, Caribbean and Pacific (ACP) States Regional Legislative and Regulatory Framework for the Exploration and Exploitation of Deep Seabed Minerals serves as a roadmap to guide policy makers and government agencies in Pacific Island States towards legislation effective and appropriate decision-making for the long-term benefit of island communities and future generations (Willaert, 2020b).

National legal framework

Two case studies where the traditional and cultural dimension have been integrated into the national legal framework are presented here:

- **Cook Islands:** Traditional dimensions of seabed resource management are clearly incorporated into Cook Islands national laws. These islands obtained in 2014 a contract from the International Seabed Authority (ISA) for the exploration of polymetallic nodules in the area and in 2017, a contract for exploration activities on their own continental shelf. In the same year, the nation set up a vast marine park, “Marae Moana” (Sacred Ocean), covering all their territorial sea and their EEZ which encompasses a huge portion of the currently known world cobalt reserve (Willaert, 2021).

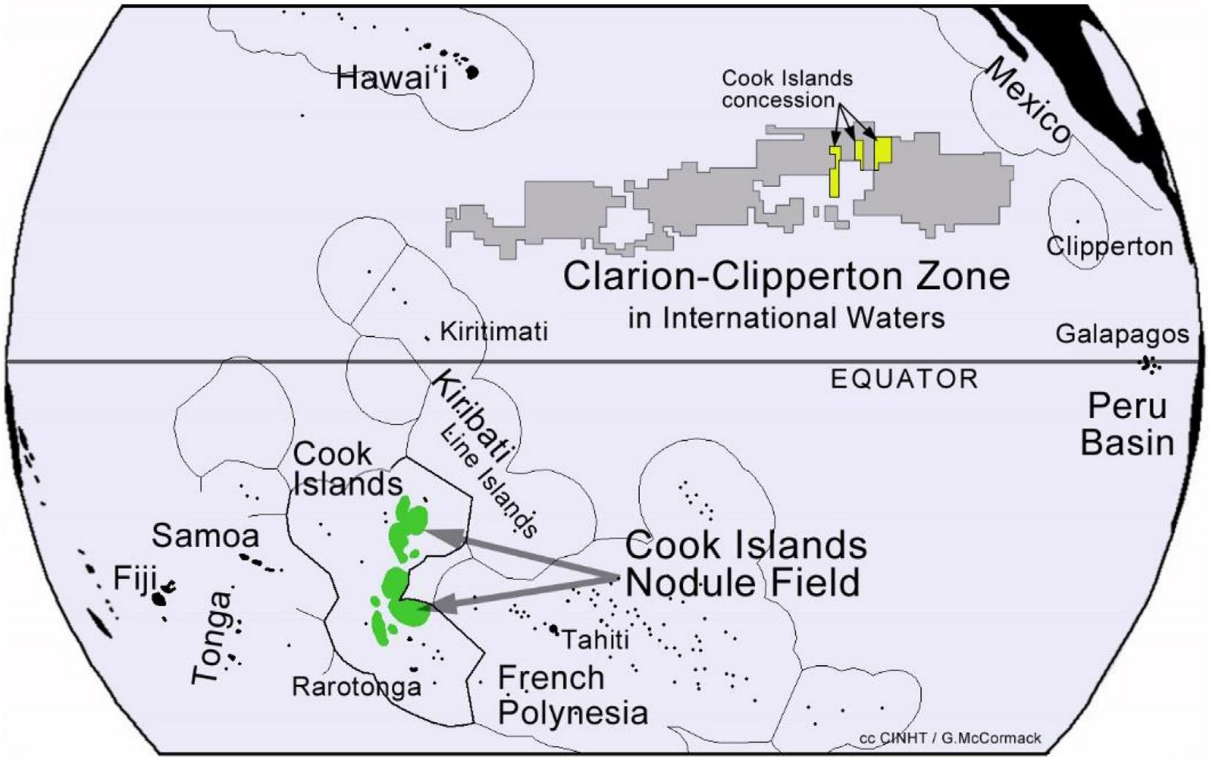

Figure 3. Context map showing the Cook Islands manganese nodule fields in relation to neighboring countries and the Clarion-Clipperton Zone International Mining Permit Area (McCormack (2016) and Petterson and Tawake (2018)).

The main objective of the "Marae Moana" Act is to protect and conserve the ecological, biodiversity and heritage values of the marine environment and to promote the shared use and sustainable development of the Cook Islands. It includes a network of marine protected areas (MPAs), some of which are "rahui" managed.

Thus, the Cook Islands balance economic interests such as tourism, fishing and DSM with the conservation of marine biodiversity and ecology, in order to maximize benefits for current and future generations of islanders.

The Cook Islands Seabed Minerals Act requires that proposed DSM activities are likely to lead to capacity building, long-term employment or structural economic benefits without any irreparable harm to community, environment or cultural practice. This Act is quite unique in the global landscape of seabed mining laws.

However, due to the recent enactment of the discussed national laws on the management of Cook Islands seabed resources, it is very difficult to assess their merits and effects, but they look quite promising (Willaert, 2021).

- **Papua New Guinea (PNG)** was the first country in the world to engage in DSM within its EEZ and to invest in a commercial seabed massive sulphide mining venture with the Canadian company Nautilus Minerals company.

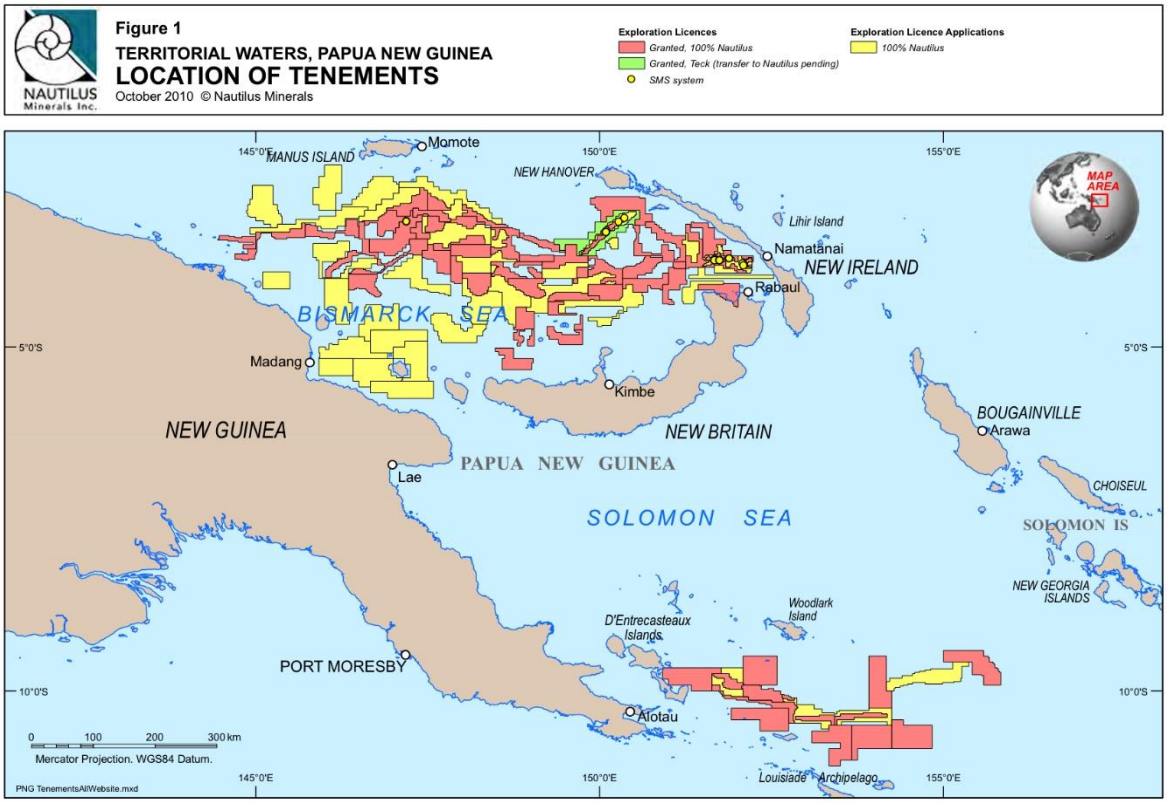

Figure 4. Nautilus' Solwara 1 project is located in the first mining area proposed by PNG (https://www.solwaramining.org).

However, in the PNG Environment Act 2000 there is no special legislation on offshore mining beyond territorial seas and no specific provisions on DSM such as a Strategic Environmental Assessment or Protected Areas for the seabed (Kakee, 2020).

In 2009, PNG granted Nautilus an environmental permit for the Solwara 1 deposit, followed by a 20-year mining lease obtained in 2011 to explore mineral-rich hydrothermal vents. The Solwara 1 project showed shortcomings in taking into account the traditional dimensions of the management of seabed resources in the absence of an adequate regulatory framework. Public petitions have been made to the government over the lack of Free, Prior and Informed Consent (FPIC) from local and indigenous communities to the project, as well as its undervalued social and cultural impacts. These communities have claimed that DSM has impacted the relational ontology that positions "beings", "spirits" and "nature" as co-makers of the "graun" (the world or cosmos) and not as separate entities (Childs, 2019).

In response, the Nautilus company tried to implement different forms of community engagement, all based on the need for a "social license to operate" (Earth Economics, 2015). These are voluntary rules developed by practitioners, such as the "International Marine Minerals Society Code for Environmental Management of Marine Mining".

- **Some Pacific Island States**, such as the Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Solomon Islands, Tonga, Tuvalu and Vanuatu, address seabed mining in their legislation or national policy. They generally recognize the precautionary principle and its approach as well as the applicability of existing norms of international law, in particular with regard to prevention, reduction or remedying of damage caused to the marine environment. As Pacific island countries are largely governed by indigenous peoples and influenced by traditional knowledge, a traditional governance system is often present (Aguon and Hunter, 2018, Secretariat of the Pacific Community, 2015).

Discussions

Currently, it is recognized that many sectoral (hierarchical) approaches to marine resource management, based on current scientific methods, have not always adequately and holistically protected species, habitats and ecosystems.

A number of traditional marine management practices provide selective and tailored access restrictions that may change over time. These practices can be applied alone or in addition to scientific tools and approaches such as the concepts of "Ecosystem Based Management" (EBM) or "Environmental Impact Assessment", permits or monitoring of techniques and gear (as in fishing) (Ardron et al., 2008, Sherman, 2014).

Traditional knowledge and marine areas managed by local communities have a central role to play in achieving national, regional and international marine protected area targets. This role is explicitly recognized in the work program of the Convention on Biological Diversity on island biodiversity, in particular concerning the Biocultural Heritage component.

Is DSM compatible with "the climate change Action/mitigation and adaptation", especially in vulnerable small island countries of the Pacific where infrastructure and institutions are least equipped to deal with additional challenges?

Deep sea minerals, especially rare earths (Hein et al., 2020), can be used for renewable energy production (Takaya et al., 2018). However, their extraction undoubtedly poses challenges in terms of sustainability and greenhouse gas emissions, especially when considering the benefit to local communities in small Pacific island countries (https://www.un.org/sustainabledevelopment/climate-change/Goal 13).

The island states characterized by minimal institutional capacity and large maritime domains provide an important example of the benefits of regional and sub-regional cooperative approach (Bambridge et al., 2021; Tilot et al., 2022).

Conclusions

Traditional perspectives on the human impact of seabed resource management are incorporated into relevant legal frameworks in a number of ways:

- At the international level, the status of the area and its mineral resources as Common Heritage of Humanity can be seen as a clear reflection of the general idea of collective ownership and mutual conservation objectives. However, this is still a work in progress and it will take time to install and implement an appropriate regime that serves all interests and worldviews.

- At the regional level, Pacific nations need to pool their resources and expertise on traditional knowledge on ocean issues. It should be included in a regional strategy to address the challenges of deep sea mining that would involve innovations, cooperative planning and the involvement of all stakeholders.

- At the national level, the case studies demonstrated that the relevant laws of the Pacific Island States, which clearly draw on regional legislative efforts, attempt to anchor, to some extent, the traditional views and interests of local communities. The Cook Islands are taking a pioneering role with their Marine Spatial Planning and Seabed Resource Management laws with the inclusion of "Rahui" in MPAs.

Indigenous Peoples and Local Communities (IPLCs), generally traveling between the coasts and the high seas, have a role as guardians of ecosystems and migratory flagship species (tuna, swordfish, whales, etc.) They are in the global debate to fill the gaps in the governance of Areas Beyond National Jurisdiction (ABNJ) and in the lack of an integrated global framework for the conservation and management of biodiversity world following a holistic approach.

The policies and practices developed in the Pacific may well serve as an appropriate model for reconciling commercial, ecological, cultural and social values in the context of deep sea mining as well as supporting Human Well-Being and Livelihoods (HWSL) of the Island communities of the Pacific and consequently of the populations of the Planet (Dahl, 2014; Tilot et al., 2022).

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List of Acronyms

ABNJ : Areas Beyond National Jurisdiction

ACP : African, Caribbean and Pacific States

ANMM : Australian National Maritime Museum

ASOM : Académie des Sciences d'Outre-Mer, France

CBD : CONVENTION ON BIOLOGICAL DIVERSITY, an agreement adopted by the UNITED NATIONS in 1992.

CCZ : Clarion-Clipperton International Zone, the high seas marine domain included between the submarine fractures of Clarion and Clipperton

CHM : Common Heritage of Humanity

CNRS : Centre National de la Recherche Scientifique

CSIRO : Commonwealth Scientific and Industrial Research Organisation

DOSI : Deep-Ocean Stewardship initiative

DSM : Deep Sea Mining

EBM : Ecosystem Based Management

EBSAs : Ecologically or Biologically Significant Marine Areas

EEZ : Exclusive Economic Zone

ESCO : Société minière française

FAO : Food and Agriculture Organisation, an agency of the United Nations

FPIC : Free, Prior and Informed Consent

HWSL : Human Well-Being and Livelihoods

IFREMER : Institut Français de Recherche pour l'Exploitation de la MER

IPLCs : Indigenous Peoples and Local Communities

ISA : International Seabed Authority, an autonomous international organization established under the United Nations Convention on the Law of the Sea (UNCLOS) of the United Nations and the 1994 Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea.

MPAs : Marine Protected Areas

PNG : Papua New Guinea

P-SIDS : Pacific Small Island States

SPC: Secretariat of the Pacific Community

UNCLOS : United Nations Convention on the Law of the Sea of the United Nations

Unesco/IOC: United Nations Educational, Scientific and Cultural Organization/Intergovernmental Oceanographic Commission

WCPFC : (The) Western and Central Pacific Fisheries Commission