

**A PECC International Project**  
***Sustainable Management of Marine Resources 2011-2012***

***Concluding Seminar***  
***The Management of Deep Sea Marine Resources and***  
***Oceans as a Means of Communication***

***December 4-5, 2012, Auckland, New Zealand***

Co-hosted and organized by NZPECC, FPTPEC, and the University of Auckland

**EXECUTIVE SUMMARY**

**BACKGROUND**

Major economic, environmental and social challenges come to the fore when dealing with management of oceans and coastal areas. An integrated and sustainable management of marine resources is a prerequisite for better protection and use of marine resources while also allowing for the development of various recreational and economic activities. Economic activities and facilities are mostly located on coastal areas. Today, 40% of the world's population lives in the coastal areas or within a 70km range; in particular, in the emerging economies of the Asia-Pacific region. The World Bank estimates that by 2025 this figure would dramatically increase. Such challenges deserve a serious attention; they have a worldwide bearing. Oceans account for more than 75% of earth's surface; and it is for this very reason that it is necessary to promote a sustainable management of the oceans.

On October 22, 2010, at the PECC Standing Committee meeting in Tokyo, a PECC international project on the **Protection and Sustainable Management of Marine Resources**, in a series of three seminars, proposed by FPTPEC was endorsed. New Caledonia constituency of FPTPEC hosted the first seminar, followed by second hosted by the East West Center and the Natural Energy Laboratory of Hawaii Authority (NELHA) in Hawaii, and the concluding seminar took place in **Auckland, New Zealand** on **December 4-5, 2012**, hosted by NZPECC and the University of Auckland. The contents of the series of three seminars will be published as a PECC international publication in 2013.

**SEMINAR 1 – Noumea, New Caledonia**

The first seminar was held in November 2011 in Nouméa, New Caledonia, focusing on the **Protection of Ocean's Resources** including fisheries, ocean and coastal area protection regulations, and management of challenges from global climate change.

The Nouméa seminar has put forward five main issues:

- an increased vulnerability of the coastline due to climate change;
- a need to change direction immediately to avoid risks for international security;
- a need for more solidarity amongst countries worldwide to develop collective action and regional cooperation for knowledge sharing and innovation
- a need for new local economic models, and,
- a need to establish new forms of governance and better manage the maritime areas.

## SEMINAR 2 - Hawaii

The second seminar entitled, “*Oceans as a Source of Renewable Energy*” held in Hawaii in March 2012, with the support of the East West Center and NELHA, covered four key areas:

- Development of new technologies for efficient use of marine energy;
- New energy sources to the sea: the operation of ocean thermal energy conversion (mainly in the Pacific), wave energy, tidal energy, the hydraulic energy, etc.;
- the means to increase the use of marine energy through technical and financial support from the public and private sector; and
- the role of marine energy in the future cities and the adaptation requirements of urban infrastructures.

The seminar highlighted a number of aspects to the various benefits and constraints to new forms of ocean energy. For example, the use of ocean thermal technology is useful for dense urban centers, with proximity to deep seas to benefit from significant differences in temperature between warm surface water and cold water from significant depth. Seawater air conditioning technology is simple and reliable for cooling buildings, and operational in many cities around the world. Wind turbines are more efficient on the sea than onshore as wind is more regular and consistent. Current energy is deemed more predictable and consistent than wave energy. In general, however, environmental conditions at sea are harsher and more aggressive than on land due to quicker corrosion, problems of anchoring, and accelerated aging. Technologies are available; taking the innovation to work in marketplace and to grow in economy of scale is the biggest existing challenge, which would need sizable companies to buy into, and invest in the new technologies.

The expected benefits of marine energy are significant: less dependence on oil, lower power consumption, reducing greenhouse gas emissions (and even zero emissions), minimal or no refuse, and reduced use of water resources. However, this requires rethinking the integration of urban services in developing better governance, by seeking the agreement of stakeholders and developing public-private partnerships. Existing networks are not formatted for renewable energy. It is therefore necessary to revisit the entire chain of production and distribution if we wish to develop renewable energy.

### SEMINAR 3 – Auckland, New Zealand

While building on the two previous seminars, the concluding seminar held in Auckland also brought in new aspects to the broad theme of marine resources management. It is now more obvious that despite the strong potential of marine resources, market by itself will not be enough to facilitate their further development; it would require all stakeholders to contribute concerted efforts and financial support. The development of marine resources calls for strong political will in support of the research and development efforts conducted by the private sector. A thorough and well-thought out industrial policy is required to develop a solid industry. In addition, various socio-economic as well as technical and environmental barriers should not be neglected: the need to collect more reliable data for sound decision-making, development of new digital tools, risks related to operations at sea, evolution and compatibility of norms must also be tackled. This is a multidisciplinary field where technologies are not yet stabilized or sufficiently protected.

World economies are facing a new paradigm; new research and new investments will be required to develop a sound exploitation of oceans' resources, namely when considering deep sea exploration. Some sources of exploitation of marine minerals are more likely than others to further develop and become viable; the transition from experimentation to exploitation will then define internationally recognized standards. The development of clusters and alliances between local and multinational firms will become necessary to develop high technology and risky exploitation. It will provide less developed economies with the possibility to reap benefits from the exploitation of their oceans' natural resources even without having mastered the technology. Such development also requires calls to the financial and development sectors, mainly through public-private partnership.

Exploitation of oceans requires also the capacity for the PECC economies, owners of the resources, to be able to control and protect them from non-authorized users. New technologies are to be implemented for a better surveillance of the oceans. Considering the increasing global call for new resources, the legal aspects related to access, preservation and environmental protection are not to be neglected.

Four sessions were organized to discuss the following issues:

***Session 1*** Identified solutions to reconcile the development of deep sea exploration and environmental protection and to provide a sound surveillance of oceans

***Session 2*** Focused on the ways to protect the resources from non-authorized users, identified available technology, international agreements to protect their own resources. It also presented technical, legal and environmental cooperation efforts being made among neighbors to monitor and protect shared waters.

***Session 3*** Looked at ways to maintain the level and quality of existing resources and ways to guarantee the protection of exclusive zones

***Session 4*** Looked at oceans as a means of communication and development for local communities. Sea is a crucial means for transportation and communication for Pacific economies and particularly for Pacific islands. Well established sea lines as well as submarine infrastructure allow for the essential passage of goods and services across the seas and help these island economies enhance competitiveness and prevent economic isolation despite the obvious challenges brought by geographic constraints.

**Presentations made at the seminar are available on the PECC website.**

## A New Social Contract for the Blue Planet: a Better Management of the Oceans



Although immense, the sea is a finite universe. Following the wake-up call that happened during the latter half of the 20<sup>th</sup> century which made us switch from the perception of our marine world being infinite to the consciousness of its fast exhaustion by human activities, the beginning of the 21st century offers us another paradox. Resources from the Blue Planet are likely to become extinct or destroyed by human activities if not wisely

managed. Fish resources are depleted, many species are disappearing, and coral reefs are affected by incurable diseases. In addition, new offshore activities, such as deep sea oil and mineral exploitation, wind and underwater turbines, underwater plants, collective housing, may create conflicts of use of the maritime space.

The overall surface area of the ocean's deep waters explored so far is more or less equal to the size of a large global city. We know very little of it; most is still to be discovered with regards to its biodiversity, species and molecules. The deep sea mining resources not yet identified are immense and we have limited knowledge to capture the unlimited energy of the solar cells that the oceans are capable of providing.

Economic activities linked to oceans represent a huge economic value well beyond all other human activities, except perhaps agriculture. Some striking figures were pointed out by Admiral Aubriot when setting the stage for the seminar discussion.<sup>1</sup>

- Extraction of ores and transformation of sea water represent already U\$50 bln
- Fishing, transformation, aquaculture generate a value of U\$160 bln
- Exploration and extraction of oil and gas represent wealth of more than U\$900 bln
- Sea transport and services at sea sum up to U\$500 bln

New considerations should be taken aboard: technical and environmental constraints in regards to the depth of oceans; the ecosystems to be evaluated not at the local but at the global level; the cost of preventing and fighting pollution which is likely to spread throughout the different oceans; the appropriation of marine resources to be discovered and exploited in marine areas outside the national jurisdictions; as well as ethical and social dimensions and responsibilities vis-à-vis the future generations.

The threats on the oceans are real; we have to act as shareholders of the oceans and not as simple stakeholders. Our responsibility is much broader, ampler, and deeper:

- We can use this common good under the condition that we are able to protecting it and sharing fairly the profits.
- Preserving the resources is not adequate in itself; we have the mandate to implement policies to render value while protecting them.
- States cannot be left claiming ownership and privileges without limits without risking the generation of severe conflicts. We have to proactively master the place given to human activities in the development of resources from the Oceans.
- Using while protecting, valorizing while preserving, this apparent conflict needs also to be managed.

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<sup>1</sup> Admiral Bertrand Aubriot, DCNS, Paris, France

## In Search for New Sources of Energy – Exploring Deep Seabed Minerals



There is rapidly growing interest and quest for offshore minerals in the Pacific waters. Recent deep seabed mineral activities in the Pacific Islands region largely consist of research and exploration as well as preparing economies to put in place the necessary legal instruments for effective administration and governance of deep sea mineral resources.<sup>2</sup> Active commercial exploration within the national jurisdiction of Papua New Guinea in recent years as well as the issuance of a mining lease to Nautilus Minerals in 2011 have led to many other companies to follow suit by applying for and being granted exploration licenses in other places such as the Solomon Islands, Tonga, and Fiji.

The regional SPC-EU EDF10 (European Development Fund 10) Deep Sea Minerals Project is being implemented in 15 Pacific economies and Tonga has become the first economy to be assisted by the project in drafting of its national seabed minerals bill and regulations in consultation. Others will follow suit and the economies are strongly encouraged to use relevant international law provisions including the precautionary principles in drafting their respective deep sea minerals policies, legislation and regulations. Other types of capacity building initiatives have been implemented by the DSM project with the aim of enabling Pacific economies effectively participate in and regulate the new industry.

There is rapidly growing interest in offshore minerals exploration in New Zealand waters. Legislation is still under development with the two equally important aims of facilitating development of potential mining operations while ensuring that environmental sustainability is not compromised. Such legislation is still under development and scientific research plays a critical role in these efforts by providing support such as much needed baseline information, a robust monitoring program, and precautionary conservation measures. A strong collaborative approach in the early stages of exploration is taking place between New Zealand minerals companies and researchers which in the long run will provide a solid foundation for subsequent environmental management.

As an example, a four-year research project funded by the NZ Ministry of Business, Innovation and Employment (MBIE) and executed by the National Institute of Water and Atmospheric Research (NIWA) of New Zealand aims to help enable management of offshore hydrocarbon and mineral operations through improved understanding of environmental impacts.<sup>3</sup> The objective of the program is to provide guidelines for consistent, appropriate and robust assessment of environmental impacts across the range of marine activities. The guidelines will be based on both Environmental Risk Assessment (ERA) and Environmental Impact Assessment (EIA) processes. The program, consisting of collaboration among various players from industry, research and government organizations, will support the development of guidelines for monitoring the impacts of marine industry operation, techniques to determine key parameters of spatial management, and improve our understanding of the impact in the broader ecosystem context.

In the case of New Zealand, a number of factors led to pushing up the need for environmental legislation higher up the priority list of policy-makers including: increased awareness of mineral resources, increased global demand for mineral resources, government's economic development agenda and increasing public interest in environmental projects and potentials.<sup>4</sup> According to the

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<sup>2</sup> Akuila Tawake, Team Leader of SPC-EU Deep Sea Minerals Project, SOPAC Division, Secretariat of the Pacific Community (SPC), Suva, Fiji

<sup>3</sup> Geoffroy Lamarche, Principal Scientist, National Institute of Water and Atmospheric Research (NIWA), Wellington, New Zealand

<sup>4</sup> Mr. Dave Trueman, Partner, Simpson Grierson, Wellington, New Zealand

Centre for Advanced Engineering, seafloor mineral deposits within New Zealand's Exclusive Economic Zone could be worth up to \$500 billion. In the past, legislation was largely industry-specific, piecemeal, and there was heavy reliance on self-regulation in regards to minerals. As of September 2012, a comprehensive legal framework has been enacted to manage the environmental effects of certain activities including minerals exploration and mining, called the 'Exclusive Economic Zone and Continental Shelf Act (Environmental Effects) 2012'. Consent decisions for exploration or other activities will be considered and managed by an independent regulatory body called EPA with the aim of finding a balance between economic development and environmental protection.

Some of the current activities taking place on the ocean continental shelf (areas beyond 200 nautical miles) include: marine scientific research (MSR), fishing, mining for seabed minerals, hydrocarbon extractions, and bio-prospecting.<sup>5</sup> Other such activities are sure to follow as we take increasing interest in the vast potential resources harbored in the marine ecosystem. These activities face unique issues such as interactions with various users in the high seas, different rules regarding MSR, possible risks of transboundary damages or harm to the global commons. When regulating such activities, one cannot assume 'business as usual.' There are legal or regulatory differences from one state to another and such differences should be reflected in the regulatory framework as much as possible.

In sum, marine resources can provide enormous potential for economic growth and development for all economies bordering the Pacific. However, ensuring sustainable exploration and exploitation through reliable data acquisition, careful considerations of other factors such as preservation of natural and cultural heritages should not be ignored.

### Surveillance of Oceans



There are clear benefits of strengthening international cooperation in shared waters by improving the governance and responsible management of the marine resources and environment. These include areas such as illegal fishing, illegal immigration, human and drugs trafficking across waters, and pollution. Cooperation, effected through various multilateral, regional, and bilateral agreements at the political level, is essential for the long-term protection of the resources, including cooperation in maritime surveillance. Further, policy coherence and harmonization of approaches can enhance the benefits of collaborative action. That necessitates a combination of good frameworks, practices, and networks.<sup>6</sup> Solid legal frameworks were regarded as essential for the joint maritime surveillance efforts in the Pacific Ocean. The Declaration on Maritime Surveillance signed by New Zealand, Australia, France and the US at the 2012 Forum, the Niue Treaty, and the WCPFC high seas boarding and inspection regime, all provided the framework for surveillance cooperation in the Pacific.

In the maritime surveillance area there was good cooperation among the QUADs (Quadrilateral Defense Coordination Group involving Australia, New Zealand, France, and the United States), which had a positive deterrent value on illegal fishing. There was room, however, to broaden the cooperative frameworks in the future to include Asian nations. This would also help to deal with future threats in the region.<sup>7</sup>

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<sup>5</sup> Dr. Joanna Mossop, Senior Lecturer, School of Law, Victoria University of Wellington, New Zealand

<sup>6</sup> Amb. Francis Etienne, Embassy of France, Wellington, New Zealand

<sup>7</sup> Captain Bruno Jeannerod, Commanding Officer, French Armed Forces in the Pacific, Noumea, New Caledonia

In the case of New Caledonia, political support among the indigenous populations was seen as crucial in the development of the Coral Sea Marine Protected Area. The MPA was used as an example to highlight the value which scientific research could add in the development of policy options to address the protection of the oceans.<sup>8</sup>

Partnerships needed to be strengthened among key organizations in the Asia-Pacific region so that a more coherent approach to the protection of the oceans could result. Benefits from scientific collaboration and value of networks in providing the necessary framework for collaboration apply not only to scientific research endeavors but also more generally to marine policy development and governance.

## Marine Pollution



In contrast to the above, it was in part the lack of international legal frameworks and common standards to deal with land-based sources of pollution which had contributed to the significant problem of marine debris in the global oceans.<sup>9</sup> The ocean was more too often treated in past centuries as a convenient dump site. And preventing or managing pollution that is spilling over into or affecting other states require going beyond national jurisdictions.

Marine plastic debris is one of the most problematic of pollutions. Plastic is commonly non-biodegradable, thus remaining in the marine system for a very long time. Ocean surface currents move the debris from its sources into areas of current convergences which become reservoirs of floating litter. It is challenging to quantify and to collect reliable data on this complex problem. A SCUD (a diagnostic model of the ocean surface currents) model has been developed using satellite data and trajectories of drifting buoys. This SCUB model is being used as a tool to investigate the pathways, along which marine debris is transported in the marine system. Needless to say, the sources and impact of marine pollution are global and thus international effort is crucial in order to mitigate the problems. In 2011, the NOAA Marine Debris Program took a lead in the initiative to promote international and interdisciplinary cooperation in the field of marine debris leading to “Honolulu Strategy”.

As much as 80% of wastewater being discharged into the ocean today is untreated and according to Veolia Environnement, half of water treatment technologies which will be used in the next 15 years have not even been invented.<sup>10</sup> Hence, continuous research and development (R&D) efforts are needed as well as ensuring appropriate technology transfer and intensive training in order to fight mitigate the environmental pollution in the sea. Public-private partnership (PPP) is crucial in this collective effort by encouraging both sectors to raise the standards and the technologies needed to ensure sustainable management of the sea and its environment. Such form of collaboration is aimed to facilitate and serve as a catalyst to the much needed innovation in the waste management field. While continued efforts to explore and responsibly exploit minerals and particular rare minerals are important, it is equally important to continue to conserve and find ways of recycling raw materials to reduce the demand wherever possible.

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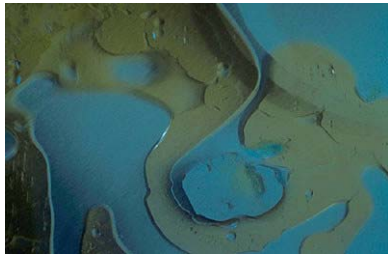
<sup>8</sup> Dr. Yves Lafoy, Embassy of France, Wellington, New Zealand

<sup>9</sup> Dr. Jan Hafner, Scientific Computer Programmer, International Pacific Research Center, University of Hawaii, USA

<sup>10</sup> Mr. Nicolas Renard, Advisor to the Chairman and CEO, Veolia Environnement, Paris, France

## Maintaining the quality of existing resources vs. Protection of exclusive zones

In view of the world economy's increasing dependence on rare earth elements for industrial use, it is particularly worth noting that 97% of the rare earth and yttrium (REY) production comes from mainland China today. These 17 identified elements are crucial for novel electronic equipment (e.g. flat-screen TV, hard-disk drives, and smartphones), green-energy technologies (e.g. fuel cells, wind turbines, LED bulbs, hybrid vehicles), and space development industry.<sup>11</sup> However, the principal uses of REY lie in advanced military technology such as missile guidance and control system, laser targeting system, and radar surveillance system.



Now this near-monopoly held by China may be challenged in the near future by the discovery of massive deposits in the mud on the Pacific floor by Japanese geologists who estimate that there are about a 100 billion tons of rare elements in the mud. The research team led by Professor Yasuhiro Kato, professor of earth science at the University of Tokyo, found the minerals in 78 locations around the Pacific. While the rare earth elements (REE) found on land are often scattered and in thin deposits, those found in the sea mud are in much thicker concentrations so the finding offers a promising prospect for more efficient exploitation of REEs in the near future.

With the objective of diversifying sources of supply for REEs for which we have become increasingly dependent, and the advancement in technology which enables it, there is noticeable rise in interest to and intentions to further the scientific exploration of the mud on the seafloor that contain the REEs. One particular challenge is that some of the REEs are highly endemic based on small amounts of deep sea samples. Other challenges include scientific, technical, economic versus environmental, legal (e.g. demarcation of EEZ and inland seas), and geopolitical concerns (e.g. diversification of supply sources).<sup>12</sup> While recognizing the important need to explore and exploit the REEs, there is evidently a need to strike a fine balance between exploitation and conservation of marine resources, in light of sustainable and responsible development.

In New Zealand, interest in offshore petroleum and minerals exploration is growing rapidly as investors assess the potential economic returns from their rich marine resources.<sup>13</sup> The main challenge of scientists and the relevant management agencies is about how to facilitate the development of this natural wealth while ensuring environmental sustainability is not compromised. The EEZ and Legal Continental Shelf in the case of New Zealand cover 5.7 million km<sup>2</sup> of ocean which means 20 times the land area. It has a complex seabed, a diverse range of habitats, is influenced by major ocean currents, and supports a globally unique and diverse biota, including mobile species that transcend lines or zones that we identify on maps. There are much more complex sets of factors and circumstances for offshore mining operations in comparison on onshore yet much less is known about the potential environmental impact of the former.

Large deposits of geological resources, including oil and gas, hydrates, minerals, sand and aggregates, phosphates, gold, polymetallic nodules and volcanic massive sulphides, have been recognized or inferred at and beneath the seafloor. Between 1997 and 2002, the marine mineral economy alone is said to have increased by 26%. A conservative valuation of this vast mineral estate is estimated at NZ\$500 billion.

In sum:

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<sup>11</sup> Prof. Yasuhiro Kato, Professor, Frontier Research Center for Energy and Resources, Graduate School of Engineering, University of Tokyo, Japan

<sup>12</sup> Dr. Martin Patriat, French Research Institute for the Exploration of the Sea (IFREMER), France

<sup>13</sup> Dr. Geoffroy Lamarche, NIWA



- There is a consensus that seafloor resources are exploitable and would provide substantial economic benefit to ocean economies.
- However, rigorous, quantitative research is still required to make estimate and model that would convince the industry.
- There is need for much more conservation science to provide sound environmental management and balance between extraction and conservation

## Communications and Transport across the Oceans



As much as an alternative source for precious minerals and other resources, the seabed is being explored further and used to meet the growing demand of laying submarine communication cables. A 2009 World Bank report on Pacific Islands states: “Distance is not just a physical concept, but also an economic one. It is the ease or difficulty of which goods, services, labor, capital, information and ideas move between places. [...] The correlation between access to markets and economic growth is strong.”<sup>14</sup>

Transporting goods and services throughout the Pacific Ocean, using some of these Pacific Islands as en-route ports for cargo ships and as hub points for submarine optical cables have significant implications for these island economies which would otherwise risk economic isolation. Companies like New Zealand Steel, owned by Bluescope Steel, formerly a business group of BHP Billiton, exports steel products to various destinations in the Pacific. Optimized shipping and logistics are of utmost concern for such companies doing business across the seas.<sup>15</sup>

As much as 90% of world’s communication flows are carried via submarine cables and the internet annual growth is as high as 60% per annum, observed between 2010 and 2016. Without doubt, laying more submarine cables and thus increasing the open access to high-speed and cost-effective broadband connectivity lead to accelerated social and economic development. However, the majority of Pacific island economies remain under-connected and they are still dependent on satellite networks which are now inadequate to meet their growing needs. Financing for the infrastructure remain the key concern that is preventing some of major projects from going ahead to alleviate this problem. Governments have crucial roles to play along with regional or global financial institutions and other private financing platforms.<sup>16</sup> Public-private partnership models take shape in rolling out submarine cable projects which allows for mixed ownership – in the forms of joint funding and joint operations or maintenance. One such example is one undertaken by Alcatel-Lucent between Tonga and Suva as part of the regional connectivity project to eventually connect all Pacific Islands with fiber optic cable. The 837km link was financed by the World Bank, the Asian Development Bank and Tongan government, and it gives access to the Southern Cross Cable in Suva, Fiji which serves as the main trans-Pacific link between Australia, New Zealand and the United States. “Gondwana-1” is another regional submarine project stretching 2,100km between Sydney and Noumea, New Caledonia. The success of submarine cable projects depend on an optimal mix of technical expertise, long-term financial commitments, and mutual confidence shared among neighboring economies for a collective regional approach in quickly achieving an economy of scale.

However, building such submarine infrastructure involved extensive research, and careful planning. For example, shortest route was not always the least expensive and shortcuts were not an option in consideration of certain seabed conditions and environmental concerns. Sometimes the sheath of the cables had to be reinforced in shallow waters, subject to substantial maritime activities. There is

<sup>14</sup> The World Bank Report 2009: Pacific Islands Development in 3D

<sup>15</sup> Ms. Blandina Diamond, Logistic Manager, New Zealand Steel

<sup>16</sup> Mr. Emmanuel Delanoue, Head of APAC Sales & Marketing, Alcatel-Lucent Submarine Networks

also a need to diversify routes to reduce the risk of failure as any disruption in submarine cables wreaks havoc and financial losses. In particular, the services trade would be most likely impacted than agricultural or manufacturing trades. Governments need to continue to analyze and assess the potential risk factors by studying various scenarios which will ultimately help decision-making on how much to invest in costly infrastructure projects such as submarine cables.<sup>17</sup>

## Conclusion

In view of the growing global demand for more minerals, it is inevitable that governments, industries, and scientists look into the possibilities of diversifying the sources of such mineral by exploring the deep seas and seabed. In view of growing demands for faster connectivity and wider open access to internet, laying more fiber optical cables on the seabed become inevitable. Human dependence on the sea goes far beyond fishing and maritime leisure activities on the surface of the ocean.

The discussions have emphasized that resources from the oceans available in most of the Pacific island territories are potentially ready for commercial exploitation; nevertheless with a view to develop a sustainable exploitation of the resource it was felt that more scientific data should be collected and made available with a view to better identify the amount and quality of the resources available, namely for the REE, as well as the environmental risks derived from. Given the growing world demand for new mineral resources from the Oceans all legal aspects related to access, environmental protection, preservation are to be put up front to allow Pacific economies to allow for the commercial use of the resource.

A sustainable exploitation of the natural resources from the Oceans calls for a strong political will to complement the R&D efforts by the private sector. Several obstacles - technical, environmental, as well as socio-cultural - are still present. Responsible exploration and exploitation of the sea are taking on new dimensions and considerations. We would need to enhance regulations and legal frameworks that can adequately cover the intricacies and complexities surrounding the protection and sustainable development of marine resources.

Long-term sustainability of the world's marine resources, given the risks, both technical and financial linked to the deep sea exploitation of resources, would require:

- 1) Strong political will on the part of governments;
- 2) Regional and international cooperation;
- 3) New technologies and innovation;
- 4) Shared accountability and ownership between the private and public sectors through PPPs; and
- 5) Better surveillance of the oceans through close cooperation among the owner economies of the resources.

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<sup>17</sup> Mr. John Ballingall, Deputy Chief Executive, New Zealand Institute of Economic Research, Wellington, NZ