日本財団 助成事業
The Nippon Foundation

Proceedings of 2nd International Seminar on Islands and Oceans

November 29, 30, December 1, 2010

Ocean Policy Research Foundation

This publication was carried out under the patronage of
the Nippon Foundation from the proceeds of motorboat racing.

Proceedings of 2nd International Seminar on Islands and Oceans

March 2011

Published by: Ocean Policy Research Foundation
15-16, Toranomon 1-chome, Minato-Ku, Tokyo, 105-0001, Japan
TEL 03-3502-1828 FAX 03-3502-2033
http://www.sof.or.jp E-mail : info@sof.or.jp

ISBN978-4-88404-254-7

Foreword

Today, islands, which are dependent on the sea, are faced with various problems accompanying climate change, such as the increasing intensity of natural disasters, sea level rise and even land submersion. Problems concerned with urbanization and waste management have also been increasing.

United Nations Convention on the Law of the Sea (UNCLOS) recognizes the rights of coastal states over the marine resources in their EEZs, while also assigning to them responsibility for the protection and preservation of the marine environment. Therefore, the management of ocean areas surrounding islands should be conducted in an integrated way, including from the perspective of marine conservation.

Island life and the ocean are closely connected in many ways. Nonetheless, in terms of the responsibility to manage and conserve their surrounding ocean areas, island states have difficulty in fulfilling the task on their own coordination and cooperation by the international community towards solutions with island states are called for.

Based on this understanding, from 2009 OPRF has started a three-year research project entitled 'Management and Conservation of Islands and their Surrounding Ocean Areas'. As a part of this project, OPRF has decided to seek cooperation with the Australian National Centre for Ocean Resources and Security (ANCORS) and the Pacific Islands Applied Geoscience Commission (SOPAC), to host an international seminar to examine issues covering the conservation and management of islands and their surrounding oceans each year.

The purpose of this seminar is to guide and support our three-year research project 'Management and Conservation of Islands and their Surrounding Ocean Areas.' as it progresses and develops. The Seminar is held to address the following three themes:

1) The management and conservation of islands
2) Adverse effects of climate change and variability on islands
3) Island-based management of ocean areas

In the first year, we studied the current issues facing island conservation and marine management in Pacific island states, i.e., carried out fact-findings. Then, in the second year, we have identified the most pressing of these issues and discussed possible solutions. In the third year, based on the results of studies conducted in the previous two years, we will discuss how to address those issues and make policy proposals accordingly. In this second seminar, therefore, we focused on addressing our second year's research agenda, which are the most pressing issues and possible solutions.

On these themes, both Japanese and overseas experts, working on issues of Pacific island states, exchanged research outcomes and opinions and discussed related issues. It is our hope that the seminar provides an ideal platform for cross-disciplinary exchange, encouraging participants to consider island and ocean issues from an integrated perspective and share their understanding, knowledge and expertise, as well as distill and consolidate the issues.

Ocean Policy Research Foundation

Acknowledgement

The 2nd International Seminar on Islands and Oceans was made possible by the generous support of The Nippon Foundation from the proceeds of motorboat racing. We would like to express our sincere gratitude for this support and also acknowledge the Foundation's concern for an understanding of marine and land environmental issues and the life of people living on islands.

Brief Overview

Seminar
2nd International Seminar on Islands and Oceans

Date
November 29, 30, December 1, 2010

Venue
The Nippon Foundation Building (Akasaka, Tokyo, Japan)

Language
English-Japanese simultaneous interpretation

Theme
The '2nd International Seminar on Islands and Oceans' will be held to discuss on 1) Management and conservation of islands, 2) Adverse effects of climate change and variability on islands, 3) Island-based Management of Ocean Areas.

Host
Ocean Policy Research Foundation (OPRF)

Co-Organizers
Australian National Centre for Ocean Resources and Security
(ANCORS, University of Wollongong)
Pacific Islands Applied Geoscience Commission (SOPAC)

Participants

Australia:

Mr. Quentin HANICH
(ANCORS, Senior Fellow)

Prof. Richard KENCHINGTON
(ANCORS, Professor)

Dr. David LEARY
(The University of New South Wales, Senior Research Fellow)

Prof. Rosemary RAYFUSE
(The University of New South Wales, Professor)

Dr. Clive SCHOFIELD
(ANCORS, Director of Research)

Prof. Martin TSAMENYI
(ANCORS, Director)

Fiji:

Ms. Emily ARTACK
(SOPAC, Maritime Boundaries Sector Officer)

Mr. Akuila TAWAKE
(SOPAC, Senior Geologist)
(paper submission only)

Prof. Robin SOUTH
(The University of the South Pacific)
(paper submission only)

New Zealand:

Associate Prof. Paul KENCH
(The University of Auckland, Associate Professor)

Japan:

Prof. Tomoya AKIMICHI
(Research Institute for Humanity and Nature, Professor)

Mr. Wataru ANDO
(Fisheries Infrastructure Development Center, Senior Research Fellow)

Dr. Swadhin K. BEHERA
(Japan Agency for Marine-Earth Science and Technology, Team Leader)

Associate Prof. Tomohiko FUKUSHIMA
(The University of Tokyo, Associate Professor)

Prof. Masahiko ISOBE
(The University of Tokyo, Professor)

Associate Prof. Yasuhiko KAGAMI
(Chubu University, Associate Professor)

Prof. Hajime KAYANNE
(The University of Tokyo, Professor)

Mr. Tadayuki OGAWA
(Japan International Cooperation Agency, Senior Advisor)

Prof. Makoto OMORI
(Akajima Marine Science Laboratory. Tokyo University of Fisheries, Prof. Emeritus)

Prof. Kensaku TAMAKI
(The University of Tokyo, Professor)

Prof. Tetsuo YAMAZAKI
(Osaka Prefecture University, Professor)

Associate Prof. Hiromune YOKOKI
(Ibaraki University, Associate Professor)

Mr. Masahiro AKIYAMA
(OPRF, Chairman)

Mr. Hiroshi TERASHIMA
(OPRF, Executive Director)

Prof. Moritaka HAYASHI
(OPRF. Waseda University, Prof. Emeritus)

Prof. Tadao KURIBAYASHI
(OPRF. Keio University, Prof. Emeritus)

Dr. Nobuyuki MIYAZAKI
(OPRF, Senior Research Fellow)

Mr. Takashi ICHIOKA

(OPRF, General Manager)

Dr. Shizuka KAWATSU
(OPRF, Research Fellow)

Dr. Kazuyuki MAIWA
(OPRF, Research Fellow)

Ms. Hiroko SASAKI
(OPRF, Research Fellow)

Mr. Yoshinori SUGAWARA
(OPRF, General Manager)

Programme

November 29, 2010
Day 1

9:00	**Opening**
9:00-9:10	**Opening Address** Mr. Masahiro AKIYAMA (OPRF, Chairman)
9:10-9:55	**Keynote Speech** Mr. Hiroshi TERASHIMA (OPRF, Executive Director) **Remarks by Co-organizer** Prof. Martin TSAMENYI (ANCORS, Director) Ms. Emily ARTACK (SOPAC, Maritime Boundaries Sector Officer)
9:55-10:15	Coffee Break

Session I

Management and Conservation of Islands

Many Pacific island states are formed from low atolls, which are vulnerable to natural disasters such as cyclones, flood tides, and shoreline erosion. Also it is pointed out that recent changes in residential patterns in those islands have brought about rapid urbanization in certain coastal areas, which has had negative impacts on island environments as well as on the lives of the people. Having noted those social and environmental problems, this session considers both institutional and technical efforts to protect islands, which are exposed to harsh conditions from natural threats, as well as efforts to facilitate natural revitalization capacity. We hope to have discussions on various topics related to the management and conservation of islands, including the preservation and revitalization of coral reefs, an important base for island life, the state and risk of natural disasters, and other issues concerned with the social and natural environment.

Chair: Prof. Hajime KAYANNE (The University of Tokyo)
Co-Chair: Prof. Richard KENCHINGTON (ANCORS)

Presentations

10:15-10:40 Associate Prof. Paul KENCH (The University of Auckland)
'Approaches for Reef Island Shoreline Management'

10:40-11:05 Mr. Tadayuki OGAWA (Japan International Cooperation Agency)
'Promotion of Renewable Energy in Pacific Island Countries'

11:05-11:10 Ms. Emily ARTACK (SOPAC) Introduction of materials
'SOPAC Disaster Reduction Programme'

11:10-11:35 Mr. Wataru ANDO (Fisheries Infrastructure Development Center)
'Technical development of seed production and transplantation of corals by the Fisheries Agency, Japan'

11:35-13:05 Lunch Break

13:05-13:30 Associate Prof. Tomohiko FUKUSHIMA (The University of Tokyo)
'Interdisciplinary Ocean Education for Solving Ocean and Island Problems'

13:30-14:10 Discussion

14:10-14:30 Coffee Break

Session II

Adverse Effects of Climate Change and Variability on Islands

The issue of climate change and its impact on the marine environment was recognized in Agenda 21 and the international community has been discussing the importance of solving global environmental problems and the submersion of islands caused by sea level rise. However, to address the environmental change caused by climate change, typically sea level rise, further discussion and study is needed to understand the ways in which both island states and the international community should collaborate to adapt and mitigate the impact from climate change. This session reviews actual influences of climate change and variability on island states in the Pacific and discusses possible measures to deal with environmental phenomena such as sea level rise. Based on this review, after discussing the responses of island and other states towards the effects of climate change and variability on islands, including sea level rise the session will focus on international cooperation regarding islanders' habitation problems.

Chair: Prof. Martin TSAMENYI (ANCORS)
Co-Chair: Prof. Makoto OMORI (Akajima Marine Science Laboratory)

Presentations

14:30-14:55 Dr. Swadhin K. BEHERA
'Impact of Climate on Coastal Securities of Pacific Islands'

14:55-15:00 Ms. Emily ARTACK (SOPAC) Introduction of materials
'2009 Update Report on the South Pacific Sea Level and Climate Monitoring Project'

15:00-15:05 Prof. Robin SOUTH (The University of the South Pacific) <Contribution by paper>
'Global change and the sustainable management of coral reefs in Fiji, Tonga, Samoa and Tuvalu'

15:05-15:30 Prof. Hajime KAYANNE (The University of Tokyo)
'Response of Pacific islands to sea level rise: an eco-technological trial in Tuvalu'

15:30-15:55 Prof. Richard KENCHINGTON (ANCORS)
'Multi sectoral management approaches to address environmental change, human well-being, and variability in the Pacific Islands Region'

15:55-16:20 Prof. Moritaka HAYASHI (OPRF)
'The Adverse Impacts of Sea-Level Rise on the Rights of Islands and Island States over their Surrounding Sea Areas: Procedural Options for International Legal Measures for Mitigating Impacts'

16:20-17:00 Discussion

18:00-20:00 Reception

November 30, 2010
Day 2

Session III

Island-based Management of Ocean Areas

UNCLOS recognizes the rights of coastal states over the marine resources in their EEZs, while also assigning to them responsibility for the protection and preservation of the marine environment. Due to this recognition, islands scattered across vast, open waters are responsible for managing extensive ocean areas and therefore play important roles as operational stations for regional and international marine management. Based on this recognition, the session will address the state of socio-economic activities developing both on islands and in surrounding ocean areas and the actual state of marine management of those areas. It will also explore ocean management in general based on the relations

between islands and their surrounding ocean.

Chair: Prof. Kensaku TAMAKI (The University of Tokyo)
Co-Chair: Ms. Emily ARTACK (SOPAC)

Presentations

9:00-9:25 Prof. Martin TSAMENYI (ANCORS)
'Evaluation of the Pacific Oceanscape to Manage the Pacific Islands and Ocean Environment'

9:25-9:50 Prof. Rosemary RAYFUSE (The University of New South Wales)
'The Pacific Oceanscape: A Secure Future for Pacific Island Nations based on Ocean Conservation and Management?'

9:50-10:15 Ms. Emily ARTACK (SOPAC)
'The Status and Challenges of Maritime Boundary Development in the Pacific Region'

10:15-10:35 Coffee Break

10:35-11:00 Dr. Clive SCHOFIELD (ANCORS)
'Setting Limits and Boundaries in the Pacific: The Essential Framework for Managing Marine Resources?'

11:00-11:25 Mr. Quentin HANICH (ANCORS)
'Distributing the Conservation Burden Equitably in the Western and Central Pacific Fisheries'

11:25-11:50 Prof. Tomoya AKIMICHI (Research Institute for Humanity and Nature)
'Coastal Resource Management and Governance in Coral Reef Ecosystem'

11:50-13:30 Lunch Break

13:30-13:55 Prof. Kensaku TAMAKI (The University of Tokyo)
'Distribution and its evaluation of deepsea mineral resources in the continental shelf and EEZs of the southwestern Pacific island states'

13:55-14:20 Mr. Akuila TAWAKE (SOPAC) <Contribution by paper>
'The Status and Challenges of the Deep Sea Minerals Industry in the Pacific Islands Region'

14:20-14:45 Prof. Tetsuo YAMAZAKI (Osaka Prefecture University)
'*Approaches for Environmental Impact Assessment of Seafloor Massive Sulfide Mining*'

14:45-15:05 Coffee Break

15:05-15:30 Dr. David LEARY (The University of New South Wales)
'Sustainable management of deep sea mining in the pacific region: Is this an oxymoron?- a lawyers viewpoint'

15:30-15:55 Prof. Tadao KURIBAYASHI (OPRF)
'*Recent Developments in National Legislation on Islands in Japan*'

15:55-16:20 Mr. Hiroshi TERASHIMA (OPRF)
'Management of islands and their surrounding oceans' (Tentative)

16:20-16:50 Discussion

December 1, 2010
Day 3

Session III
Island-based Management of Ocean Areas
(continued)

9:00-9:25 Associate Prof. Yasuhiko KAGAMI (Chubu University)
'Remote islands and the international regime of the protected areas'

9:25-9:50 Dr. Hiromune YOKOKI (Associate Professor, Department of Urban and Civil Engineering, Ibaraki University)
Dr. Daisaku SATO (Department of Urban and Civil Engineering, Ibaraki University)
'Coastal Management for Shore Protection on Atoll Islands'

9:50-10:00 Discussion

10:00-10:15 Coffee Break

10:15-11:15 **Overall discussion**

11:15-11:30 **Break**

11:30-11:45 **Wrapping Up**
Mr. Hiroshi TERASHIMA (OPRF)

11:45-12:00 **Closing Remarks**
Mr. Hiroshi TERASHIMA (OPRF)
Prof. Martin TSAMENYI (ANCORS)
Ms. Emily ARTACK (SOPAC)
Adjourn

12:00-13:30 Lunch

14:00-16:00 Open Forum

Contents

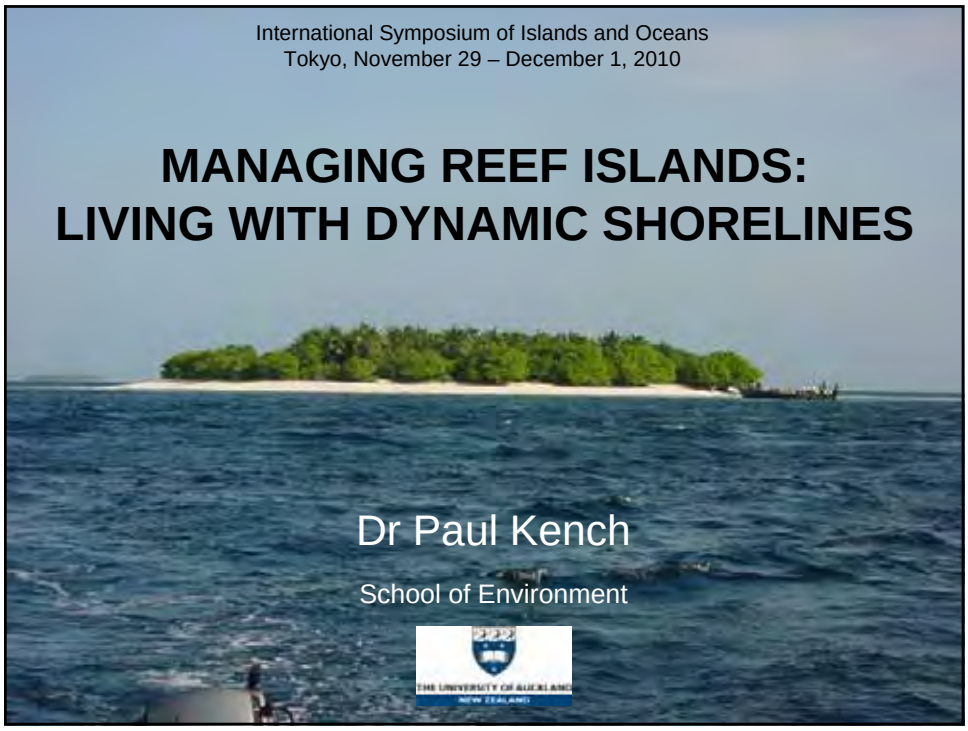
Administration and Editorial Office

Session I

Management and Conservation of Islands

International Symposium of Islands and Oceans
Tokyo, November 29 – December 1, 2010

MANAGING REEF ISLANDS: LIVING WITH DYNAMIC SHORELINES



Dr Paul Kench

School of Environment

1. INTRODUCTION

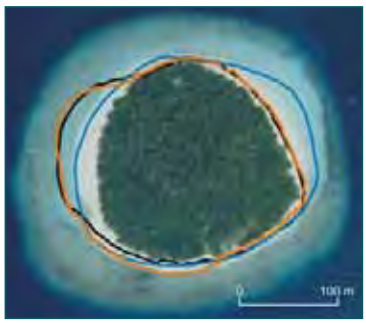
Small Island Dynamics & the Management Dilemma

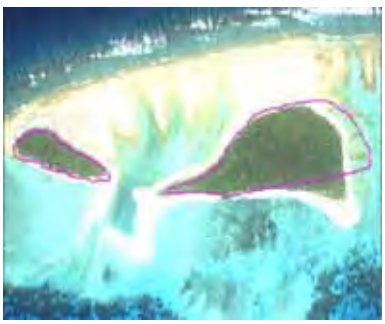
Small islands are dynamic landforms

- In the long-term islands are geologically robust
- In the short-term islands exhibit large physical changes

Major modes of adjustment

A) Instability / Migration



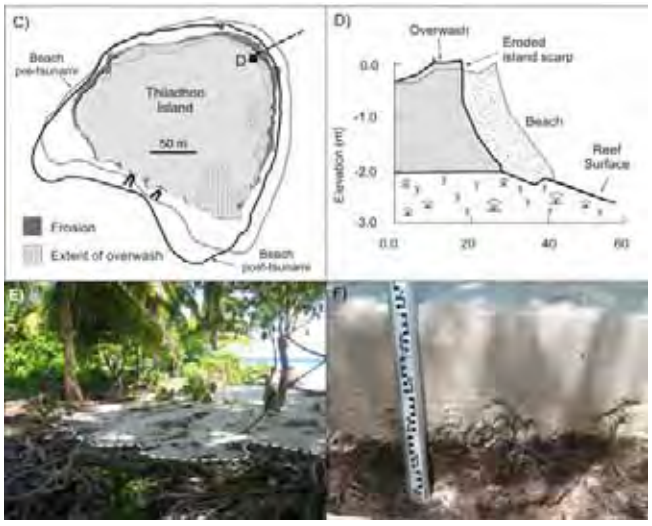


1. INTRODUCTION
Small Island Dynamics & the Management Dilemma

B) Erosion and reduction in island area

1. INTRODUCTION
Small Island Dynamics & the Management Dilemma

C) Vertical building



1. INTRODUCTION
Small Island Dynamics & the Management Dilemma

D) Static - no physical change

1. INTRODUCTION
Small Island Dynamics & the Management Dilemma

- Small island dynamics incompatible with human occupation
- Range of *ad hoc* interventions to protect assets and stabilise shorelines

1. INTRODUCTION

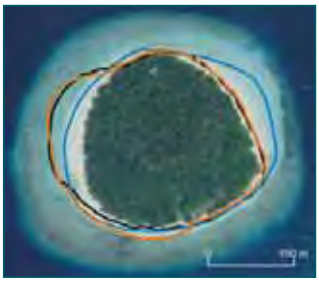
Small Island Dynamics & the Management Dilemma

- Traditional engineering approaches can compromise geomorphic processes and may not be compatible with natural island dynamics:
  - Design & construction
  - High failure rate
  - Do not solve cause of island instability
  - Exacerbate shoreline instability

1. INTRODUCTION

Small Island Dynamics & the Management Dilemma

- A paradigm shift is required that rejects the 'static island' model & tackles the challenge of '**living with island dynamics'**
  - Acknowledges the secret to long-term resilience of islands relies on maintenance of geomorphic processes
  - Safeguards island communities



Objective: To present examples of approaches to live with island dynamics that span different management and planning timescales

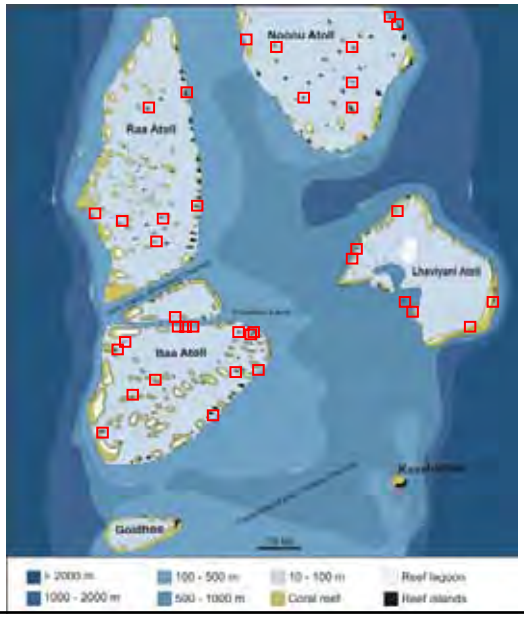
AIM: To Improve Management of Reef Island Shorelines

Approach.....

- Develop process-based understanding of shoreline behaviour:
  - Physical shoreline adjustment
  - Hydrodynamic controls

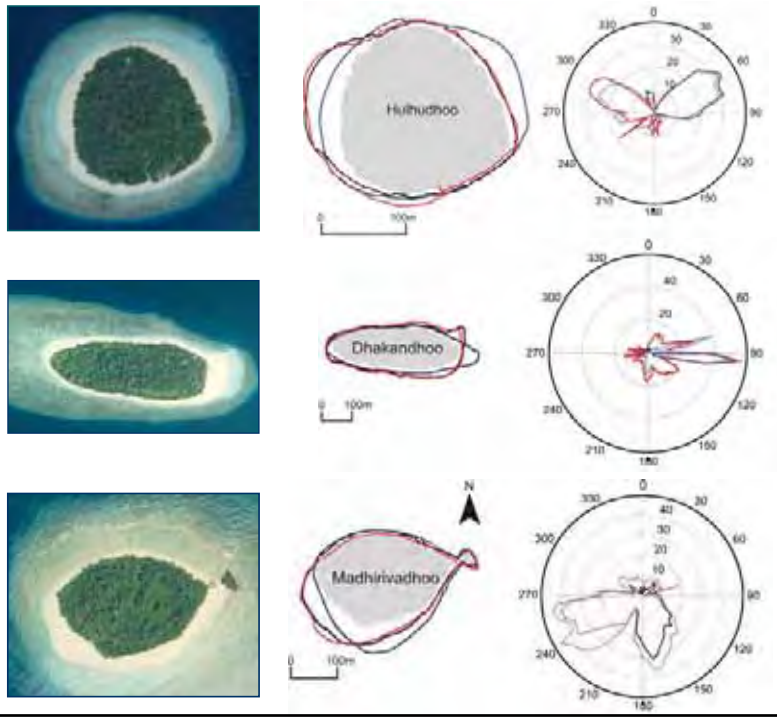
2. LIVING WITH ISLAND DYNAMISM: SHORT TERM APPROACHES
A) The Maldives Environmental Management Project

38 Islands from 4 atolls



2. LIVING WITH ISLAND DYNAMISM: SHORT TERM APPROACHES
A) The Maldives Environmental Management Project

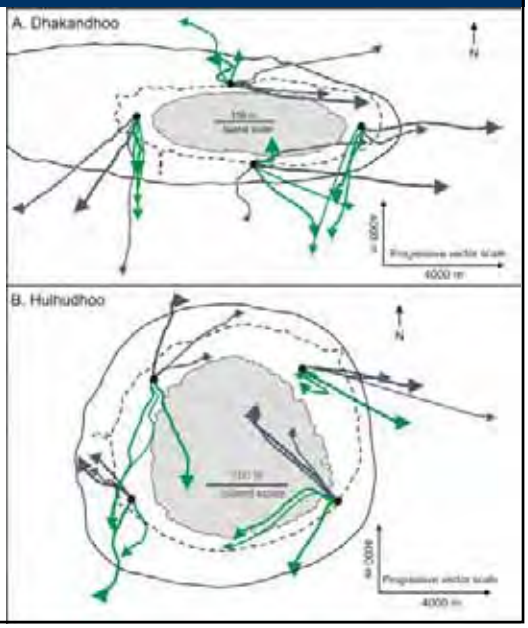
Depict differences in style and magnitude of shoreline change between islands



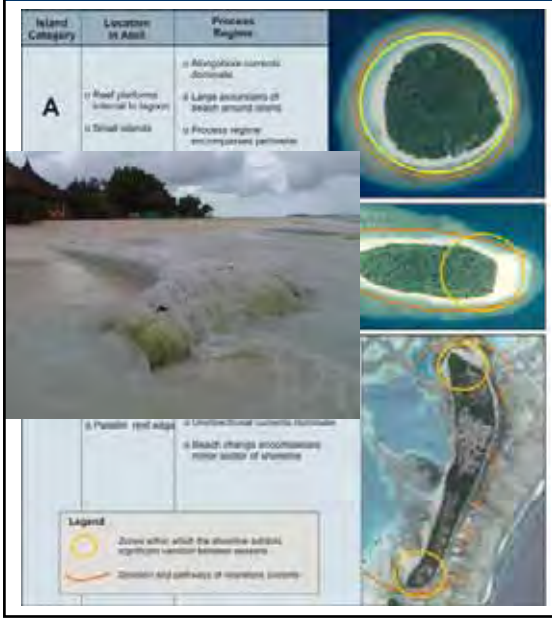
2. LIVING WITH ISLAND DYNAMISM: SHORT TERM APPROACHES
A) The Maldives Environmental Management Project

- Evaluate nearshore current processes that drive shoreline change

Synthesised process characteristics for islands of distinct type



2. LIVING WITH ISLAND DYNAMISM: SHORT TERM APPROACHES
A) The Maldives Environmental Management Project



Planning Guidelines

- Avoid permanent shoreline structures on circular islands
- Harbours must be detached

- Avoid permanent shoreline structures on elongate islands
- Permit temporary shoreline structures outside zone of dynamic shoreline change
- Harbours must be detached

- Avoid permanent shoreline structures in dynamic zones
- Permit shoreline structures outside zone of dynamic shoreline change
- Harbours must be detached

2. LIVING WITH ISLAND DYNAMISM: SHORT TERM APPROACHES
B) Alternatives to Hard Engineering Solutions

Nourishment

- Supplement sediment budget of island shorelines
- Small scale = beach replenishment
- Requires monitoring and maintenance

2. LIVING WITH ISLAND DYNAMISM: SHORT TERM APPROACHES
B) Alternatives to Hard Engineering Solutions

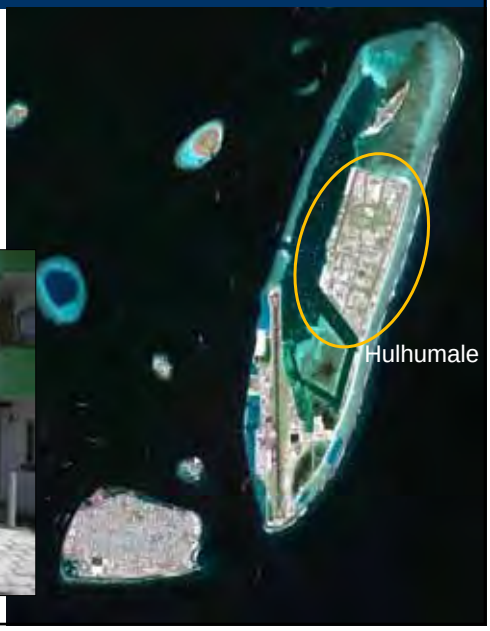
Nourishment

- Large scale reclamation

2. LIVING WITH ISLAND DYNAMISM: SHORT TERM APPROACHES
B) Alternatives to Hard Engineering Solutions

Nourishment

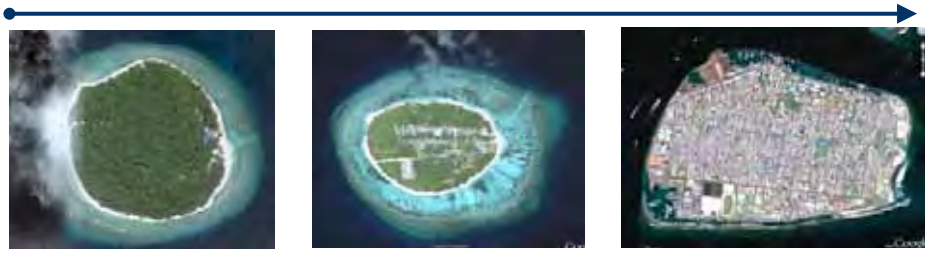
- Thinking big.....island construction



2. LIVING WITH ISLAND DYNAMISM: SHORT TERM APPROACHES
C) Alternatives to Hard Engineering Solutions - Relocation

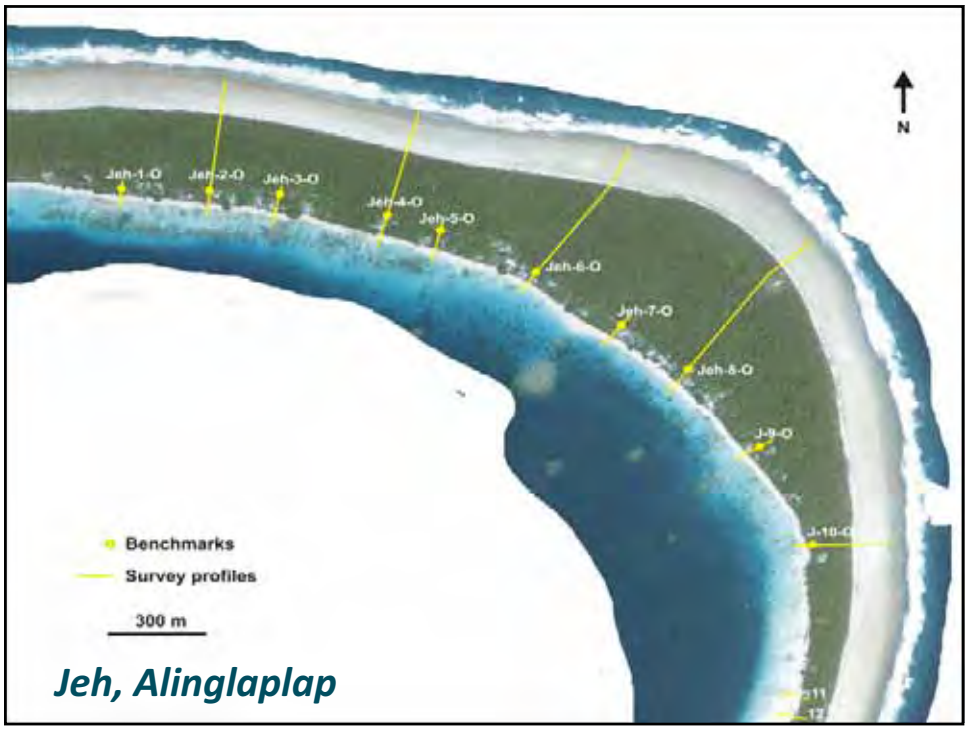
3. LIVING WITH ISLAND DYNAMISM: MEDIUM TERM APPROACHES
Planning: Resolving Spatial Variability

- 1000's of islands – they are not homogenous
- Identify Islands most and least stable



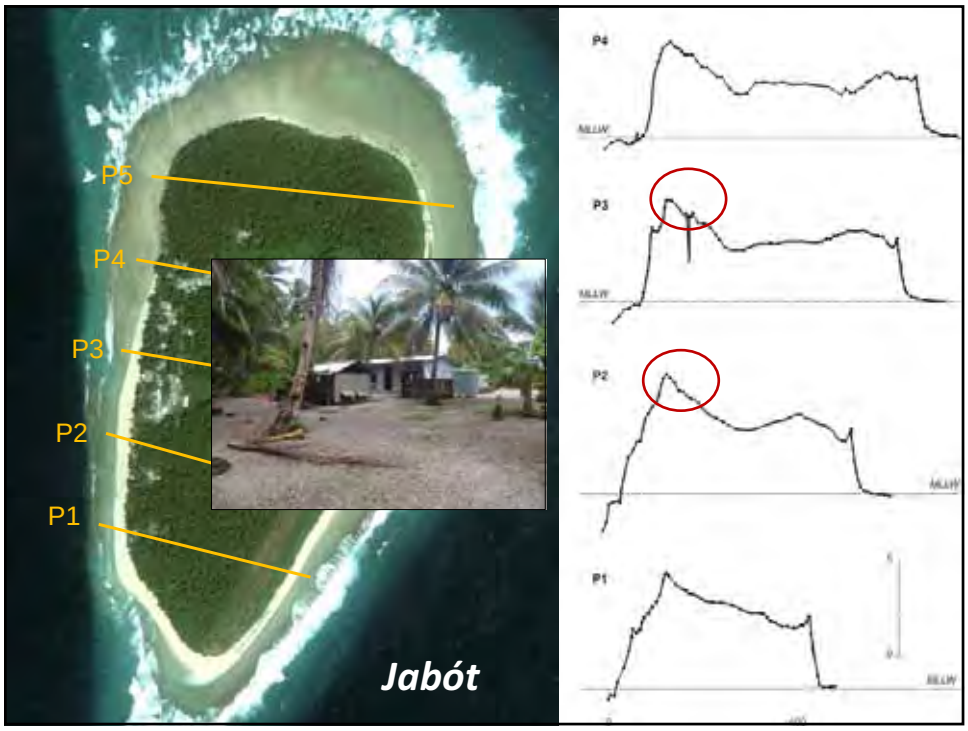
3. LIVING WITH ISLAND DYNAMISM: MEDIUM TERM APPROACHES
Planning: Resolving Spatial Variability

Marshall Islands:
a study of two islands



3. LIVING WITH ISLAND DYNAMISM: MEDIUM TERM APPROACHES

Planning: Resolving Spatial Variability



3. LIVING WITH ISLAND DYNAMISM: MEDIUM TERM APPROACHES

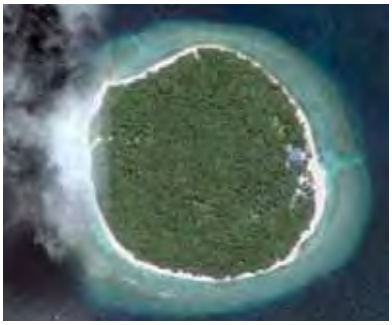
Planning: A Dual-Focussed Approach

1A. Consolidation of major assets and infrastructure on **Urban islands** with compromised natural processes.....OR

3. LIVING WITH ISLAND DYNAMISM: MEDIUM TERM APPROACHES
Planning: A Dual-Focussed Approach

1B. Consolidation of future development on **stable islands**.

The Maldivian Government are currently focussing on regional centres.



3. LIVING WITH ISLAND DYNAMISM: MEDIUM TERM APPROACHES
Planning: A Dual-Focussed Approach

2. Smaller Rural & Non-Inhabited Islands

- A flexible approach that promotes relocation between islands at centennial timescales (50-100 yrs)
- Places an emphasis on understanding natural island dynamics

3. LIVING WITH ISLAND DYNAMISM: MEDIUM TERM APPROACHES
Planning: A Dual-Focussed Approach

- Island migration is not uncommon and has been triggered by:
  - Storm events/tsunami
  - Food and water shortage
  - Epidemics
  - Politics

4. CONCLUSIONS

1. There are alternatives to the conventional management paradigm of static islands
2. Living with island dynamics requires a robust understanding of spatial and temporal variability in island characteristics and island change
3. A range of management approaches are possible that include:
   - More targeted use of appropriate engineering designs
   - Alternatives to hard engineering solutions
   - Planning that reflects island dynamics
4. The major constraint is the capacity of existing management agencies and planning processes to embrace change

The Kiribati Adaption Project – Phase II
Improving the Protection of Public Assets

The Kiribati Adaption Project – Phase II
Improving the Protection of Public Assets

Promotion of Renewable Energy in Pacific Island Countries

Tadayuki OGAWA（Japan International Cooperation Agency）

1. Abstract

In general, Pacific Island Countries (PICs) heavily depend on imported fossil fuel for energy supply and transportation. Therefore, vulnerable energy security has been observed due to the availability and cost fluctuation of fossil fuel. The situation is even worse for small remote islands where the cost of energy supply is higher than major islands. In order to overcome the situation, most PICs are trying to promote and disseminate Renewable Energy (RE) as an option for energy supply. In a global perspective, RE is expected to contribute up to the share of 17% to reduce CO2 emissions by 50% in 2050, according to the International Energy Agency. This paper introduces some promising RE technologies which could be further introduced in PICs. Solar Photovoltaic (PV) and solar thermal technologies are already introduced in many PICs, whereas hydro, biomass, wind and geothermal technologies are limited due to geographic condition and resource distribution. In order to promote RE furthermore, long-term development plan indicating priority project sites for each RE technology is necessary. In addition, fiscal incentive measures and institutional capacity development for energy ministry and/or utility company will be required.

2. Current situation of energy supply and demand in PICs

This section briefly outlines current issue of energy supply and demand in PICs.

Most PICs heavily depend on imported fossil fuel for energy supply as well as transportation. Table-1 shows energy consumption by each resources, and percentage of oil and biomass.

Table-1　　Overview and Breakdown of Energy Consumption

Country	Year	Energy Use in kTOE				Percentage of :	
		Oil	Biomass	Hydro	Solar	Oil	Biomass
Cook Islands	2003	9.4	0.8	0	N/A	92	8
Federated States of Micronesia	2002	73	12	0	N/A	86	14
Fiji	2000	298	N/A	113.5	low	N/A	N/A
Kiribati	2003	16.2	3.9	0	0.1	80	20
Marshall Islands	2003	81.8	7.6	0	N/A	91	9
Nauru	2003	15	0	0	0	100	0
Niue	2002	2.3	low	0	0	100	0
Palau	2003	93.6	~0	0	N/A	100	0
Papua New Guinea	2001	493	947	80	25	32	61
Samoa	2003	73.2	73	N/A	N/A	50	50
Solomon Islands	2001/2	68.4	109.8	1.8	N/A	38	61
Tokelau	2003	0.34	0	0	N/A	100	0
Tonga	2000	34.2	20.3	0	low	62	37
Tuvalu	2003	3.4	N/A	0	N/A	90	10
Vanuatu	2003	37	37	low		50	50
Source: Pacific Islands Renewable Energy Project (2004)							

We can observe that dependency on oil is extremely high in Cook Islands, Marshall Islands, Nauru, Niue, Palau, Tokelau and Tuvalu. In order to evaluate energy demand per capita,

following Figure-1 shows petroleum import and Green House Gas emission per capita. Significant differences are acknowledged among PICs. Palau is by far the largest, followed by Marshall Islands, Nauru and Niue. Therefore, those countries are considered to be the possible candidates for improving energy supply situation through introduction of Renewable Energy.

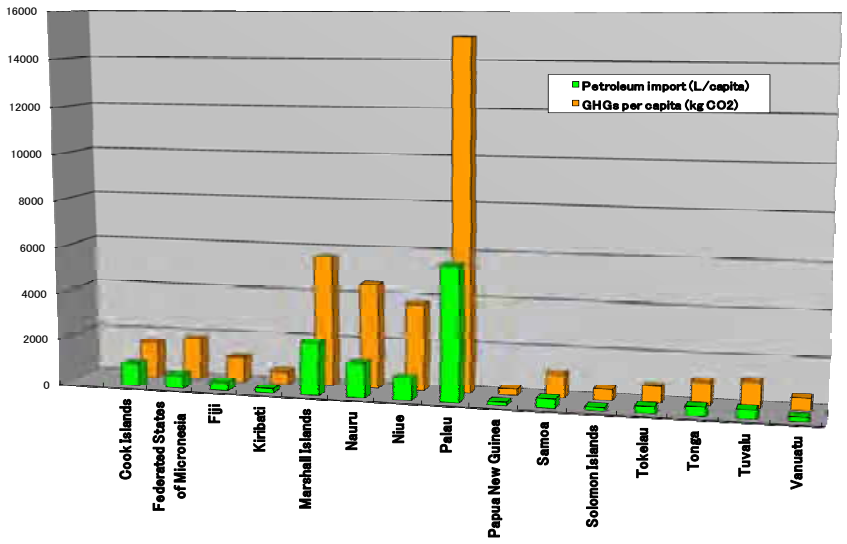
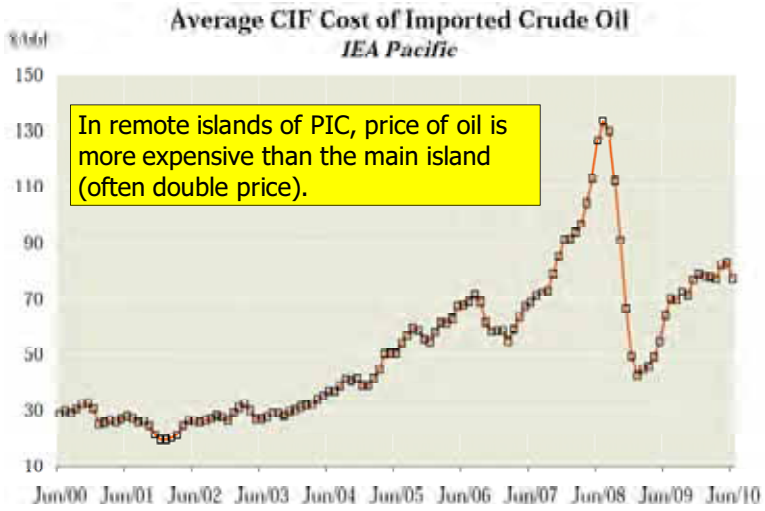


Figure-1　Overview and Breakdown of Energy Consumption

For countries mentioned above in general, the situation of energy security is very vulnerable, due to limited storage of fossil fuel and long supply chain from oil-producing countries with high transportation cost. Figure-2 shows the historical trend of average CIF cost of imported crude oil in the region. It shall be noted that the oil price for remote islands will be much more expensive than the capital island, often double the price.



Source: International Energy Agency

Figure-2　Average CIF Cost of Imported Crude Oil

As for power supply, electricity is available only in major islands, because marginal cost of supplying small remote islands is too high to be covered by electricity payment from consumers. Therefore, 70% of population in the region doesn't have access to electricity.

Table-2 Overview and Breakdown of Energy Consumption

Country	Year	Population	Percent of households with access to electricity
Cook Islands	2004	18,000	99%
Federated States of Micronesia	2000	107,000	54%
Fiji	1996	844,000	67%
Kiribati	1993	85,000	29%
Marshall Islands	1999	54,600	63%
Nauru	2002	10,100	100%
Niue	2003	1,700	100%
Palau	2004	19,100	97%
Papua New Guinea	2003	5,200,000	less than 10%
Samoa	2001	176,100	93%
Solomon Islands	1999	457,000	16%
Tokelau	2003	1,500	100%
Tonga	1999	100,000	80%
Tuvalu	2003	9,300	more than 95%
Vanuatu	1999	212,000	19%
Total		7,295,400	78%
Source: SOPAC (2007)			

Also I would like to emphasize that human and institutional capacity is very limited especially in rural communities. It is observed that only a few officers working for Ministries and/or utilities have good educational and vocational background and experience. In addition, many those staff tends to work abroad, such as Australia and New Zealand once they acquire enough academic and career experience. Another issue is environmental damage caused through conventional energy supply which includes habitat loss for flora and fauna and pollution of ocean and air.

In the last part of this section, several pictures are referred to introduce the general conditions of power supply in PICs. Figure-3 shows a diesel engine generator in Marakal Island of Palau. In many PICs, electric power is primarily supplied by similar diesel engine generators. However, the capacity of generators is not enough to meet growing power demand in many countries.

Figure-3　Diesel Engine Generator (DEG) in Palau

This picture shows the emergency diesel generators installed in Federated States of Micronesia (FSM). Unfortunately, now the generators cannot run due to improper maintenance by the operation staff. Also there are many cases where generators have not been operated for a long time due to high fuel cost.

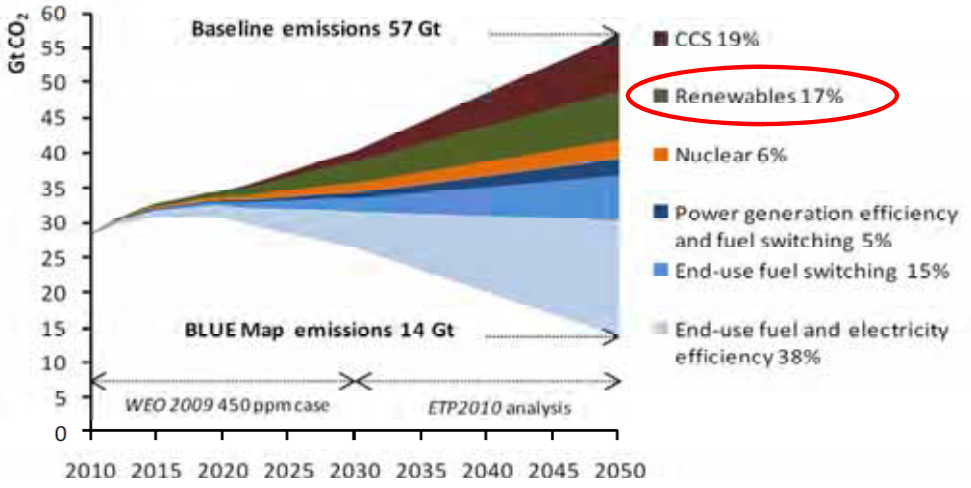
Figure-4　Emergency Diesel Engine Generator (DEG) in FSM

Also, transformers and other electrical equipment need periodical maintenance. However, sometimes they are not well maintained and the reliability and quality of power supply is not good enough.

Figure-5　Substation Transformer in FSM

3. General issue of disseminating Renewable Energy (RE) around the world

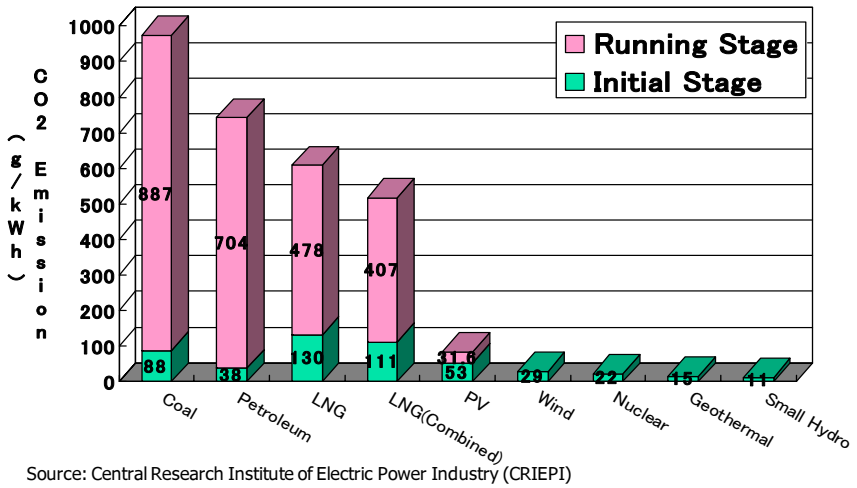
In this section, general issue and trend of disseminating Renewable Energy (RE) around the world are introduced. According to International Energy Agency (IEA), 17% of global GHG emission will have to be reduced through introduction of RE in year 2050. In this BLUE Map scenario, we can achieve 50% reduction of global CO2 emission by 2050.



Source: International Energy Agency

Figure-6　Combination of Technologies and Countermeasures

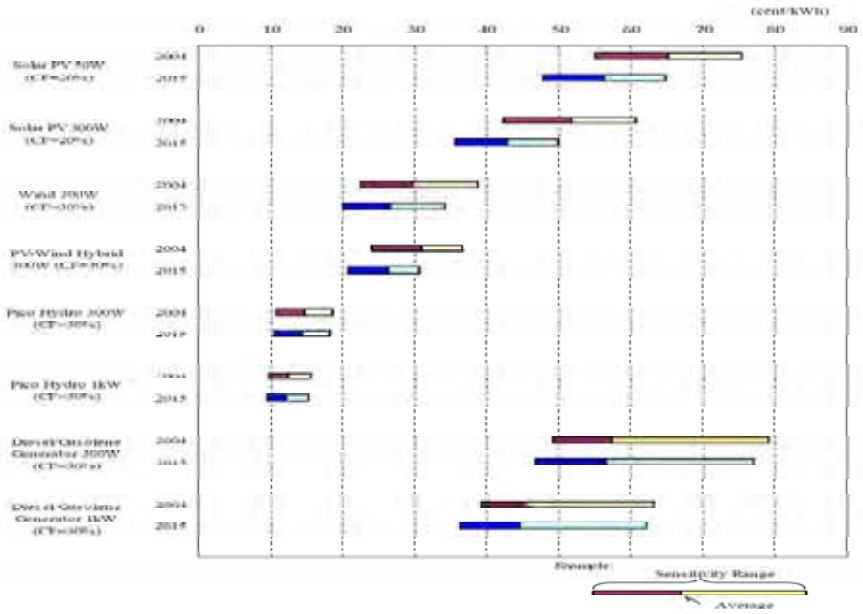
If we compare CO_2 emission for different sources of power generation, emissions through RE such as solar photovoltaic (PV), wind, hydro, geothermal are much lower than conventional fossil fuels. In general, CO_2 emission from coal-fired thermal power plants is among the highest. Thus recently Research and Development is rapidly on-going for newly developed technologies including Integrated coal Gasification Combined Cycle (IGCC) and Ultra-Super Critical (USC) steam condition in order to improve thermal efficiency as well as reducing SOx and NOx emission.



Source: Central Research Institute of Electric Power Industry (CRIEPI)

Figure-7 CO_2 Emission by Power Generation Facilities

Then why Renewable Energy has not been introduced in a large scale so far? Of course the biggest obstacle is higher initial investment compared with conventional fossil fuel resources. If you compare initial capital cost of different off-grid technologies, you can find that the unit cost of solar PV is much higher than other Renewable Energy. However, we have to compare life-cycle cost of each generation option instead of initial investment. If there is a gap between initial capital cost and available fund, some incentive measures have to be considered to go for options with smaller life-cycle cost. In Germany and Spain, the incentive scheme called Feed-in-Tariff has been introduced to promote PV system. In PICs where the price of electricity is higher, RE technology could compete with conventional energy sources with proper incentive scheme for RE.



Source: World Bank (2007)

Figure-8 Capital Cost Range of Renewable Energy Technologies (Off-grid)

4. Expected technology options for RE in PICs

This section presents potential renewable energy resources available in PICs. Please note that Solar Photovoltaic (PV), Solar Thermal and Biomass are available in most PICs. On the other hand, resources for hydro, wind and geothermal are limited in larger terrain countries, such as Fiji, PNG, Solomon, Vanuatu, FSM and Samoa.

(1) Solar Photovoltaic (PV)

PV was first introduced in PICs for telecommunication systems in 1970s.

After that, independent PV systems which are not connected to utility grid have been installed as a measure for village electrification in small islands such as Solar Home System (SHS), public facilities. Figure-9 shows the typical composition of solar home system or SHS. PV Modules generate power, which will be stored in storage battery and supply electrical appliances such as lighting, radio and TV.

Many SHSs have been installed in PICs and in the world, but unfortunately many of them are not in operation. The system configuration looks rather simple, which might lead to improper design, operation & maintenance of the system.

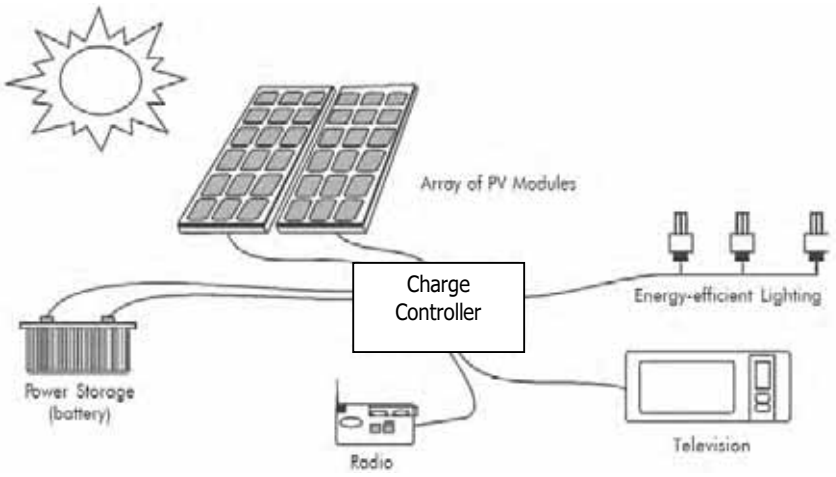


Figure-9 Typical Composition of Solar Home System (SHS)

In addition to the above-mentioned isolated system, large-scale grid-connected PV systems are gradually introduced recently.

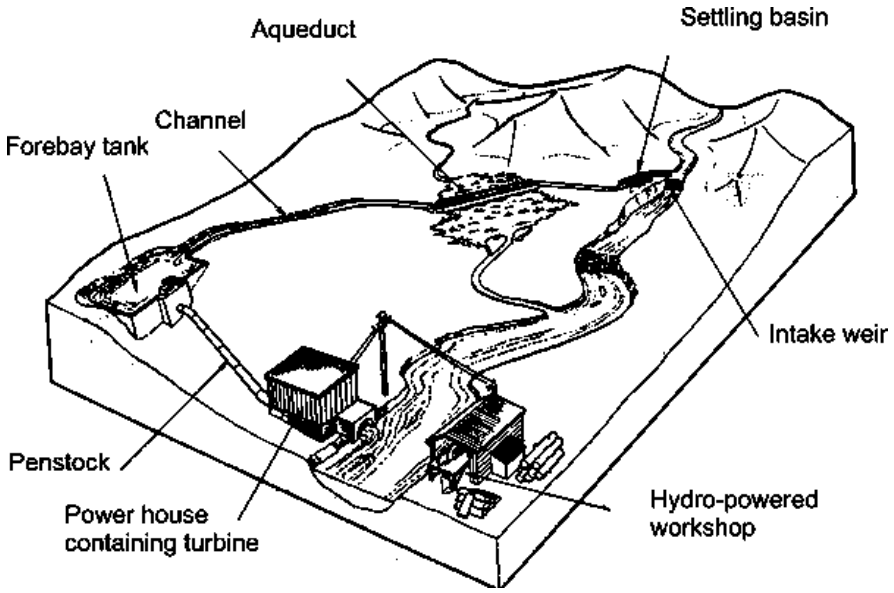
(2) Solar Thermal

The second option of Renewable Energy is solar thermal. Solar Thermal technology has primarily been applied for solar water heating and crop drying. Domestic solar water heaters have been manufactured in Tonga, Fiji and PNG. However, since piped hot water is not so widely disseminated in PIC houses, more opportunities are expected for tourist facilities and other commercial facilities.

(3) Hydro

The third option of Renewable Energy is hydro. Potential sites are located only in larger mountainous countries such as Fiji, PNG, Solomon, Vanuatu, FSM and Samoa. Most potential sites are located in remote areas which makes them economically unattractive. Distinctive flow rate between rainy and dry seasons makes it difficult to supply stable power throughout a year.

Figure-10 shows typical configuration of run-of-the-river type hydro power station. Water is diverted from intake which will lead to settling basin, aqueduct, channel, forebay tank, penstock, and power house.
The power is generated at the power house, and water is discharged to the mainstream of the river.



Source: howtopedia.org

Figure-10 Typical Construction of Small Hydro Power Station

(4) Biomass

The fourth option of Renewable Energy is biomass. In this paper I will focus on liquid biofuel, which is the most promising option for biomass energy. In PIC region, only Fiji and Vanuatu have significant activities for large-scale introduction of biofuel. Refined vegetable oil (coconut, palm, and jathropha) has significant potential to replace diesel fuel for power generation in remote islands where the cost of diesel is higher. However, additional cost is required to modify engines (heaters, injectors, pistons, etc.)
The production of biodiesel from vegetable oil possibly leads to reduce imported diesel fuel

in transport sector. On the other hand, such import-substitution might reduce government revenue from taxes and customs duties on imported fossil fuels.

In many PICs, experiment to replace diesel oil with coconut oil has already been conducted. The energy produced from coconut oil is a little bit smaller than diesel fuel, but it is generally enough to replace diesel fuel. It is important to evaluate the cost of operating the coconut oil expeller including labor when comparing the cost with the conventional fossil fuel.

(5) Wind

The fifth option of Renewable Energy is wind. Generally speaking, wind energy resources are located in higher latitude area of South Pacific in PICs.

However, there are several difficulties to introduce wind turbine in the region. First, pacific wind resource tends to be seasonal and variable so wind power supply cannot be stable. Therefore, combination with grid power (stable supply) or storage battery is required.

Second, manufactures are shifting to large-scale wind turbine (2-3MW or larger) to achieve higher efficiency. As a result, for small island countries, size of power generation is too big to absorb fluctuation of frequency and voltage.

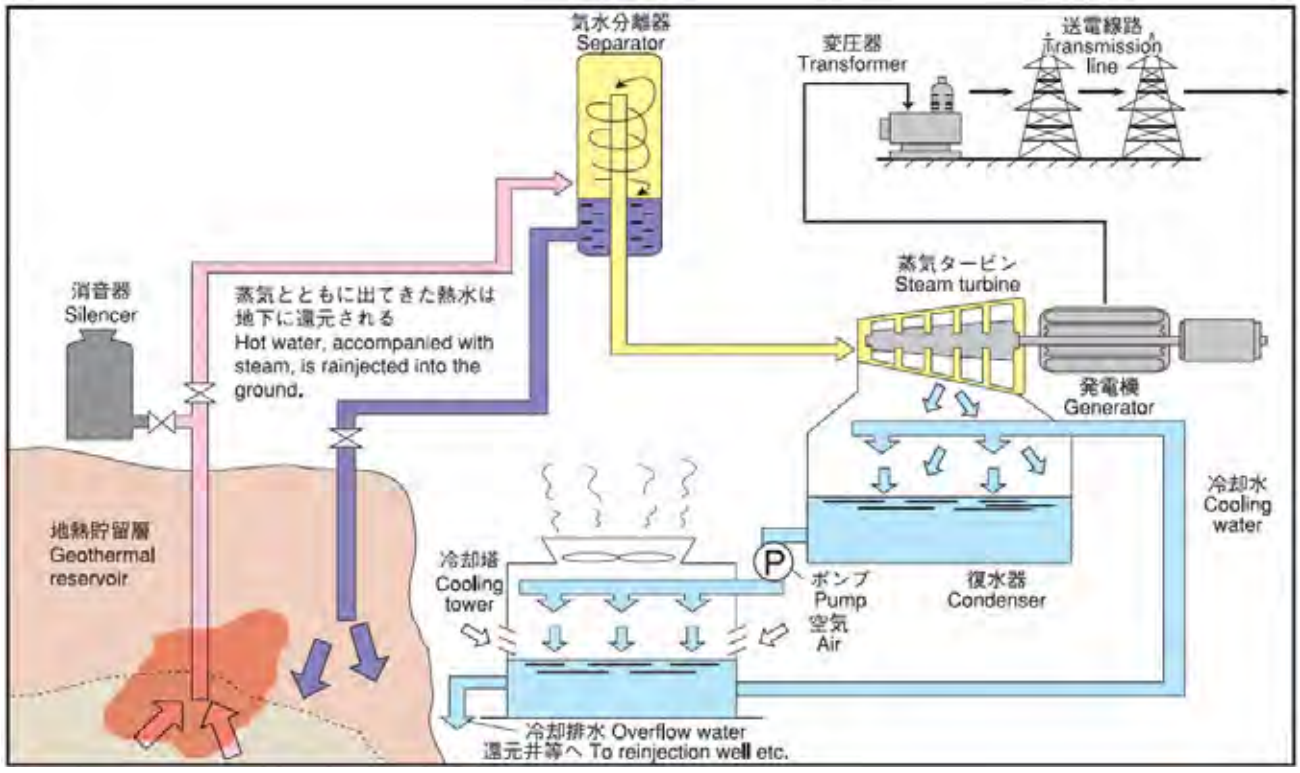
One of the biggest problems to install big wind turbine is that the region is frequently hit by large-scale cyclones. The wind turbine mast shall be high enough to receive the wind energy large enough to generate stable power throughout a year. It means that the wind turbine masts are sometimes hit by strong wind, which might cause to fall down the masts. In order to avoid this problem, some wind turbine manufactures developed the tiltable wind turbine as shown in Figure-11. Another advantage of this product is it can be transported and installed without heavy vehicle.

Figure-11 Tiltable Wind Turbine

(6) Geothermal

The last option of Renewable Energy is geothermal. Only PNG has an operating geothermal facility in the region. In PNG, Total Generation Capacity is 56MW, which meets 75% of island's power demand. In general, Long-term stable output of steam shall be examined for each project site. And financing arrangement for the Feasibility Study to confirm the development potential is the biggest obstacle.

Figure-12 shows schematic diagram of geothermal power generation system. Steam is separated at the separator from geothermal fluid. This steam is lead to steam turbine, and rotate synchronous generator. After passing through the steam turbine, low temperature steam is converted into water in a condenser and drained. The hot water accompanied with steam is reinjected into the ground. This type of geothermal power generation is called single flash type. Binary type power generation uses working liquid which has lower boiling point to use low temperature steam for power generation.



Source: New Energy and Industrial Technology Department Organization (NEDO)

Figure-12 Schematic Diagram of Geothermal Power Generation

5. Possible policy measures to promote RE in PICs

In conclusion, I would like to propose several possible policy measures to promote renewable energy as follows. First of all, Long-term development plan is necessary with priority project sites for each RE technology. The next issue is that RE cannot compete with

conventional fossil fuel technology without fiscal incentive measures (subsidy, tax, import duties, etc.). And finally, institutional capacity development for energy ministry and/or utility company is necessary for planning and designing of RE projects (especially off-grid), since they tend to depend on external consultants who are not familiar with socio-economic conditions in PICs.

Technical development of seed production and transplantation of corals by the Fisheries Agency, Japan

Wataru. Ando [w-ando@fidec.or.jp], Ryota. Nakamura [r-nakamura@fidec.or.jp]
Fisheries Infrastructure Development Center
Hidekazu. Yamamoto [hyamamoto@ecoh.co.jp]
ECOH Corporation

Abstract

Coral reef is not only the richest example of biodiversity in the sea, but it's also one of the most economically important ecologies and an irreplaceable asset of mankind. However, coral reefs have been seriously degraded by various factors such as climate change. This problem is serious for the fishery in coral reef. Therefore, the development of restoration techniques to increase coral colonies is indeed necessary. Past attempts to restore coral communities have mainly used transplanted coral fragments. Trials on transplantation of fragmented coral have been conducted in many countries as means of restoring the depleted coral colonies. However, this method would not only wound the coral colonies but also affects the ecosystem of the coral reefs where large quantities of fragments are taken for restoration purposes. On the other hand, juvenile corals can be produced by sexual reproduction in the laboratory. As a large number of eggs and sperm released from the broodstock are used in this technique, mass-culture of coral juveniles is possible. Also genetic diversity of the sexual method is higher than that of the asexual one. The Fisheries Agency of Japan started a project of coral propagation, in 2006. This project has the objective of developing practical sexual reproduction techniques for rehabilitation of coral reefs. Okinotorishima was chosen as the target site of coral propagation. The island is the southernmost Japanese territory where is located about 1,740km far from Tokyo. The goals of the project are to develop a series of methodology as follows,

1) Production of juvenile corals from eggs in land tanks.
2) Long-term maintenance for juvenile corals and long distance transportation.
3) Transplanting cultured juvenile corals back to the native, remote coral reef.

We produced approximately 63,000 colonies of 1 year old juvenile corals, which were attached on 564 artificial substrates (ceramic tiles), with the eggs spawned in June 2007. They were transplanted to the native Okinotorishima in May 2008, and have been monitored so far.

Keywords: Coral reefs, Restoration, Fishery, Okinotorishima island

Coral Habitat Expansion Project

Okinotorishima Island is the southernmost island of Japanese territory, located 1,740 kilometers (1,060 miles) south-southwest of Tokyo. The island is an isolated table reef, east-west 4 kilometers and north-south 1.7 kilometers. Around the island, corals certainly play an important role in ecological system. However, coral reefs are decreasing due to environmental deterioration. Therefore, Fisheries Agency of Japan started the Coral Habitat Expansion Project around the island in 2006. This project develops methods to maintain and increase coral ecosystems around the island.

We have researched the growing condition and natural environment of corals around the island. We brought up juvenile corals from eggs, and eventually transplanted 63,000 juvenile corals to the island.

Fig.1 Okinotorishima Island

The project flow is shown in Fig.2. The main techniques are as follows.

1) Production of juvenile corals from eggs in land tanks.

2) Long-term maintenance for juvenile corals and long distance transportation.

3) Transplanting cultured juvenile corals back to the native, remote coral reef.

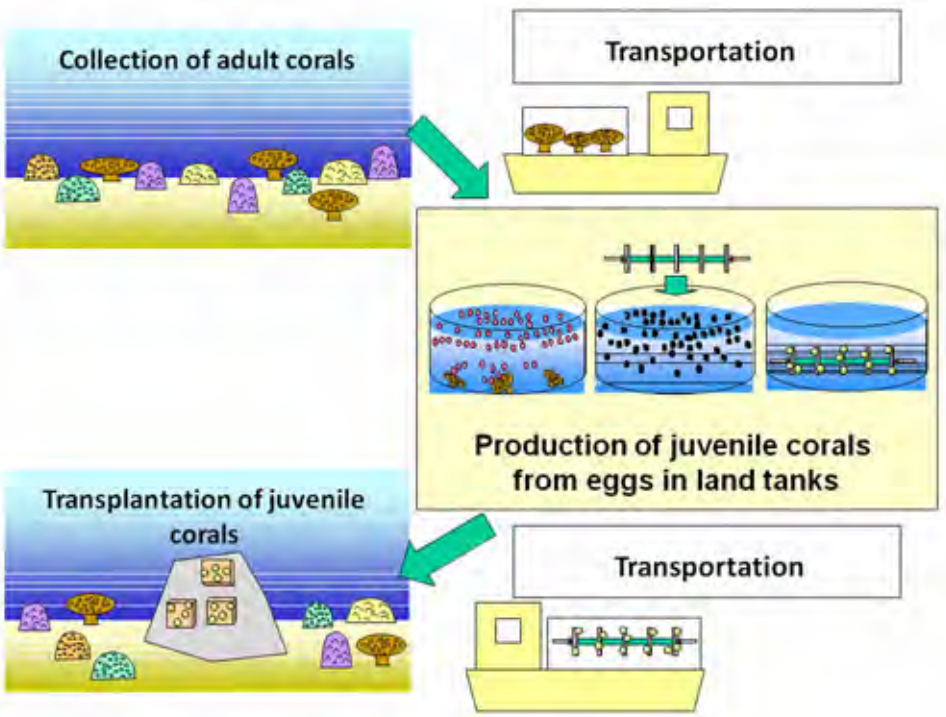


Fig.2 Outline of the project

We collected 45 colonies of 3 species of *Acropora* as mother corals and tranpoted from Okinotorishima Island to Akajima Coral Hatchery in Okinawa (Fig. 3) in the period between May 2006 and May 2007.

Fig.3 Akajima Coral Hatchery in Okinawa

From June to August 2007, most of mother coral colonies spawned in the tanks. Seed production was carried out using those eggs spawned. In *Acropora tenuis*, which was one of the spices collected as the mother coral, the best results of seed production was achieved as follows:

Approximately 111,000 larvae settled on the substrates. Those juveniles were reared in land tanks for about 10 months. Herbivorous snails and fish were stocked with the juvenile corals for the algae extermination. The survival rate of the juveniles was over 80 % in three months, and around 60% in ten months after spawning. We achieved this high survival rate of the juvenile corals, and believe that the technology of coral spawning and seed production in land tanks has been almost successfully developed.

We transported and transplanted the substrates with approximately 63,000 juveniles of *A. tenuis* to knolls (patch reefs) in the reef of Okinotorishima Island in May 2008 (Fig. 5). Some coral colonies were covered with basket for preventing from the fish feeding (Fig. 6).

We have monitored the transplanted corals to grasp survival and growth of the transplanted corals so far. In the most recent research in May 2010, the mean coverage of the juveniles protected with the baskets were 4 times higher than initial one. Meanwhile, the coverage of the juveniles without the baskets also have increased slightly since decreased in the early period of 8 months after transplantation.

Photo : THE SANKEI SHIMBUN

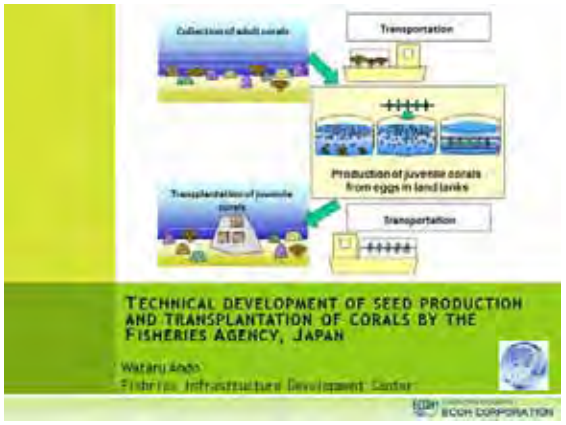
Fig.4 Juvenile corals in land tanks

Fig.5 Transplantation of substrates with juvenile coral colonies

Fig.6 Monitoring research of transplanted corals

Conclusion

From the site surveys at Okinotorishima Island, the present condition of coral distribution and coverage and environmental conditions surrounding those corals are almost understood. These information will be utilized to monitor the future change of the coral reefs as well as to evaluate the effectiveness of our transplantation activities. At present, we are still trying to improve the techniques of seed production and tranplantation of coral juveniles. We expect that these techniques will works practically to increase coral coverage on Okinotorishima Island in the near future, and will be applied for recovery of coral reefs worldwide.



TECHNICAL DEVELOPMENT OF SEED PRODUCTION AND TRANSPLANTATION OF CORALS BY THE FISHERIES AGENCY, JAPAN

Wataru Ando
Fisheries Infrastructure Development Center
EDAC CORPORATION

RESTORATION OF CORAL REEFS TECHNIQUES

1980～	Transplantation of fragments corals
1990～	Artificial substrate for coral transplantation
1996	Production of juvenile corals from eggs (AMSL)

PERFORMANCE OF CORALS TRANSPLANTED

category	Nr	Number of the colonies (year)	Survival rate (%)
	1	206	46
	2	250	?
	3	2,000	?
	4	520	?
	1	5,400(block)	?
(natural)	2	2,000～5,000	5(1year)
(natural)	AMSL		89(6month)
	F.A	65,000	60 (1year)

Change of coral coverage around Okinawa main island during the period from 1972-2000

TOTAL COMMERCIAL CATCH OF FISH IN CORAL REEFS

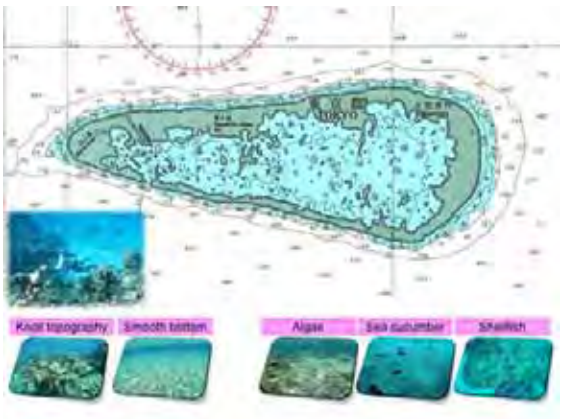
OBJECTIVES OF THIS PROJECT

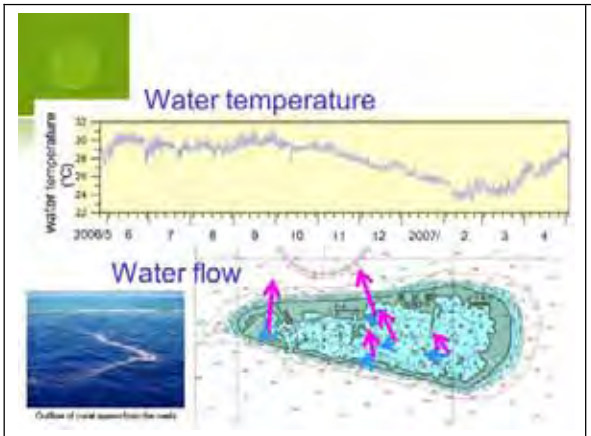
1) Production of juvenile corals from eggs in land tanks.
2) Long-term maintenance for Juvenile corals and long distance transportation.
3) Transplanting cultured juvenile corals back to the native, remote coral reef.

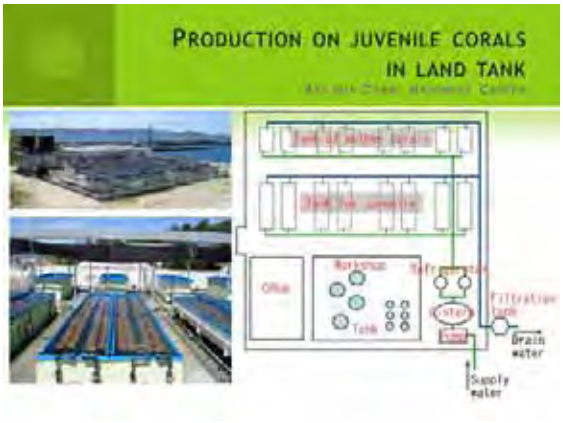
STUDY SITE

Akajima Coral Hatchery , Okinawa

Okinotorishima Island

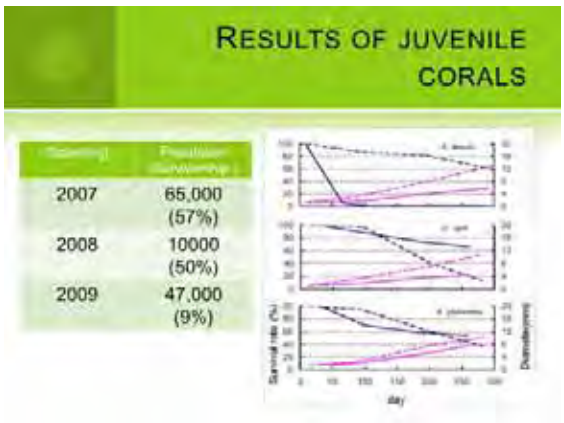



Water temperature
Water temperature (℃)
2006/5 6 7 8 9 10 11 12 2007/ 2 3 4
Water flow


PRODUCTION ON JUVENILE CORALS IN LAND TANK
Office
Filtration tank
Drain water
Supply water


COLLECT MOTHER CORALS
Okinotorishima
A. tenuis
A. sp4?
A. globiceps?
Okinawa
A. humilis
A. hyacinthus
P. damicornis
P. pellida
A. formosa

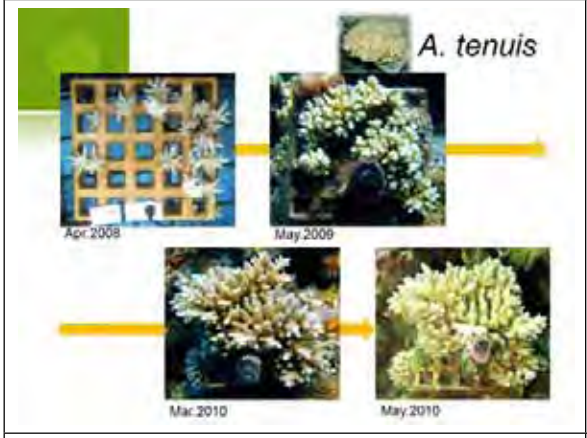

PRODUCTION ON JUVENILE CORALS (PROPAGULES) IN LAND TANK
A. tenuis
1month
3month
10month
14month
17month
Unglazed ceramic substrates (12 cm long x 12 cm wide x 2.5 cm thick)

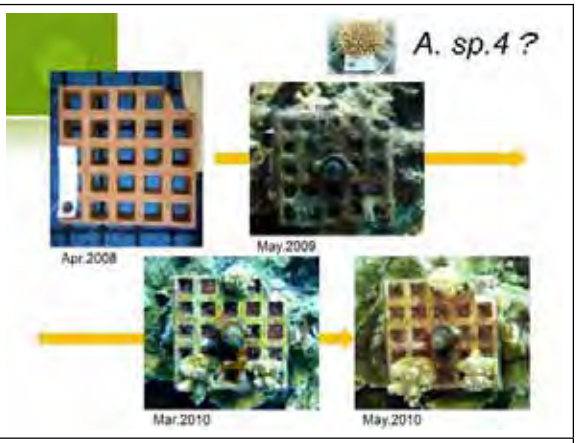

RESULTS OF JUVENILE CORALS
2007 65,000 (57%)
2008 10000 (50%)
2009 47,000 (9%)
day

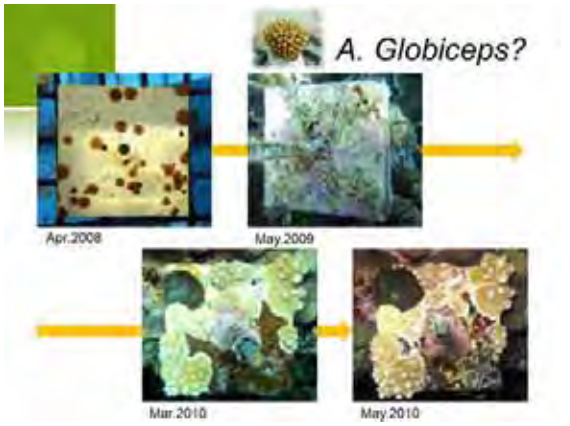

SUBSTRATES

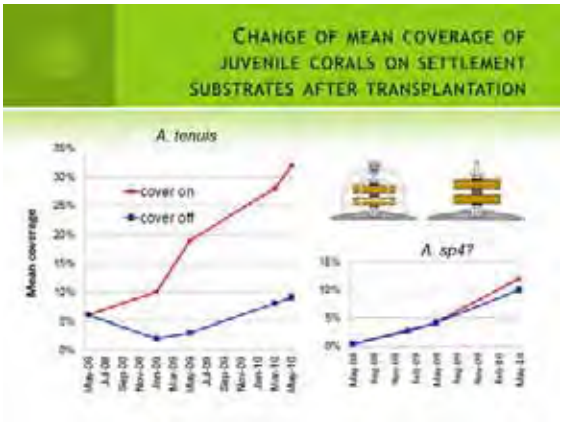

LONG DISTANCE TRANSPORTATION
1st Apr.2008
2nd Jan.2009
3st. May.2010


TRANSPLANTATION OF JUVENILE CORALS

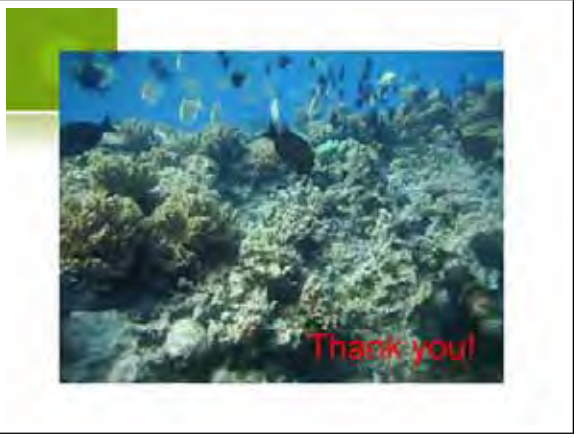

A. tenuis
Apr.2008
May.2009
Mar.2010
May.2010


A. sp.4 ?
Apr.2008
May.2009
Mar.2010
May.2010


A. Globiceps?
Apr.2008
May.2009
Mar.2010
May.2010


CHANGE OF MEAN COVERAGE OF JUVENILE CORALS ON SETTLEMENT SUBSTRATES AFTER TRANSPLANTATION
A. tenuis
cover on
cover off
Mean coverage
A. sp47


FUTURE PLANS


Thank you!

Interdisciplinary Education for Solving Ocean and Island Problems

Tomohiko Fukushima
University of Tokyo

ABSTRACT

Many and various problems exist concerning the ocean and islands. Among these, the ones that require a long-term approach, an international approach, and a holistic approach are especially amenable to educational solutions. Ocean educations have been done over hundreds years. However, required education, in current, is an interdisciplinary ocean education. The interdisciplinary ocean education intended to produce well-rounded individuals with both specialized knowledge and trans-boundary perspectives, and that they have critical thought leading to the comprehensive solutions called for by society to ocean problems. In the present, in Japan, volunteer members from several universities and two research institutes have formed a study group for interdisciplinary ocean education. The present author believes educational studies will contribute to solve problems of ocean and islands.

INTRODUCTION

Many and various problems exist concerning the ocean and islands. Some of them are the problems unique to small island states that are often overlooked by those living on the continents. Prominent among these are natural disasters such as cyclones, floods, high tides, and coastal erosion. Also, as land area is limited, unique social problems also arise, including high population density on the coastlines, waste accumulation, and contamination of drinking water. Economic fragility is also a large problem; for example, the excessive dependence on financial aid and remittances from those working abroad. Variety can be found not only among the problems, however, but also among the approaches employed to solve them. For example, in looking at the urgency of contaminated drinking water, contagious diseases, and destruction of basic infrastructure due to natural disasters, time is a major factor. As regards the issues of economic independence and the raising of awareness concerning environmental problems, a considered, deliberate approach over time is more effective. There are also differences between domestic and international initiatives. In the case of recovery from natural disasters or population decentralization, a single island can implement the necessary measures. However, in dealing with fundamental measures for addressing global environmental problems, Exclusive Economic Zone issues, and boundary demarcations, neighboring countries and international society should be involved. Problems also vary in the kinds of remedies they require: scientific and technological, legal and prescriptive, and holistic. Among these, the ones that require a long-term approach, an international approach, and a holistic approach are especially amenable to educational solutions. Needless to say, the education should be done according to the new order on the ocean (describe next chapter). In order to promote the education, Pacific island states should gain the broadest perspective on ocean problems and take a step forward for execution. Given to those, a research group to promote the education was formed in Japan .

Table 1 Types of Problems

origin	problems
natural disasters	cyclonic, flooding, high tide water, salt pollution, shore erosion etc.
social trouble	high population density on the coastlines, waste accumlation, contamination of drinking water etc.
economic fragility	excessive dependence on financial aid, remittances from people working abroad etc.

Table 2 Types of approaches to solve problems

approach type	approaches to solve problems
emargency	contaminated drinking water, contagious disease, destruction of basic infrastructure
deliberate	economical independency, public awareness of environmental issues
domestic	recovery from natural disaster, decentralization of population
international or regional	global environmental problems, problems boundary demarcations issues
others	science and technology, legal , comprehensive and systematic fashion etc.

NEW ORDER ON THE OCEAN

The creation of a new order on the ocean agreed on by international society came about due to the promulgation of the UNCLOS. The Convention was adopted in 1982 after a long process of debates beginning with the First United Nations Conference on the Law of the Sea (UNCLOS I) in 1958, followed by UNCLOS II in 1960 and UNCLOS III from 1973 to 1982. It was then promulgated 12 years later, in 1994. Contemporary sea classifications, that is, internal waters, territorial waters, contiguous zones, exclusive economic zones, continental shelf and international waters, are based on this convention, which has also established international rules for ocean development and use, and put in place new initiatives aimed at protecting and conserving the marine environment. One of the main reasons it took so long before the UNCLOS was adopted in 1982 was conflicts between developing countries and developed countries over the issue of development of deep seabed resources. Details of the debates can be left to specialist literature, however, no doubt, there was fact that the unfolding of a fierce debate concerning political, economic, scientific and legal aspects of the sea in international society. This is what interdisciplinary discussion.

From the 1990s, global environmental problems were raised in international society. In 1992, the United Nations Conference on Environment and Development (the Earth Summit) was held. The Summit called for sustainable development, adopting Agenda 21, an action plan for the realization of sustainable development, and establishing the Commission on Sustainable Development (CSD) to monitor its implementation. At the Earth Summit, the Framework Convention on Climate Change (FCCC) and the Convention on Biological Diversity (CBD), which were being discussed separately as environmental conventions, were also opened for signatures. Through these developments, interest in environmental problems grew on a global scale, the close connection of the existence of the sea to our daily lives became more widely understood, and the demand from ordinary citizens and society in general for scientific information about the sea grew.

Consequently, scientists needed to have a multilayered, integrated understanding of complex ocean systems. This indicates the general dissemination of concern about ocean problems and the increasing demand for an interdisciplinary approach to ocean research (Fukushima *et al.*, 2011).

As mentioned above, there was debate within the international community interdisciplinary, and scientists have become interdisciplinary approach is required. However, understanding of a concept for " interdisciplinary" is not shared yet.

INTERDISCIPINARY STUDY

Interdisciplinarity is defined as “scholars and specialists from various fields cooperating on a research issue that requires specialist knowledge or experience from many fields, or the act of integrating ideas from a range of academic disciplines in a single debate” (Daijisen dictionary), and the cross-section participation of different academic fields is its guiding principle. In this respect, the interdisciplinary system is the antithesis of the old university system of one professor to one academic field, a custom is maintained at present.

Modern science has been characterized by fields of research becoming increasingly subdivided from the time of Descartes and it has generated a wealth of knowledge. Although the approach of interdisciplinarity runs counter to the current of modern science, demand for increasingly interdisciplinary research has been growing since the 1990s. The reasons for this trend were explained internationally in terms of global environmental problems and domestically in terms of frequent incidents in coastal waters, but another reason can also be extracted from the tide of science—science has become a factor in determining the competitiveness of nation states. Thus, a situation develops in which the scale and scope of the research project must exceed the expertise of an individual and, inevitably, move to interdisciplinary research (Shioki, 1993).

Motivation for promoting interdisciplinary research is increasing from the dual perspectives of individual curiosity and societal demands. As for the former, if researchers are interested in a topic that cannot be properly researched within one specialist field, they will inevitably pursue an interdisciplinary approach. To study changes in a quantity of fishery resources, for example, it is necessary make investigations from the broad-ranging perspectives of fisheries science, physical oceanography, chemical oceanography, and meteorology. As for the latter, it is often true that only when barriers between fields such as ecosystems, engineering, economics, resources, administration and law are surmounted can the key to a solution be found, as typified by a research into environmental measures.

Much of the interdisciplinary research that takes place today and many of the interdisciplinary academic fields that are pertinent today, are linked to the resolution of problems in human society. The issues related to the ocean, such as rising sea levels due to global warming, development of seabed resources in the Arctic Ocean, protection and harvest of highly migratory marine species, piracy measures and disaster assessment measures concerning seabed earthquakes and tsunamis, also demand an interdisciplinary approach. In other words, interdisciplinary ocean studies is interdisciplinary, integrated science which can be used as a scientifically rational way to solve various ocean problems caused by human activity and natural conditions. Given to those backgrounds, the implementation of educational practice will be reviewed in the next section.

Table 3 Developmental stages in interdisciplinary engagement (after Sherif and Sherif, 1969).

I. The first stage is the multi-disciplinary stage. This is the stage where " interaction between specialist academic disciplines is minimal, with each specialist field contributing in its own original way", and it is situated as being the start line of interdisciplinarity.	III. The next stage is the cross-disciplinary stage. This is the stage in which there are demands for a new specialist field pertinent to various existing specialist fields, and it can be also referred to, as Borrero (1978) does, as supplemental interdisciplinarity, or "theoretical integration of
II. The next stage is the inter-disciplinary stage. At this stage, the main focus of attention is the borders of various specialist fields, and possibilities for the creation of new knowledge structures emerge. This interdisciplinary stage is only one stage of interdisciplinarity, but the term is often	IV. The last stage is the trans-disciplinary stage. Borders between specialist fields weaken, and new structures of academic systems emerge. In Borrero's classification in 1978, the content of the concept of transdisciplinarity is different.

OCEAN EDUCATION

In the past, education for the purpose of developing human resources to address ocean-related issues generally took place in the workplace on an as-needed basis. However, systematic thinking based in academic training could not be applied, and as the issues surround utilization of the ocean become increasingly complex in the future, it is obvious that dealing with problems will be more difficult. There is, therefore, great significance in universities implementing a structured program of interdisciplinary ocean education.

Comparison of Japanese and U.S. universities circumstances

According to the Digest of Education Statistics (*1) published in 2009, there were 4,352 universities in the USA in 2007 with 1,371,000 affiliated instructors. Although there have been fluctuations in the rate of growth in the numbers of universities and teachers since the 1970s, the time from which the earliest data are available, growth has always been positive. It is difficult to ascertain the number of universities that implement ocean education, as the definition of ocean education itself is far from clear. However, a total of 59 universities are registered in the Consortium of Ocean Leadership (*2), which plays a central, national role in ocean education. As it is unclear how many universities actually implement ocean education, statistical analyses are not possible. However, a brief survey of the websites of the 59 institutions mentioned above suggests that only a minority of them provide education on ocean management or interdisciplinary ocean education.

The aims of graduate school education in the USA can be broadly divided into the development of researchers and the development of highly trained individuals. In Japan those who choose the former track take a course of education that probes deeply into a scientific or technical specialist field. Graduate school education is more prevalent in the USA than in Japan. As American companies, which do not guarantee lifetime employment and do not have a culture of in-service continuing education, it is normal to employ personnel who already have the required strengths. In

contrast, the motivation for pursuing an advanced degree is less in Japan as such graduates, especially PhD holders have limited options aside from research careers.

Apart from research institutes and universities, employment options for PhD holders include international organizations, such as the UN. It is said that the employment rate for advanced degree holders in Japan is low, but actually, there is a high demand for personnel with thorough knowledge of specific fields, especially specialists with a PhD. The problems of interdisciplinary education and acquisition of PhDs may be outside the scope of this work, but in the present difficult climate of securing employment with a company may mean that applying to an international organization is a way to break through.

Practice in Universities

(North America, Oceania)

At present, interdisciplinary ocean education is being carried out at several universities in North America and Oceania, e.g. School of Marine Affairs, University of Washington(*3); Fisheries Centre, University of British Columbia (*4); Centre of Marine Policy, University of Wollongong (*5); Marine Studies Programme, South Pacific University (*6) etc. (Table 4) (SOF, 2004). Although the curriculums of each university have their unique aspects, there is a common emphasis on practical contents. It should also be noted that these universities are making efforts to gain students from the mid- career demographic by creating more practical programs, shortening attendance requirements, allowing research papers in substitution for a master's thesis, etc. This approach not only makes clear the increased focus on capacity development but also the fact that the supply of qualified personnel has yet to equal society’s demands.

(Japan)

In Japan, specialist education related to the sea has been carried out since the Meiji era (1869-1912) in the form of practical studies for human resource development in specific fields such as merchant ship studies, fisheries science, shipbuilding, transportation, and maritime safety. The roots of present-day Tokyo University of Marine Science and Technology, Kobe University Faculty of Maritime Sciences, National Fisheries University, University of Tokyo Faculty of Agriculture Fisheries Department, Hokkaido University Faculty of Fisheries Sciences and Japan Coast Guard Academy are such specialist technical training institutions. Concurrently, the sea has long been a focus of research in the natural sciences, such as earth sciences, biology and meteorology. However, the first institutions to be established specifically for the purpose of ocean research were the University of Tokyo Ocean Research Institute and the Tokai University School of Marine Science and Technology, which were established in 1962. It has taken until now almost 40 years since then to establish interdisciplinary ocean education that is conducive to ocean management.

Recently, interdisciplinary ocean education has been undertaken at several universities, at the Univ. of Tokyo(*7), Kyoto Univ.(*8), Tokyo Univ. of Marine Science and Technology(*9), Yokohama National Univ.(*10), and elsewhere. There are characteristics unique to each university, but they all share the aim of human resource development. However, problems remain for each program. For example, although many topics are offered, the relevance between fields has not been emphasized. Reasons for this might include the absence of a standard program, resulting in the lack of common knowledge bases and understanding among faculty in different fields

Table 4 Universities that have interdisciplinary / trans-boundary ocean education program.

Univ.	Division	Program
Univ. of Miami	Division of Marine Affairs and Policy: MAF (Rosenstiel School of Marine and Atmospheric Science: RSMAS)	MAF program
University of Washington	School of Marine Affairs: SMA	SMA program
Dalhousie Univ.	Faculty of Law	Marine Affairs Program: MAP / Marine and Environmental Law Program: MELP
University of British Columbia	Institute for Resources, Environment and Sustainability: IRES	Resource Management and Environmental Studies: RIMES
Univ. of Wollongong	Center of Maritime Policy	
University of Queensland	Center of Maritime law	
University of South Pacific	Marine Studies Programme: MSP	Maritime Affairs Programme: MSP
Univ. of Tokyo	UT Ocean Alliance	Interdisciplinary Ocean Program (3)
Kyoto Univ.	Field Science and Education Research Center	Linkage of forest, human and coastal ecosystem
YNU (1)	Center for Oceanic Studies and Integrated Education (COSIE)	Integrated Marine Management Program
TUMST(2)	Department of Marine Policy and Culture	Course of Marine Policy and Management

(1) YNU: Yokohama National University (2) TUMST: Tokyo University of Marine Science and Technology (3) translated by the present author

STUDIES FOR INTERDISCIPLINARY OCEAN EDUCATION

There are a lot of problems in the current interdisciplinary ocean education (Fukushima, 2010). And currently, the interdisciplinary ocean education does not gain in popularity. While the education is important for the new ocean governance. In particular, to the solve problems related to the ocean and islands that carried out under the new order on the ocean are essential.

Research Group on the Interdisciplinary Ocean Education

In order to promote interdisciplinary ocean education, basic problems must be overcome; for example, the building of a standard program, establishment of a common knowledge base and understanding among professors and universities, etc. Recognizing these demands, volunteer members from several universities and two research institutes have formed a study group for interdisciplinary ocean education, and begun a fundamental study of the relevant issues (Fukushima, 2010,).

The policy of this group is to foster a common consensus of approach, while maintaining the unique characteristics of each university, with its ultimate aim being the creation of a basic program conducive to both diversity and unity. The group has heretofore concentrated on definitions and aims for the interdisciplinary ocean education, curriculum outlines, and model lectures, but intends to expand its discussion to examine possible career opportunities.

Analysis of current conditions

Based on the principles of the Basic Act on Ocean Policy, curriculums of the four universities are compared. The six principles of the Basic Act on Ocean Policy, are 1) Harmonization of the development and use of the oceans with the conservation of the marine environment, 2) Securing safety and security on the ocean, 3) Improvement of scientific knowledge of the ocean, 4) Sound development of ocean industries, 5) Comprehensive governance of the oceans, and 6) International partnerships with regard to the ocean. The contents of these principles are related to each other, and partially overlap. As 5) Comprehensive governance of the oceans and 6) International partnerships with regard to the ocean are related to the whole, they were impossible to treat independently. Curriculum analysis was carried out using the figure of the overlapping four areas. (Fig.1). It is clear that universities show unique characteristics, even within interdisciplinary ocean education. The University of Tokyo and the Tokyo University of Marine Science and Technology cover a comparatively wide range of fields, while Kyoto University concentrates on a small number of selected fields, and the Yokohama National University lies somewhere in between them.

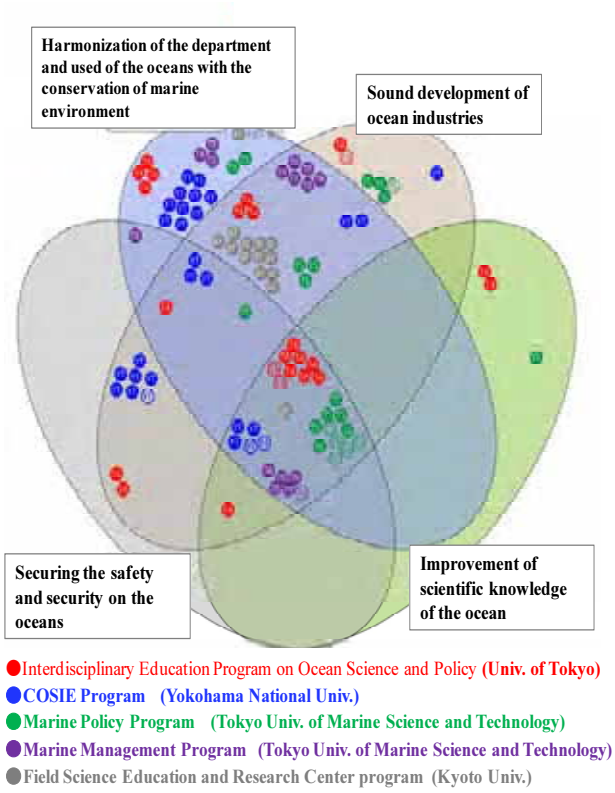


Fig. 1 Subjects distribution in the ocean education program. (after Fukushima, 2010)

Definition

The study Group made definition of the interdisciplinary ocean education. However, this is not authorized one. The member of the group hopes that this suggestion will be a kickoff to argue about contents of interdisciplinary marine education.

Definition of Interdisciplinary Ocean Education

An education intended to produce well-rounded individuals with both specialized knowledge and trans-boundary perspectives capable of critical thought leading to the comprehensive solutions called for by society to ocean problems.

Solutions to Problems called for by Society

Behind the need for interdisciplinary ocean education has social problems today. In other words, under the demands of society, the academic field can expand. However demands of society are not permanent, the theme of the education is also transient. In that regard, it is different from the basic science, and it is required of applications. Therefore, the themes are treated here, there are infinite extents. This research group, choose the keywords related to the ocean for 1980, was divided into six themes (Table 5)

Table 5 Classification of ocean-related- issues (after Fukushima *et al*., 2011)

Environmental Conservation		Safety and Security		Enhance of Scientific Knowledge		Development of Ocean Industries	
Impacts: fishery activities	Ship-induced pollution	Piracy and maritime terrorism	Responses to natural disaster	Promotion the basic science field	Promoting the scientific fronter area	Strategy of industrial development	Innovations for industrial creation
Impacts: oil and gas development	Impacts: ocean construction	Transportation of hazardous substances	Bootstrapping and smuggling	Data sharing	Development of inflastructure	Flag of convenience ship	Training the technical experts
Impacts: mineral resource developments	etc.	Shipwreck and rescue system	etc.	Human resources development	etc.	Maritime infrastructure network	etc.

ComprehensiveOcean Governance		International Cooperative Efforts	
Boundary of Administration	Highly migratory fish stocks	Conflict with neighboring countries	Resources management in high sea
Great Pacific Garbage Patch	Coastal Erosion	Over sea trading	Global environmental issues
Remote island infrastructure	etc.	Dangerous waters of the Straits	etc.

Fields of study incorporating trans-boundary points of view field,

The traditional academic challenges has been fragmented with various themes. However, the challenges of today's ocean cannot be solved by themselves. For example, resource studies in the past, cannot learn to adjust to the interests of other industries. In order to respond to new environmental policies such as precautionary principle, ecosystem management etc. a comprehensive perspective will be required. In this case, may have the opinion that simply adds new content to traditional education. However, the purpose of interdisciplinary ocean education is not accumulation of ocean-related-knowledge. Important thing is to understand the relationship

between them. Now, universities have tried in interdisciplinary ocean education, are struggling to spot. The study group create a diagram to capture the relevant synapses related issues (Fig 2).

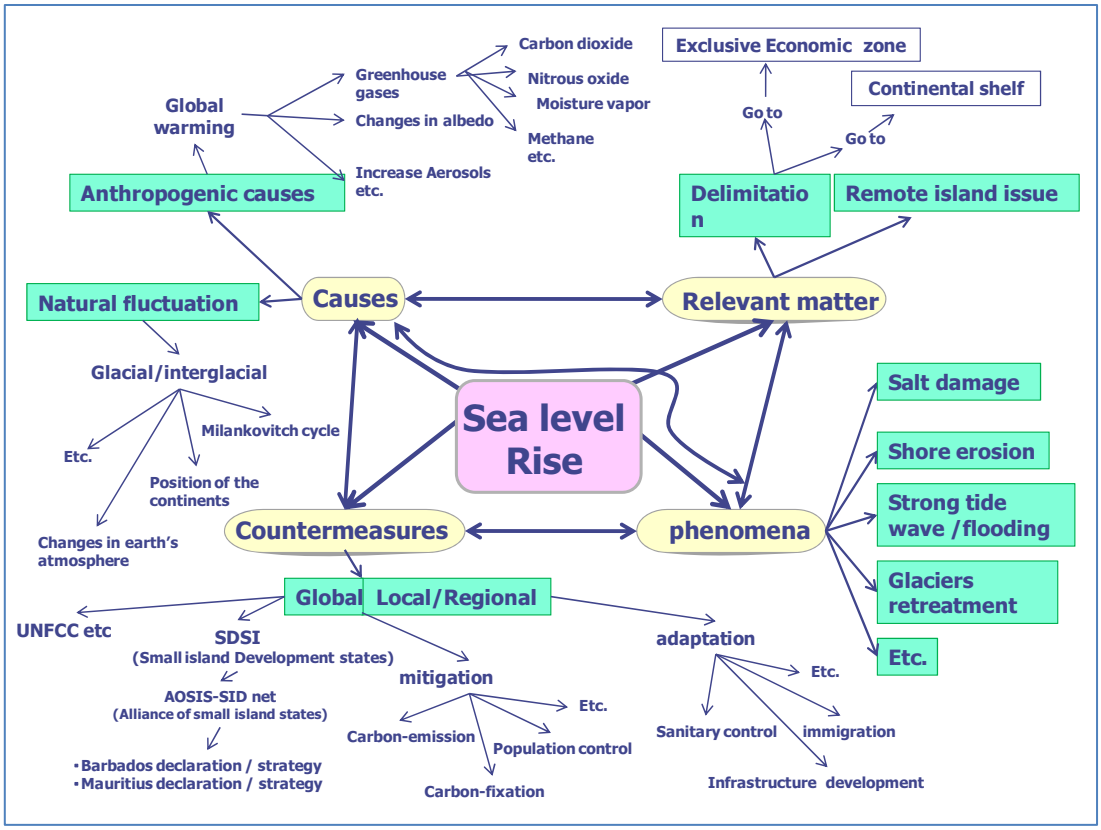


Fig. 2 A relation synapse of sea level rise for a interdisciplinary lecture.
(after Fukushima *et al.*, 2011)

CONCLUSION

After the creation of the new order on the ocean, new approaches has begun. Accordingly, personnel are required to have a new perspective. The university, provides human resources play a major role, has been embarrassed. Because there are problems. For example, although many topics are offered in lectures, the relevance between fields has not been emphasized. Reasons for this might include the absence of a standard program, resulting in the lack of common knowledge bases and understanding among faculty in different fields. On the other hand, if we are able to overcome this problem, we can expect major step toward solving the complex problems facing society ocean current. Needless to say, problems related to the ocean and islands are involved. The present author believes that the research group on interdisciplinary ocean education at the university level will play a important role for the ocean problem solving.

ACKNOWLEDGEMENTS

The authors acknowledge the member of the Research Group on Interdisciplinary Ocean Education at the University Level, organized in the Ocean Alliance of the University of Tokyo for their valuable suggestion. Mr. John Dolan, Ocean Chuogakuin University, revised the English manuscript.

REFERENCES

Borrero, A. (1978). "Multidisciplinary Studies: Ways Means and Applications, Interdisciplinary Studies: Ways Means and Applications," Proc.7th ICUS, pp.1019-1022.

Fukushima, T.(2010). " Activities of the Research Group on Interdisciplinary Ocean Education at the University Level," Proc. Special Session on Techno-Ocean 2010., Kobe.

Fukushima, T., Mukai, H. and Suenaga, Y. (2011). "Interdisciplinary Ocean Education with New Order on the Oceans." Proc. 22th Ocean Engineering Symp., JFOES and JASNAOE, Tokyo.

Sherif, M & C.W. Sherif (eds) (1969) "Interdisciplinary relationships in the social sciences". Aldine Publishing, Chicago, 376pp.

Shioki, M. (1993)."ドイツ近代科学を支えた官僚," Chuo-Koronn-sya, Tokyo, 218p. (in Japanese)

SOF (2004). "Ocean management education should be in Japanese universities", SOF technical report, SOF. 177pp. (in Japanese)

FOOTNOTE

(*1): Digest of Education Statistics http://nces.ed.gov/programs/digest/ (2011/1/31)

(*2): Consortium of Ocean Leadership http://www.oceanleadership.org/(2011/1/31)

(*3): School of Marine Affair, University of Washington : http://depts.washington.edu/smea/(2011/1/31)

(*4): Resource Management and Environmental Studies, University of British Columbia: http://www.calendar.ubc.ca/vancouver/index.cfm?tree=12,204,828,1406 (2011/1/31)

(*5): Centre for Maritime Policy, University of Wollongong: http://www.uow.edu.au/research/profile/UOW008920.html (2011/1/31)

(*7): Ocean Alliance, University of Tokyo website: http://www.oa.u-tokyo.ac.jp/en/index.html (2011/1/13)

(*8): Tokyo University of Marine Science and Technology. website: http://www.s.kaiyodai.ac.jp/seisakuHP/index.html (2011/1/13)

(*9): Field Science Education and Research Center, Kyoto Univ. website. http://fserc.kyoto-u.ac.jp/panf/gaiyou4.pdf (2011/1/13)

(*10): Tokyo University of Marine Science and Technology. website: http://www.s.kaiyodai.ac.jp/seisakuHP/index.html (2011/1/13)

(*11): YNU-COSIE website. http://www.cosie.ynu.ac.jp/english/ (2011/1/13)

Coastal Management for Shore Protection in Atoll Islands

Hiromune YOKOKI[1)] and Daisaku SATO[2)]

[1)] Associate Professor, Department of Urban and Civil Engineering,
College of Engineering, Ibaraki University, Japan
[2)] Post-doctoral Researcher, ditto.

1. Introduction

Numerical calculations were carried out for estimating the future morphology of reef islands in Majuro atoll, Marshall Islands. In this paper, the method and results of the several years' studies on Majuro atoll are summarized. It is strongly expected that the results of our studies become fundamental information for sustainable island conservation not only in Majuro but also in other atoll islands.

2. Field investigation on coastal morphological changes

Field investigations in Majuro atoll were conducted between 2006 and 2009 to address the quantitative changes of the coastal morphology by measurement of the beach profiles. Figure 1 b) indicated the locations of the beach profiles that were set based on the previous measurement, which was conducted by SOPAC (1997). An example of measured beach profile is indicated in Fig 2. In order to address the quantitative changes during 10 years, the hatched area in Fig 2 were calculated from the beach profile as well as on the other survey lines (Table 1).

3. Basic concept of the numerical calculation

The morphological changes of the Majuro were caused by various natural and artificial factors. We

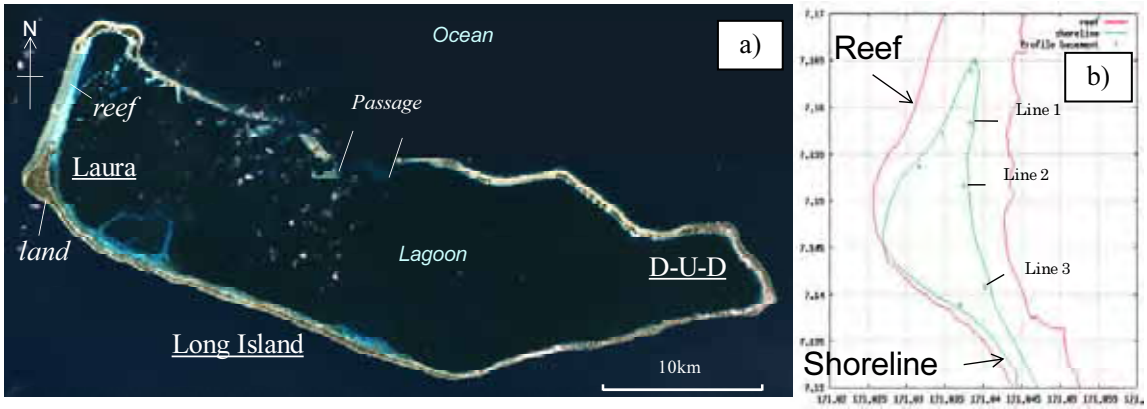


Figure 1 a)Majuroatoll, Marshall Islands, b)Location of the beach profiles

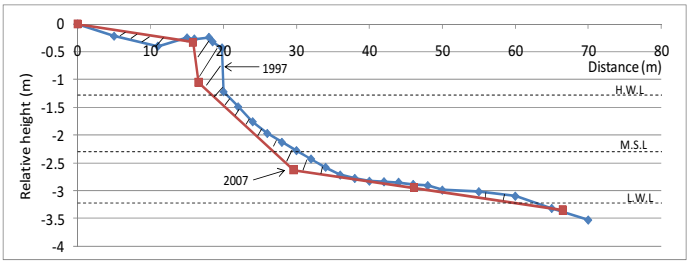


Figure 2 Example of measured beach profile (Line1)

Table 1 Difference between 1997 and 2007. The unit is m3/m.

	Line 1	Line 2	Line 3
1997	77.3	156.5	161.4
2007	70.4	163.5	170.6
Diff.	-6.9	7.0	9.2

focused on the natural process of the morphological change and it was divided into two major factors by the external forces affecting the morphological changes (Sato and Yokoki, 2008). They were called normal and extreme conditions. In the normal condition of the external forces, the daily and seasonal waves and currents transport coral sands and foraminifers and change the topography of the lagoonal beaches. On the other hand, the typhoon and hurricane cause the waves with larger energy than in the normal condition and thus they transport coral gravels which are large and heavy in the ocean-side coasts (Maragos et al., 1973; Baines and McLean, 1976; Mergner, 1985). In Majuro atoll, the typhoon struck out directly in November 1991 and November 1997 according to the best truck data from 1945 and 2008 distributed by the Joint Typhoon Warning Center (JTWC). By 1945, it was reported that the severe damage caused by typhoon in 1905 and 1918 (Xue, 1997). These historical data show that the extreme events hit the Majuro atoll about once in 100 years. As more than 80% of the island's sediments are fine foraminifer sands (Yasukouchi, 2008), the daily and seasonal sands movement on the lagoonal coast was dominant for estimating of the island morphological changes, thus was calculated in this study.

4. Method for estimating the future island form

4.1 Calculation method

For the efficient implementation of the simulation for a hundred years, the wave field simulation was carried out every 10 years with increasing the sea level. The decade ratio of the projected sea-level rise was quantified from IPCC AR4 (IPCC, 2007) which projected that the sea level would rise up to 59cm by 2100. The boundary condition of the wave field simulation included significant wave height, mean wave direction, mean wave period, mean wind speed and mean wind direction, which were fixed as annual averages during the calculation. Calculation of the longshore sediment transports, net volume changes, and representative shoreline were carried out as annual base. Calculation of the net volume change included sediment supply from foraminifers. Inner iteration for 10 years, which showed as a broken line in Fig 2, was calculated using the same wave field for the 10 years. If it was necessary, the wave height and direction were interpolated by using the calculated results of the wave height and direction around the area. The representative shorelines calculated from net volume change in each mesh updated the distribution of the island meshes in the water depth and topographic data used in the wave field calculation.

4.2 Calculation of the wave field

In the calculation, wind waves and swells were targeted as driving forces of sediment transport. We used the Simulating WAves Nearshore (SWAN) model to calculate the transformation of these waves. This model treats waves as a two-dimensional wave action density spectrum. The basic equation is shown in Eq. (1) (Booij et al., 1999):

$$\frac{\partial}{\partial t}N+\frac{\partial}{\partial x}(C_x N)+\frac{\partial}{\partial y}(C_y N)+\frac{\partial}{\partial \sigma}(C_\sigma N)+\frac{\partial}{\partial \theta}(C_\theta N)=\frac{S}{\sigma} \qquad (1)$$

where t is time, x and y are horizontal coordinates, σ is angular frequency, θ is the wave direction taken counterclockwise from the geographic east. N is the wave action density; C_x, C_y are the propagation velocities in horizontal directions, respectively; C_σ is the propagation velocity in σ-direction; and C_θ is the propagation velocity in θ-direction. S in the right-hand side of the Eq. (1) is the source term in regard to energy density, representing the effects of wave generation, dissipation, and nonlinear wave-wave interactions.

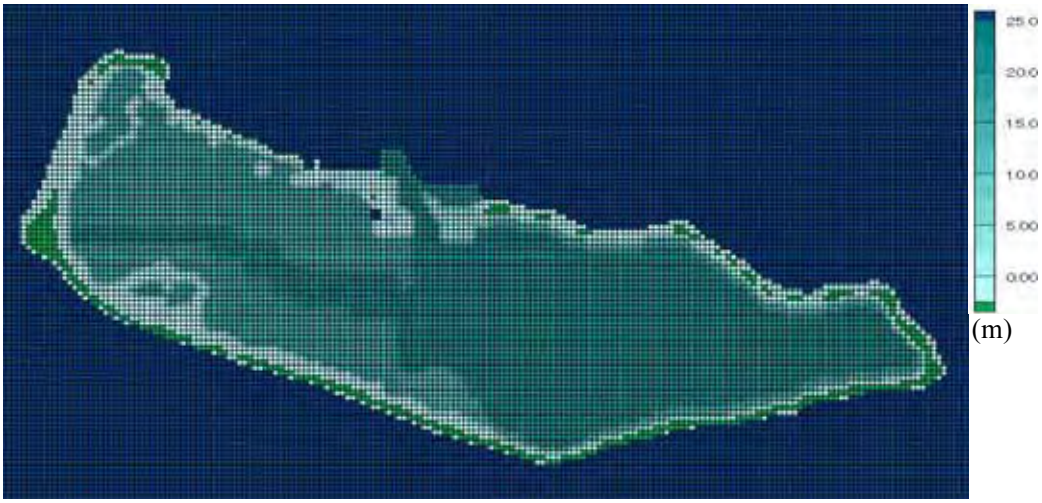


Figure 3 Water depth and initial island's shape of the calculation domain.

Figure 3 shows the calculation domain and initial topography of the islands, which was approximately 45km west–east and 25km north–south and covers the entire Majuro atoll. We extracted the landforms and reef lines of the atoll from IKONOS images taken in 2001. The calculation grid was rectangular and its size was approximately 32m. Water depth in the lagoon was digitized from the chart surveyed in 1954; we assumed a uniform 0.5m water depth on the reef flat because of the lack of detailed data on reef flats.

4.3 Calculation of the longshore sediment transports and their net volume changes

Longshore components of wave energy flux at each nearshore grid were calculated by using the simulated nearshore significant wave height, mean wave direction, significant wave period, and significant wavelength, as shown in Eq. (2):

$$P = \frac{1}{8}\rho g H_b^2 C_{gb} \sin\alpha \cos\alpha \tag{2}$$

where ρ is density of seawater, H_b is significant wave height, C_{gb} is the group velocity calculated from the significant wave period and significant wavelength, and α is the angle of the mean wave direction to the shoreline. The volume of longshore sediment transport was calculated from the longshore component of wave energy flux as in Eq. (3) (Komar and Inman, 1970):

$$Q = \frac{KP}{0.6(\rho_s - \rho)g} \tag{3}$$

where Q is the volume of longshore sediment transport and ρ_s is density of the sediment. Here, 0.39 was applied to the value of K as a general coefficient introduced in CERC (1984).

The net volume of the longshore sediment transport was calculated from the continuity of sediment in longshore direction, which is the same concept of the 1-line model described in Eq. (4):

$$\frac{\partial Q_{vol}}{\partial t} = \frac{\partial Q}{\partial \xi} + q \tag{4}$$

where Q_{vol} is net volume of longshore sediment transport, ξ is the alongshore coordinate. q is

Table 1. Annual sediment production volume at each mesh calculated by Fujita et al. (2009).

	Northern part of the Laura, lagoon	Middle part of the Laura, lagoon	Southern part of the Laura, lagoon	Northern of the atoll, lagoon
Sediment production volume (m^3/annual)	7.44	0.36	2.28	25.32

sediment production rate. As shown in Table 1, we used the annual sediment production volume at each area as indicated in Fujita et al. (2009). Calculation of the net longshore sediment transport adopted the same grid used in the wave field calculation. The size of the mesh was 32m in *x*- and *y* direction. In *z* direction, we assumed the uniform height, 2m, for all islands. As initial condition, the island meshes without shoreline were set as 100% of sediments within the mesh and those with shoreline were set as 50%. The meshes without island, which were water meshes, were 0%. If the sediment ratio was calculated to be over 100% at some mesh, the shoreline prograded and the mesh became the island one. On the contrary, if the sediment ratio became 0%, the island mesh changed to the water mesh with 0.5m water depth as on the reef. Prograding of the island mesh was limited by existence of the reef edge.

5. Calculated results on the future island form

5.1 Western area

Figure 4 shows the calculated result in the Laura islet located in the western area of the atoll. Gray (Green) and light gray (green) areas in the figure indicated the initial shape of the island and the reef rim digitized from the satellite image taken in 2000. Solid lines, broken lines and dotted lines show the calculated results at 10 years, 50 years and 100 years later, respectively. Our calculated result indicated that the northern tip of the Laura would experience serious erosion during the coming 100 years. This large erosion is not only the future phenomenon calculated by this study but also ongoing problem in the tip of Laura islet (Xue, 2001; Yokoki et al., 2005; Sato and Yokoki, 2008). From our result, the ongoing large erosion would accelerate and the shoreline would retreat by 50m in 100 years later.

5.2 Southern area

Figure 5 shows the calculated result in the southern end of Long Island. The legends in the figure are same as Figure 4. In the western side of this area, the large erosion was calculated. Although the erosion was a little at coming 10 years later, it accelerated year by year. The shoreline retreated by about 100m after 100 years. On the other hand, the no-change and accreted areas were also calculated. It is indicated that the sea-level rise directly connects to the serious erosion in all lagoonal coasts. The wave height in the nearshore zone increased because the sea-level rise enabled to propagate the waves with higher energy. Although it increased the potential of the longshore sediment transport, the balance between inflow and outflow sediment caused not only the erosion but also the accretion.

5.3 Northern area

Figure 6 shows the calculated result on the northern islands of Majuro atoll. Legends used in the figure are as same as in Fig 4. Additionally, the distribution of the outflow sediment volume was also indicated in the figure. In this study, the accreted volume beyond the reef edge was treated as the

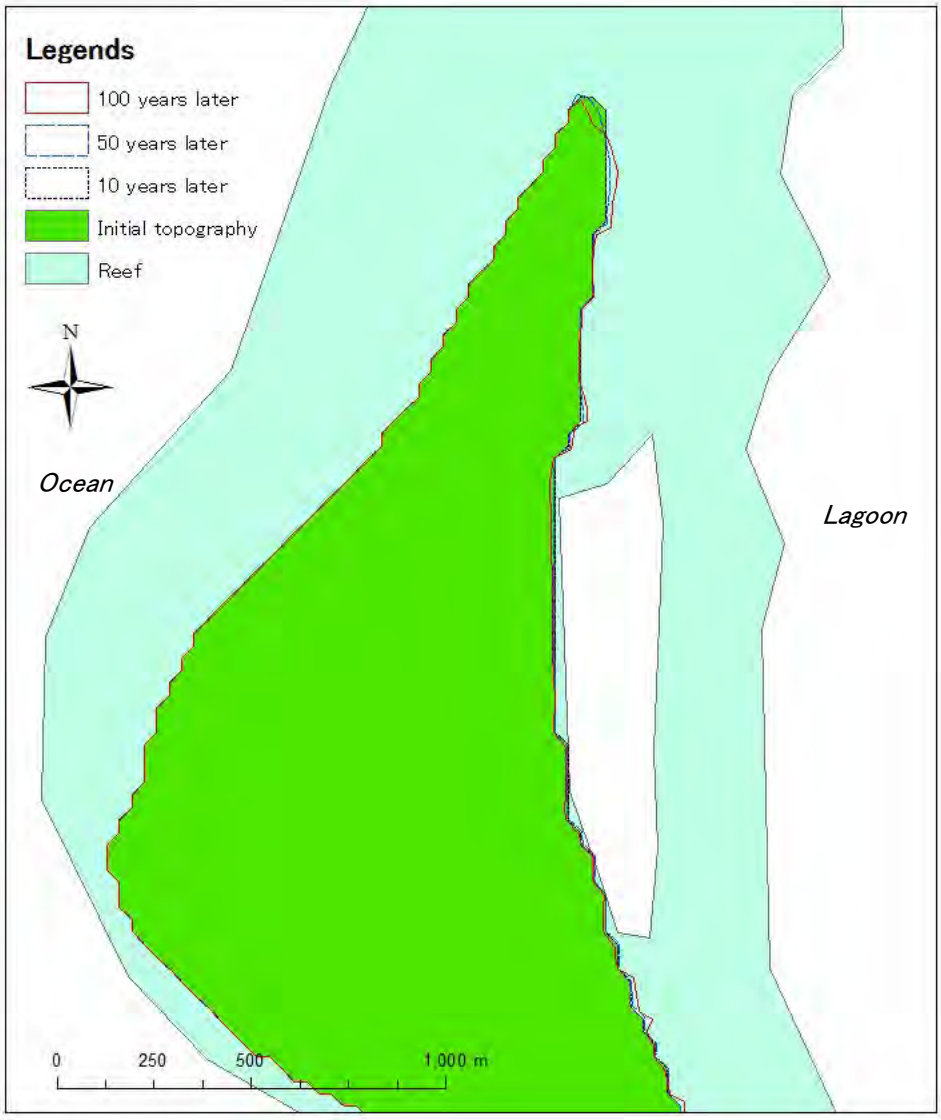


Figure 4 Calculated result in Laura islet.

out-flown sediments from the reef flats to the lagoon. The calculated position of the shoreline indicated large lagoonal-ward accretion. The large accretion also connected the two neighbor islands at 100 years later. The out-flown sediments were addressed in many areas where the large accretion was calculated on the lagoonal reef flats.

6. Potential of the sustainable beach nourishment

In this study, the future estimation of the morphological changes was calculated and indicated the necessity of the sustainable island conservation plan. We focused on the mass balance of the sediment volume in Majuro atoll, and planned beach nourishment implementation using the out-flown sediments calculated in the northern atoll.

6.1 Scenarios of the beach nourishment

We set three scenarios of beach nourishment, among which the triggers of the implementation were

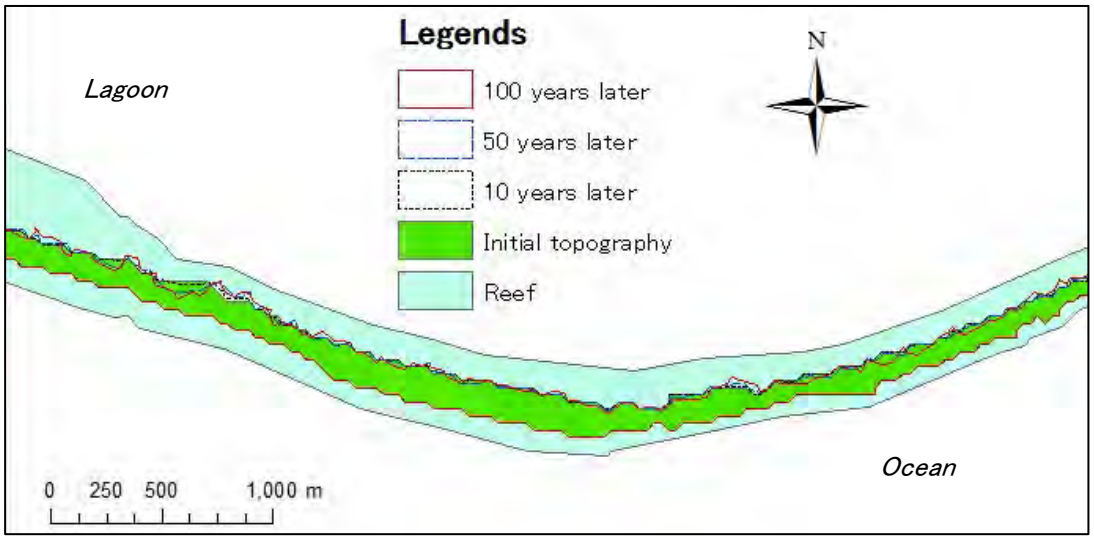


Figure 5 Example of the calculated result in Long Island

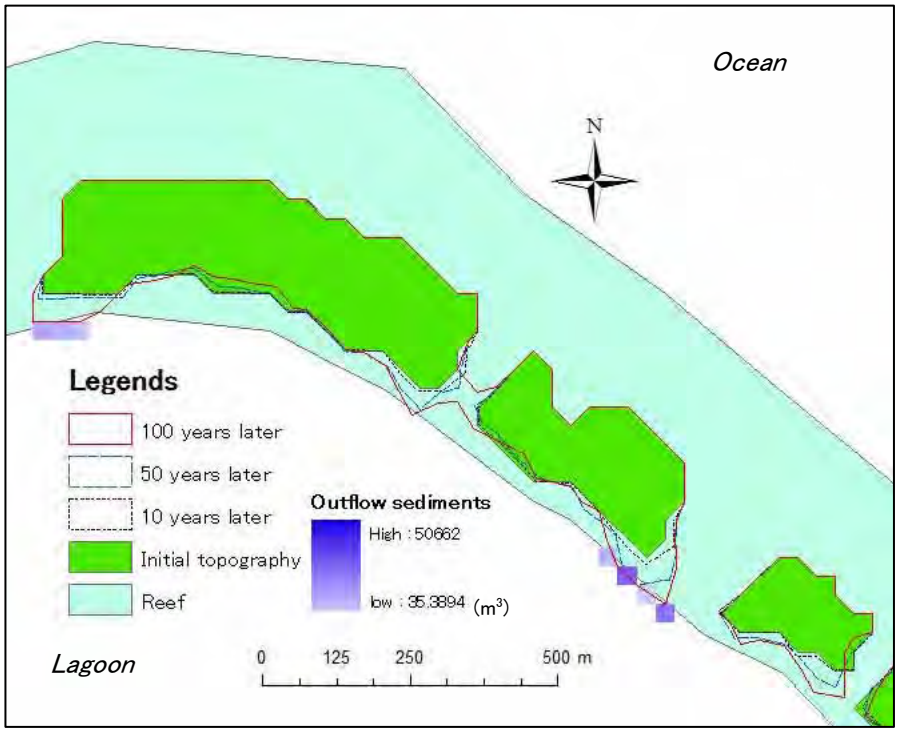


Figure 6 Example of the calculated result in northern islands.

different as shown in Table 2. In this study, the trigger controlled the implementation of the beach nourishment. The beach nourishment was carried out as maintaining the initial island using the outflow sediments calculated every 10 years in the northern lagoon.

6.2 Calculated results

Figure 7 shows the accumulated erosion volume changes at the scenarios. In this figure, the calculated result without beach nourishment is also indicated. The calculated results in all scenarios

Table 2 Scenarios of the beach nourishment. Nourishment implements every 10 years.

	Trigger	Area	Source of sands
NA-1	shoreline retreat by 1m	From Laura to D-U-D	Northern islets
NA-2	shoreline retreat by 5m	From Laura to D-U-D	Northern islets
NA-3	shoreline retreat by 10m	From Laura to D-U-D	Northern islets
NL-1	shoreline retreat by 5m	Laura, LongIsland	10-50 : anywhere 50-100 : northern islets

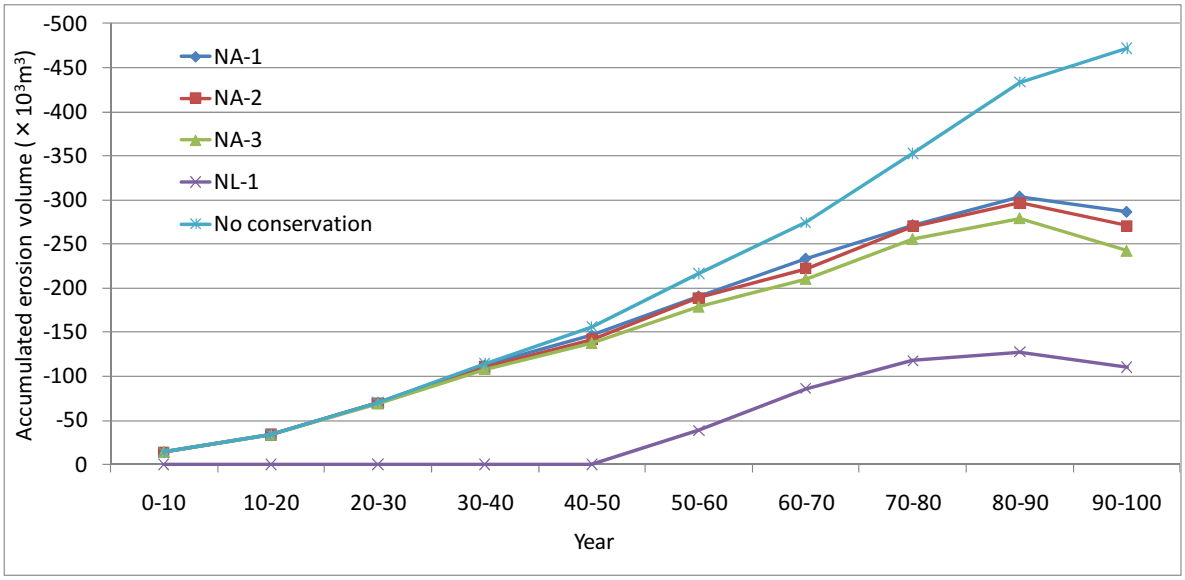


Figure 7 Differences of the accumulated erosion volume.

were same as that without nourishment by 40 years later, because the out-flown sediments, which were source sands of the beach nourishment, were not accreted enough. At 40 years later, the accumulated erosion volume was decreased year by year due to the effect of the beach nourishment. Finally, the beach nourishment decreased the erosion volume about 30% compared with that without conservation.

7. Conclusions

In this study, the numerical calculation on the future morphological change was carried out in the Majuro atoll and it indicated the large erosion was calculated in many areas in the coming 100 years. In the Long Island area, calculated result showed that the shoreline retreated about 100m. Not only the large erosion but also the large accretion, however, was calculated in the several areas, especially in the northern part of the atoll. We focused on the outflow sediments accumulated on the nearshore lagoon for sustainable beach nourishment. We set three beach nourishment scenarios and the constructed model examined them. Comparing the accumulated erosion volume indicated that the beach nourishment using the outflow sediments, which accreted under the natural process of the longshore sediment transport, decreased the erosion. Finally, it decreased the erosion volume about 30% compared with that without conservation. This result shows the possibility and effectiveness of the sustainable beach nourishment by using the sands provided naturally in the Majuro atoll.

Acknowledgements: This study was financially supported by the Global Environment Research Fund, the Ministry of Environment, Japan (B-15, Ba-085). The authors deeply appreciate it.

References

Baines, G.B.K. and R.F. McLean (1976) Sequential studies of hurricane deposit evolution at Funafuti Atoll. *Marine Geology*, 21, M1–M7.

Booij, N.R., C. Ris and L.H. Holthuijsen (1999). A third-generation wave model for coastal regions 1. Model description and validation. *Journal of Geophysical Research*, 104, C4, 7649-7666.

Coastal Engineering Research Center (CERC) (1984). Shore Protection Manual.

Fujita, K., Y. Osawa, H. Kayanne, Y. Ide and H. Yamano (2009). Distribution and sediment production of large benthic foraminifers on reef flats of the Majuro Atoll, Marshall Islands. *Coral Reefs*, 28, 29-45.

IPCC (2007). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Forth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Kayanne, H., M. Chikamori, H. Yamano, T. Yamaguchi, H. Yokoki and H. Shimazaki (2005) Interdisciplinary Approach for Sustainable Land Management of Atoll Islands. *Global Environmental Research*, 9(1), 1-7.

Komar, P.D. and D.L. Inman (1970) Longshore sand transport on beaches. *J. Geophys. Res.*, 30, 5914-5927.

Leatherman, S. P. (1977) Sea-level rise and small island states: An overview. *Journal of Coastal Research*, Special Issue 24, 1–16.

Maragos, J.E., G.B.K. Baines and P.J. Beveridge (1973) Tropical cyclone creates a new land formation on Funafuti atoll. *Science*, 181, 1161–1164.

Mergner, H. (1985) Initial recolonization of Funafuti Atoll coral reefs devastated by hurricane “Bebe”. *Atoll Research Bulletin*, No.284, 1-16.

Mimura, N., L. Nurse, R.F. McLean, J. Agard, L. Briguglio, P. Lefale, R. Payet and G. Sem (2007). Small islands. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., *Cambridge University Press*, Cambridge, UK, 687-716.

Sato D. and H. Yokoki (2008) Field investigation and numerical simulation toward the control of longshore sediment transport on Laura islet in Majuro Atoll. *Annual Journal of Coastal Engineering*, JSCE, Vol. 55, (2), 1401-1405. (In Japanese)

Xue. C. (1997) Coastal Sedimentation Erosion and Management of Majuro Atoll Republic of Marshall Islands. *SOPAC Technical Report*, 254, 1-80.

Xue, C. (2001) Coastal erosion and management of Majuro Atoll, Marshall Islands. *Journal of Coastal Research*, 17(4), 909–918.

Yamano, H., H. Kayanne and M. Chikamori (2005) An Overview of The Nature and Dynamics of Reef Islands. *Global Environmental Research*, 9(1), 9-20.

Yasukouchi, T. (2007) Ecological and phisical factors of Holocene atoll-island formation in the Pacific. Ph. D Thesis, University of Tokyo, 1-129.

Yokoki, H., H. Yamano, H. Kayanne, D. Sato, Y. Minami, S. Ando, H. Shimazaki, T. Yamaguchi, M. Chikamori, A. Ishoda and H. Takagi (2005) Comparison between Longshore Sediment Transport Due to Waves and Long-term Shoreline Change in Majuro Atoll, Marshall Islands. *Global Environmental Research*, 9(1), 21-26.

Session II

Adverse Effects of Climate Change and Variability on Islands

Climate Variations Link to Sea Level Changes: Implications for Pacific Islands

Swadhin Behera[1,2] and Toshio Yamagata[2,3]
[1]Research Institute for Global Change, JAMSTEC, Yokohama, Japan
[2]Application Laboratory, JAMSTEC, Yokohama, Japan
[3]School of Science, The University of Tokyo, Tokyo, Japan

Abstract

The sea level rise is a great concern for the human society now. It is said that some of the island nations like Tuvalu might be submerged under water if the present rising trend in the sea level continues. Besides a direct threat to the human habitats, sea level rise is expected to affect the coastal zones on various direct and indirect ways. The sea level rise is estimated to be about 20 cm in the last hundred years and is often linked to the anthropogenic climate change. However, it is noticed that the rising trend in the global sea level not always corresponds to the trend of global warming. Moreover, the interannual to decadal sea level variations embedded on the general trend are directly associated with the modes of climate variations. The El Niño is shown to be one such climate variation mode that has significant impact on the sea level of the Pacific.

In recent studies, the newly identified climate variation mode, the El Niño Modoki is shown to influence the decadal variation of sea level. The sea level anomalies associated with El Niño and El Niño Modoki are distinct from each other. During El Niño Modoki, the sea level is higher than normal in the central Pacific whereas during El Niño the higher than normal sea level prevails in the eastern Pacific. Therefore, most of the Pacific islands will experience the influences of those two modes differently; particularly the islands around the dateline will experience opposite phases of sea levels depending on the dominance of either El Niño Modoki or El Niño. Recently, the central Pacific sea level went from a lower than normal phase to a higher than normal phase associated with a phase change from La Niña Modoki to El Niño Modoki during 1995-2006. In the rising phase the rate of the sea level rise was 8 times of that of the general trend in sea level. Therefore, it is important to appreciate that impacts of the climate on sea level not only appears through secular trends but also through changes in magnitude, frequency and phase of natural climate variations - even through the evolution of a new climate mode such as El Niño Modoki.

1. Introduction

The global trend of sea level rise has raised worldwide concerns for its direct and indirect impacts on human populations, large part of which live near the coasts. It is often stated that the sea level rise due to global warming is encroaching low-lying coastal regions and islands. Pacific islands such as Tuvalu and Kiribati could become uninhabitable within decades. Several other island nations are expected to loose major chunks of habitable landmasses. According to the IPCC reports based on projected changes, even a moderate rise in sea level would have a wide range of impacts on coastal environments and infrastructure. Besides its obvious direct impacts on the human habitats, the anticipated sea level change would cause wetland and coastal plain flooding, coastal erosion, salinization of aquifers and soils, and a loss of habitats for fish, birds, and other wildlife and plants.

World's coastal cities were mostly developed in a period when global sea level was relatively stable. However, sea level has been rising since the late 19th century (*e.g. Douglas, 1991*). The estimated rise of global sea level is about 15-20 centimeters (about 2.0 mm/year) during the last hundred years (Fig. 1). This rate of the ascent seems to have accelerated toward the end of 20th century (e.g. *Church et al., 2004; Cazenave and Nerem, 2004; Nerem et al., 2006*). Satellite measurements taken over the past decade indicate that the rate of increase was about 3.1 mm/year (Fig. 2), which is significantly higher (*e.g. Cazenave and Nerem, 2004*) than the average rate estimated for the 20th century. Projections based on climate change scenarios suggest that the rate of sea level rise is likely to be higher in 21st century. While the implications are simple to recognize, the underlying mechanisms are scientifically challenging to resolve. In

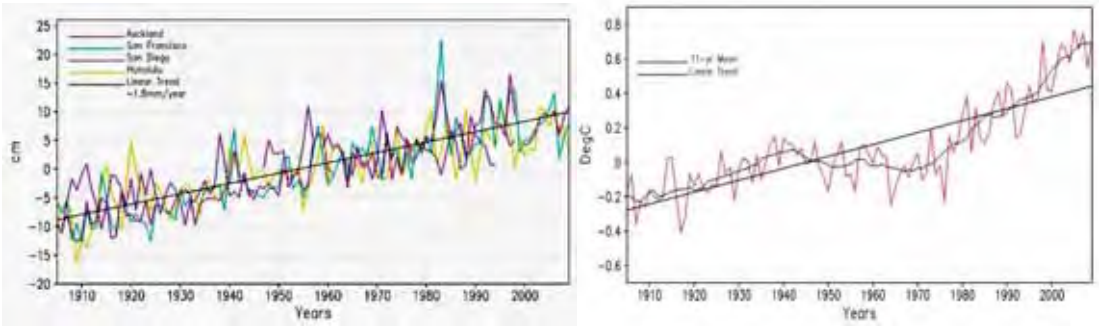


Fig. 1 (Left) Annual sea level trends as derived from four selected tide-gauge locations (Auckland, San Francisco, San Diego and Honolulu) in the Pacific Ocean. All the time series extend to 1905. The mean trend is shown in the black line. (Right) The corresponding changes in global annual surface temperature (based on Goddard Institute for Space Studies (GISS) Surface Temperature Analysis). The black line represents the linear trend and the blue line represents the 11-year running mean.

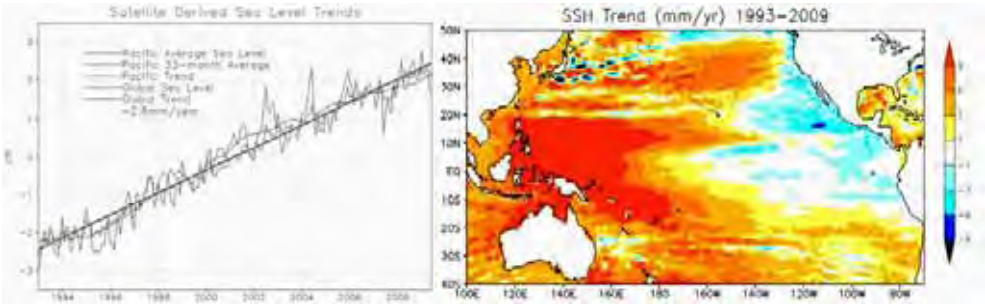


Fig. 2 (Left) The global and Pacific sea level derived from the satellite altimeter data. The average sea level for the Pacific Ocean region (shown in the right panel) is shown in blue line and that for the global ocean is shown in red line. The linear trends for both regions are almost similar and are shown in yellow and black lines respectively. (Right) The spatial distribution of the linear trend in Pacific Ocean.

order to be well prepared against the expected disasters arising from such a dramatic change in coastal environment, we need to understand how sea level variations occur regionally under the global warming stress.

The concern on projected change arises mainly due to uncertainties in the processes responsible for the sea level rise; thermal expansion, the melting of glaciers and ice caps, and the loss of ice from the Greenland and Antarctic ice sheets. It may be noted that the sea level rise has not just started in the 19th century. Changes in global sea level that are extracted from paleo records have been reported on interglacial scales. From those past records it is recognized that sea level was 120 m lower from the present level; about 18,000 years ago during the last ice-age when large chunks of ice were stacked up on the continents as glaciers. At that time there was a land connection between Asia and Alaska over which humans are believed to have migrated to North America. The global sea level has been gradually rising for the past 6,000 years to reach the present level. Considering these facts, it becomes a challenging task to differentiate the sea level changes associated with natural long-term variability from that of the anthropogenic origin.

The anthropogenic sea-level changes become a matter of concern after the introduction of the satellite observations. The satellite altimeter data gave us the opportunity to explore the global scale sea-level changes. Recent studies are able to show that the changes in the sea level are characterized by uneven spatial structures with positive trends in one region and negative in the other (*e.g. Cazenave et al., 2004*) as compared to the linear rise envisioned from the global averages of historical records. The spatial variations in sea level sometimes are associated with climate modes on time-scales from years to decades. The North Atlantic Oscillation, the El Niño/Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO) are some of the

known modes of climate variations that are linked to the regional sea-level variations. *Volkov and van Aken* (2005) suggested that the interannual variation of the sea level in the North Pacific is coherent with PDO, which possibly switched from a positive phase to a negative phase in 1998. Other studies have linked the sea level variations to ENSO (*Chambers et al., 2002; Willis et al., 2004; Llovel et al. 2009*).

In recent decades, the tropical Pacific is in a strange state from a climate dynamicist's viewpoint; we often observe a warm sea surface temperature (SST) anomaly associated with high sea level and low atmospheric sea level pressure anomalies in the central tropical Pacific (*Ashok et al., 2007; Weng et al., 2007; Ashok and Yamagata, 2009*). Interestingly, this warm SST anomaly is sandwiched between two cold SST anomalies with low sea level in the eastern and western Pacific. This pattern shows a marked difference (Fig. 3) from the conventional El Niño and the anomalous ocean-atmosphere condition named as the El Niño Modoki (Pseudo El Niño) in 2006. It is shown that the El Niño/La Niña Modoki (ENSO Modoki) was responsible for the recent decadal variations of the sea level in the tropical Pacific Ocean (*Behera and Yamagata, 2010*).

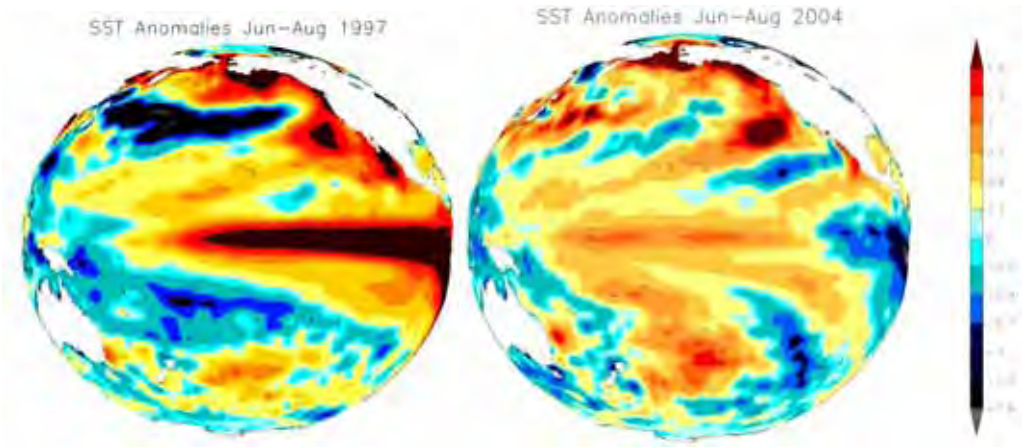


Fig. 3 SST anomaly patterns for the typical El Niño (left) and El Niño Modoki (right) events.

2. Data

Sea level anomalies are derived from satellite altimeter data archived by AVISO. The dataset merges TOPEX/Poseidon, Jason and ENVISAT observations that cover the period from late 1992 to present. In addition to the altimeter data, annual tide-gauge data from several stations are also extracted from the Revised Local Reference data archived by the Permanent Service for Mean Sea-Level and made available from their website (http://www.pol.ac.uk/psmsl/). SST anomalies are derived from optimally interpolated version 2 SST monthly data (*Reynolds et al.,* 2002). Seasonal cycle is removed from the altimeter based

on climatology of 1993-2007 and the long-term mean for the period 1905-2007 is removed from the annual tide-gauge data. SST anomalies are derived from a base period of 1979-2007.

3. Climate change and sea level rise

The 20th century secular trend in sea level anomalies are derived from the selected tide-gauge data that have longer than hundred years of observation. All four stations show a rise of sea level from early 20th century to present (Fig. 1). The mean trend is about 2 mm/year. The monotonous rise in the global sea level is also recognized in recent satellite observation (Fig. 2) as also reported in several previous studies (e.g. *Church et al. 2006; Beckley et al., 2007*).

The changes in sea level can mainly be attributed to steric changes due to ice melting, higher rainfall and thermal expansion caused by the global warming keeping aside the geological changes. The melting back of sea ice will not directly contribute to sea level rise because this ice is already floating on the ocean. However, the melting of Greenland and Antarctic ice would contribute to the rise in sea level. Moreover, the melting of sea ice leads to a reduction in albedo. This allows for greater absorption of solar radiation and global warming, thus helping further melting of continental ice in a feedback loop. Also, fractures in the floating ice shelves will allow a faster flow of continental ice to the oceans thereby providing an additional contribution to the rise of sea level. Besides the ice melting, the sea level rise could be related to the thermal expansion of the water volume due to heating of the oceans. However, there remain questions about the amount of heat that has been taken up by the oceans in addition to the sensitiveness of the earth system to global changes. The model simulations (and associated climate sensitiveness) of 20th century heat uptake by the oceans and of the amount of sea level rise do not fully match, making it more difficult to understand and project the amount of thermal expansion that can be expected in the 21st century.

It may be noted that the trend of sea level rise does not entirely correspond to that of the global surface temperature (Fig. 1), because of the complex interactive processes as discussed above. While the sea level rose somewhat continuously throughout the 20th century, the global surface temperature dropped between 1940 and 1970 to rise again from thereafter. The changes in sea level are also not uniform over the global oceans. For example, from the recent satellite observations, we find that there is a strong rising trend of sea level in the western Pacific compared to a descending trend in the eastern Pacific. Therefore, the link between the sea level rise and the global warming is not so straightforward as has been put forth in some of the reports. Moreover, embedded in the global trend there are short-term variations (Fig. 1) that cannot be neglected because of their large amplitudes and obvious impacts on the coastal securities. Those short term variations (on interannual to decadal scales) are mostly related to either local factors or the climate modes such as ENSO and ENSO Modoki: The ENSO is

shown to affect the sea level in tropical Pacific (e.g. *Llovel et al., 2009*) and the ENSO Modoki is linked to the recent decadal variation (*Behera and Yamagata 2010*).

4. Sea level changes associated with ENSO and ENSO Modoki

ENSO is a notable mode of climate variation in the tropical Pacific that significantly affects the regional weather and climate of many parts of the world. The warm phase of ENSO, El Niño, is characterized by unusual warming in the sea surface temperature off the coast of Peru in South America reaching a peak phase around the Christmas season. The changes in the ocean-atmosphere conditions during an El Niño event lead to higher than normal sea level in the eastern side of the Pacific, associated with wind and water convergences. The opposite conditions prevail during a La Niña event. Most of the interannual sea-level variations in the Pacific Ocean are shown to be linked with ENSO. Several earlier studies (*e.g. Church et al. 2004, 2006; Cazenave and Nerem, 2004; Carton et al. 2005; Lee and McPhaden 2008*) found a dipole pattern in the sea level trends with large positive (negative) trend in the western (eastern) Pacific associated with ENSO. From the records of tide-gauge stations located within about 15° of the equator, *Church et al. (2004)* reported that large interannual variability (peak-to-peak amplitudes as large as 45 cm) in the sea level are mostly associated with ENSO events.

Unlike the results reported earlier, *Behera and Yamagata* (2010) found that the recent decadal variation in sea level is mostly associated with the ENSO Modoki. Most of the previous studies, that analyzed the interannual variation of Pacific sea level, missed this effect because the altimeter data for those studies were limited only up to about 2002. Nevertheless, some recent studies found that the amplitude of the decadal variation in tropical Pacific has strengthened toward the end of 20th century (*e.g. Feng et al. 2010*). *Behera and Yamagata* (2010) further demonstrated that this decadal change is depicted by the shifting of the positive sea level to the central Pacific mostly during the decade of 1998-2007, when the basin gave rise to several ENSO Modoki events (*Ashok et al. 2007; Weng et al. 2007*).

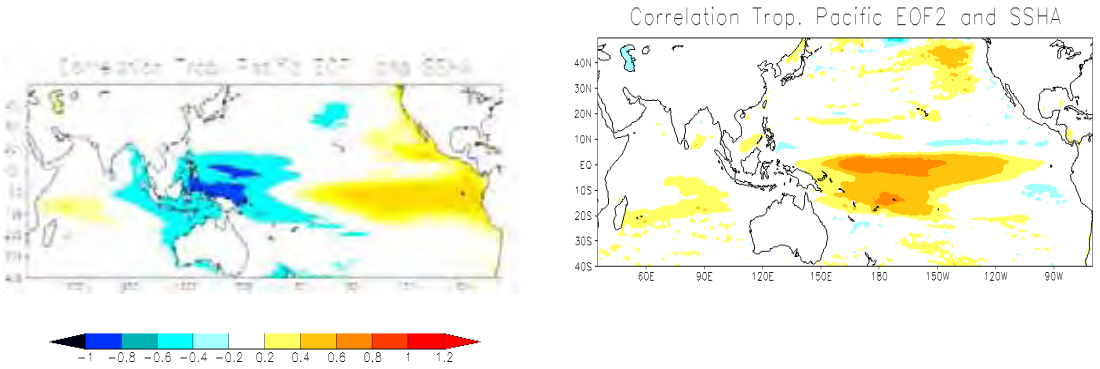


Fig. 4 Correlation of EOF1 (left) and EOF2 (right) with the satellite derived sea level anomalies in the Indo-Pacific regions.

An El Niño Modoki phase is characterized by warm SST anomalies in central Pacific flanked by cold anomalies in the eastern and western Pacific. As the central Pacific is warmer than normal during an El Niño Modoki event, surface wind converges to central Pacific that in turn causes higher than normal sea level there owing to water convergences. An opposite situation prevails during the La Niña Modoki phase. In order to compare the influences of ENSO and ENSO Modoki on the sea level variability of the tropical Pacific, modes of sea level anomalies are identified using EOF technique. The sea level variations related to first two modes are quite different as revealed from the correlation patterns shown in Fig. 4. The EOF1 exhibits a dipole pattern with opposite correlations, which basically correspond to the ENSO variability as reported earlier, in eastern and western Pacific. The EOF2 correlation pattern is distinctly different from that of EOF1. With positive correlations in the central Pacific, the EOF2 correlation pattern illustrates higher (lower) sea level anomalies in that region associated with the phases of El Niño (La Niña) Modoki. Most importantly, as discussed in the followings, the recent occurrences of ENSO Modokis have influenced the decadal variations in the Pacific sea level.

Behera and Yamagata (2010) found that the central Pacific sea level has dropped in 1995-99 to subsequently rise in the middle of 1999, from which time it has stayed persistently above the global trend of sea level until 2007. They demonstrated that the wind convergence to the central Pacific associated with the El Niño Modoki phase helped the decadal rise of sea level during 2000-2004 as compared to a lower sea level phase during 1995-1999 associated with the La Niña Modoki phase. This to some extent is depicted by the average Pacific sea level anomalies (green line in left panel of Fig. 2). It may be noted here that the spatial distribution of the sea level variation is diverse as compared to the basin average trend. For example, the sea level rise in the central tropical Pacific, during the above period, was about 24 mm/year, which is about eight times of the reported rise in the global sea level. Quite interestingly, the low frequency El Niño variability was found to be out of the phase with the sea level variation

during 1995-99. During the rising phase it was noticed that the El Niño index and the central Pacific index were in-phase but the amplitude of the El Niño index was very weak. Therefore, it is clear that the ENSO Modoki dominated the sea level variations in the central Pacific during 1995-2006.

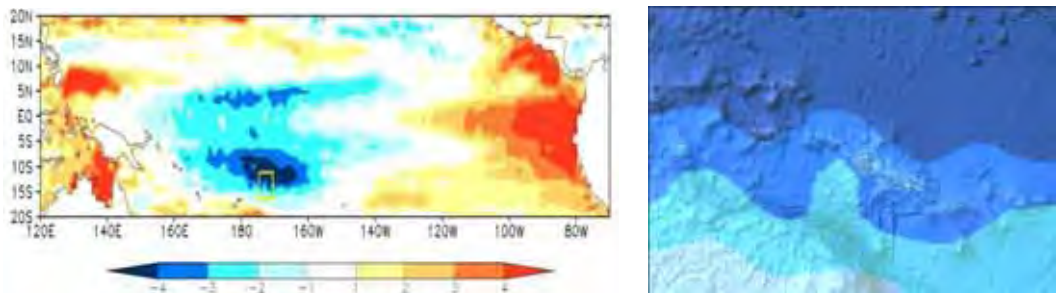


Fig. 5 Spatial distribution of sea level anomalies during the phase of La Niña Modoki (left) and the related distribution around the Samoa Island (right).

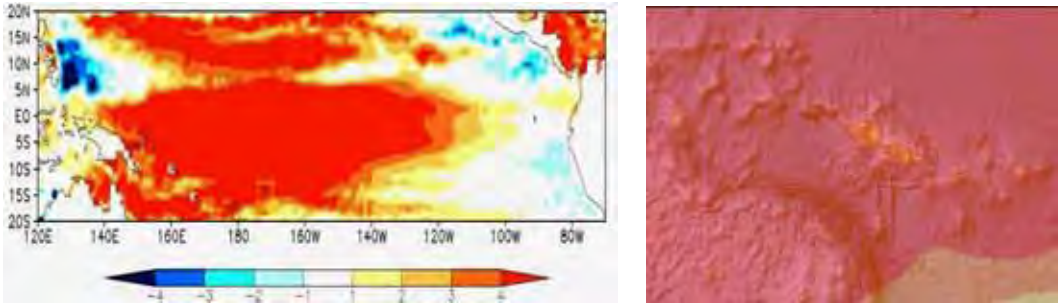


Fig. 6 Same as Fig. 5 but for the phase of El Niño Modoki when the sea level is higher than normal in the central Pacific.

The possible impacts of ENSO Modoki on the sea level variations of the central Pacific are depicted in Figs. 5 and 6. During the La Niña Modoki phase (1997-99), the sea level is lower than normal in the central Pacific. The amplitude of sea level descend is higher in the subtropical south-central Pacific. An opposite pattern is seen in the phase (2002-2004) of El Niño Modoki covering the whole of central Pacific (Fig. 6). The regional patterns are projected on a smaller region (marked by the yellow box in Figs 5 and 6) in southern subtropics to depict the large variations that a coastal zone typically experiences during the opposite phases of ENSO Modoki. This variation in the sea level might cause a large problem for the coastal zone management and needs to be investigated further for its socioeconomic impacts on the coastal zones.

5. Summary

It is written in a report of the Intergovernmental Panel on Climate Change that global sea level rose at an average rate of 1.8 (1.3~2.3) mm/year from 1961 to 2003. The rate is said to be higher during 1993-2003: about 3.1 (2.4~3.8) mm/year, which is expected to accelerate in 21st century. However, the present trend not necessarily signifies the trend that we should expect in the future. There are considerable uncertainties on the projected changes in the sea level. The sea level rise, that is believed to be caused by anthropogenic climate change, can be linked to thermal expansion of sea water and melting of land ice. Most numerical models used to estimate the rising sea level cannot easily estimate the amount of future heat uptake by the oceans and the full effects of changes of ice sheet flow. Therefore, the models will have limitations to estimate the future changes and projected estimates have to be amended time to time. In any case, we should recognize that even the worst projected values are too small compared to commonly accepted threats in many parts of the world. For example, it is noted that the regional trends in sea level changes associated with climate modes such as ENSO and ENSO Modoki have far greater amplitudes than the present/projected global trends.

We observe an unusual state of the tropical Pacific in recent decades associated with El Niño Modoki/La Niña Modoki that has considerably affected the basin's sea level. During the El Niño Modoki phase, warm SST anomalies are found in the central tropical Pacific associated with high sea level. Opposite anomalies prevail in the eastern and western tropical Pacific. The situation reverses during the phase of La Niña Modoki when the central Pacific experiences cold SST anomalies together with lower than normal sea level. Those patterns are very different from that of the conventional El Niño/La Niña. The frequent occurrence of El Niño Modoki is a true identity of the encroaching ocean in the central tropical Pacific. Under this change in climate conditions, the sea level rise associated with the El Niño Modoki needs to be discussed more seriously to develop effective adaptation and mitigation measures for the Pacific islands. (see also http://www.sof.or.jp/jp/report/pdf/200903_ISBN978-4-88404-217-2.pdf).

References:

Ashok, K., S. K. Behera, S. A. Rao, H. Weng, and T. Yamagata 2007: El Niño Modoki and its possible teleconnection. *J. Geophys. Res.*, 112, C11007, doi:10.1029/2006JC003798.

Ashok, K., and T. Yamagata 2009: Climate change: The El Nino with a difference, *Nature*, 461, 481-484.

Behera, S., and T. Yamagata, 2010: Imprint of the El Niño Modoki on decadal sea level changes, *Geophys. Res. Lett*., 37, L23702, doi:10.1029/2010GL045936

Cazenave, A., and R. S. Nerem 2004: Present-day sea level change: Observations and causes, Rev. Geophys., 42, RG3001, doi:10.1029/2003RG000139.

Cazenave, A., K. D. Minh, and M. C. Gennero 2004: Present-day sealevel rise: From satellite and in-situ observations to physical causes, in Satellite Altimetry for Geodesy, Geophysics and Oceanography, vol. 23, edited by C. Hwang, C. Shum, and J. Li, Springer, New York.

Chen G, and C-Y. Tam 2010: Different impacts of two kinds of Pacific Ocean warming on tropical cyclone frequency over the western North Pacific. Geophys. Res. Lett., 37, doi:10.1029/2009GL041708.

Chambers, D. P., C. A. Mehlhaff, T. J. Urban, D. Fujii, and R. S. Nerem 2002: Low-frequency variations in global mean sea level: 1950–2000, *J. Geophys. Res.*, 107(C4), 3026, doi:10.1029/2001JC001089.

Church, J. A., N. J. White, R. Coleman, K. Lambeck, and J. X. Mitrovica 2004: Estimates of the regional distribution of sea-level rise over the 1950 to 2000 period, *J. Climate*, 17, 2609–2625.

Church, J. A., N. J. White, and John R. Hunter 2006: Sea-level rise at tropical Pacific and Indian Ocean islands, *Global and Plan. Change*, 53, 155–168.

Douglas, B.C., 1991: Global sea level rise, *J. Geophys. Res.,* 96, p. 6981—6992.

Feng, M., M. J. McPhaden, and T. Lee 2010: Decadal variability of the Pacific subtropical cells and their influence on the southeast Indian Ocean, *Geophys. Res. Lett*., 37, L09606, doi:10.1029/2010GL042796.

Lee, T., and M. J. McPhaden 2008: Decadal phase change in large-scale sea level and winds in the Indo-Pacific region at the end of the 20th century*, Geophys. Res. Lett.*, 35, L01605, doi:10.1029/2007GL032419.

Llovel W, A. Cazenave, P. Rogel, M. Berge-Nguyen, (2009), 2-D reconstruction of past sea level (1950-2003) using tide gauge records and spatial patterns from a general ocean circulation model, in revision. *Clim. Past*., 5:1-11.

Reynolds, R.W., N.A. Rayner, T.M. Smith, D.C. Stokes, and W. Wang 2002: An Improved In Situ and Satellite SST Analysis for Climate. *J. Climate*, 15, 1609-1625.

Nerem, R. S., E. Leuliette, and A. Cazenave, 2006: Present-day sea-level change: *A review, C. R. Geosci*., 338, 1077– 1083.

Volkov D.L., H.M. van Aken 2005: Climaterelated change of sea level in the extratropical North Atlantic and North Pacific in 1993-2003, *Geophys. Res. Lett*., 32, doi:10.1020/2005GL023097.

Weng, H., K. Ashok, S. K. Behera, S. A. Rao, and T. Yamagata, 2007: Impacts of recent El Niño Modoki on dry/wet conditions in the Pacific Rim during boreal summer. *Climate Dynamics*, 29, 113-129.

Willis, J. K., D. Roemmich, and B. Cornuelle 2004: Interannual variability in upper-ocean heat content, temperature and thermosteric expansion on global scales, *J. Geophys. Res*., 109, C12036, doi:10.1029/2003JC002260.

Global Change and the Sustainable Management of Coral Reefs in Fiji, Tonga, Samoa and Tuvalu

G. Robin South
Institute of Marine Resources,
The University of the South Pacific, Suva Fiji and Apia, Samoa
In collaboration with
S. Bala, P. Chand, L. Limalevu, C. Morris, J. Veitayaki & C. Wilkinson
and the Governments of Fiji, Tonga, Samoa and Tuvalu

2nd International Seminar on Islands & Oceans, Tokyo, Japan. Nov. 29 – Dec. 1, 2010

Outline

- Preamble
- Methodology
- Outcomes – recurrent themes
- The Fishery
- Marine Protected Areas
- National Marine Biodiversity Inventories
- Global Change Projects
- Further Action
- Conclusions
- Acknowledgements

Preamble

Healthy coral reefs are vital to the sustainability of the peoples' livelihoods in the Pacific Islands. Global change has increasing impacts on Pacific coral reefs, including sea level rise, increased sea surface temperature, ocean acidification, and natural phenomena like cyclones, leading to increased vulnerability of coastal communities.

Preamble (continued)

Our aim was to bring Pacific Leaders together with scientists and experts on the sustainable management of coral reefs, so that they can be appraised of the impacts of global change and of those factors that are affecting the health of their coral reefs, using the most recent information available.

Methodology

- The method was to hold face-to-face discussions with government leaders and those responsible for coral reef management in each of the target countries.
- A general overview of coral reef issues in the Pacific was prepared by the Institute of Marine Resources, followed by dossiers on each country, including a gap analysis regarding global change and coral reef governance issues.
- Input from the countries was sought before the dossiers were distributed to participants.

Methodology (continued)

- Workshops were held in the four countries during June – August 2010, at which a total of some 130 senior officials attended.
- The workshop format comprised presentations on the current status of coral reefs and climate change issues and policies given by the project team leaders, government officials, NGOs and civil society representatives.
- Break-out groups reviewed the gap analysis and recommendations. Conclusions were then discussed in Plenary, when a national coral reef action plan was formulated.

Outcomes – Recurrent Themes

- All countries are signatories to the UN Conventions and Agreements relevant to global change and the environment.
- All are reviewing and updating policies regarding conservation of their coral reefs.
- All recognise the importance of global change and its effects on the sustainable use of their marine resources and their food security.
- Climate change has generally not yet been built into national policies as a cross-cutting theme.
- There is a need to improve communication among those line departments responsible for management of coral reefs.

Outcomes – Recurrent Themes (2)

- There was a universal lack of knowledge of the 2002 Regional Oceans Policy, developed and approved by the Forum Leaders and presented at the World Summit on Sustainable Development held in Johannesburg.
- Two countries, Tonga and Tuvalu, resolved to examine the possibility of using the Regional Oceans Policy as a template for the development of National Oceans Policies.
- The need to raise public awareness about global change and coral reef issues was recognised by all, as was the need to find ways to incorporate marine issues in the school curriculum.

Outcomes – Common Threats

- Unsustainable fishing causing stock depletion.
- Pollution from land-based sources.
- Habitat destruction.
- Global change: sea level rise, sea temperature rise; ocean acidification; increased strengths of cyclones.
- Population rise.

The Fishery

- Over-fishing & stock depletion is a major problem.
- This coupled with rapid population growth indicates that there will be a serious shortage of fish within the next 25 years.
- Fishery regulations are adequate, but enforcement is a serious problem, largely because of lack of capacity.
- Expansion of aquaculture may address some of the shortages, but Samoa and Tuvalu have limited opportunities for this.

Marine Protected Areas

- The establishment of MPAs or comparable conservation areas is of high priority.
- Community engagement is essential for the long-term management of protected areas.
- To date only Fiji and Samoa have a high level of community engagement in MPAs.
- The importance of monitoring in support of management and policy is considered a high priority in all countries.
- The lack of monitoring capacity is a limiting factor.

National Marine Biodiversity Inventories

- With the exception of Fiji, National Biodiversity inventories are seriously inadequate and much of the marine biodiversity, with the exception of commercially important species, is unrecorded.
- All recognised the need for much more work on the development of their National Marine Biodiversity inventories.
- The scarcity of national or regional experts in taxonomy is a hindrance. Training in this area is urgently needed.

Global Change projects

- A significant number of donor-supported global change projects are underway in all countries.
- It was noted that there is a need for greater coordination among projects, to avoid duplication.

Further Action

- Outcomes to be followed-up during the next 12 months.
- Need to upgrade National Marine Biodiversity Inventories, and for surveys in Tonga, Samoa and Tuvalu.
- Introduction of the Seagrass Watch programme recommended for Tonga and Samoa.
- Development of a regional climate change clearing house proposed, preferably at USP.
- Need for capacity building in all countries.
- Need to address the disconnection between communities, government and other players.

Further Action (2)

- Need to harmonise projects so as to have better coordination among agencies.
- Need to assist with the marine science programme at the National University of Samoa.
- Need to raise public awareness of coral reef issues, and to find ways of introducing relevant curriculum in schools.
- Reactivate the *Two Samoas* initiatve.
- Facilitate attachments of USP students with their home governments.

Further Action (3)

- Introduce coral identification training in Tonga, Samoa and Tuvalu.
- Encourage closer cooperation with SPREP on coral reef and coral reef management issues.
- Need for good governance at the community level.
- Need for continuous monitoring in support of government policies, and create relevant statistics on stock and fishing in order to understand trends.
- Need for more Marine Protected Areas.

Conclusions

- Good governance is in place in the four target countries
- Policies relating to global change and the sustainable management of coral reefs are in place or under active development
- The issues of global change are recognised by all four countries, but there is a need for a more integrated management approach between government and all stakeholders.
- Enforcement of regulations is limited by capacity in all countries.
- Capacity building in all areas is of high importance.

Conclusions (2)

- Awareness-raising of coral reef issues is recognised as highly important, and should include introduction of appropriate curriculum in schools.
- Countries are custodians of some of the richest marine biodiversity in the world, but are seriously hampered in development of comprehensive national marine inventories because of lack of taxonomic expertise.
- If current trends continue, there will be a crisis in food supply within the next 25 years.

Conclusions (3)

- Alternative life-styles need to be developed as wild fish stocks decline, and aquaculture may be a partial solution to address future food shortages.
- Establishment and monitoring of MPAs is vital to the sustainable management of coral reefs now and in the future. Community engagement is vital to this.

Acknowledgements

- Asia-Pacific Network for Global Change (CaPABLE Programme funding; Project CBA2009-FP11-South).
- PACE-SD and START Oceania at USP.
- The Governments of Fiji, Tonga, Samoa and Tuvalu.
- The USP centres in Tonga and Samoa.
- The Secretariat of the Pacific Regional Environment Programme (SPREP).

Many thanks for your attention

Response of Pacific Islands to Sea Level Rise: An Eco-Technological Challenge in Tuvalu

Hajime Kayanne
Department of Earth and Planetary Science, the University of Tokyo

Abstract

Atoll island is formed and maintained by sand production, transportation and sedimentation process. Major component of sand in the Pacific atolls is foraminifera, which is produced on the ocean-side reef flat, and then transported from the ocean-side to the lagoon-side coast through channels between the islands. Sand is then transported along the lagoon-side coast by longshore current, and finally deposited to nourish sandy beach. At present, however, this natural process has been deteriorated by local human stresses. High production of foraminifera and corals are degraded by human waste. Transportation of sand from the ocean to the lagoon is blocked by a causeway, and longshore transportation and sedimentation along the lagoon coast is prevented by jetties, dredges and upright seawalls. All these local factors severely reduce natural resilience and increase vulnerability against the projected future sea level rise and the global changes. Countermeasure plans must be based on and must not conflict with the natural island formation process. We launched "Eco-technological management of Tuvalu against sea level rise" under Science and Technology Research Partnership for Sustainable Development funded by JICA and JST. The goal of this project is to regenerate sandy beach along Fongafale Island, Funrafuti Atoll Tuvalu by rehabilitation of production, transportation and sedimentation process including establishing foraminifera culture system.

Keywords: atoll islands, Tuvalu, sea level rise, foraminifera

Is Tuvalu being submerged by sea level change?

Tuvalu is an atoll-island country with 9 atolls. Its land territory consists of low, flat islands formed by coral gravels and foraminifera sand with an average elevation of one to two meters. With its low elevation, Tuvalu is threatened by sea level rise induced by the global warming. Projected rise in sea level is estimated as 18 to 59 cm in this century suggested by the Fourth Report of IPCC (IPCC, 2007), and an elevation of 1 to 2 m is low enough to be submerged by this rise.

Actually, in Fongafale Island in Funafuti Atoll, the capital atoll of Tuvalu (Fig. 1), inundation of the central part of the island during spring high tide ("King Tide") has been observed and reported as a result of the sea level rise, because they had never experienced this situation yet in Tuvalu (Fig. 2). Not only popular media but also science journalism attribute this situation to sea level rise, and cite

Tuvalu as the first victim of the global warming (Patel, 2006). However, the amount of sea level rise is estimated as 10 to 15 cm during the 20th century (Church et al., 2006). This amount is large enough for Tuvalu with 1 to 2 m elevation. However, the elevation of the central part of Fongafale Island is 1 m above mean sea level (MSL) and should have been flooded even before the global warming, as the spring high tide reaches 1.3 m above MSL.

Historical change in land-use pattern in Fongafale clearly shows this area had been inundated well before the global warming, as old as 19th century (Yamano et al., 2007). An old geological map shows that in 1896, a swamp fringed with mangroves spread over the central part of Fongafale Island. In 1942 during WWII, an airstrip was constructed by U.S. Army, which obscured the original natural landscape. Since Tuvalu attained independence in 1978, the population of Fongafale has increased from 200 to 5000, and residential area has expanded into the central area, where the swamp had existed and inundation occurs naturally. Therefore, the present problem in Tuvalu is not as simple as that of submergence as a result of sea level rise, induced by global warming, but also includes the expansion of residential areas into a vulnerable part of the island.

However, if sea level rises as projected, by the end of 21st century, most parts of Fongafale will be inundated (Kayanne, 2010). The island itself is not a stable but a dynamic landform both with short (seasonal to yearly) and long (decadal to millennial) timescales (Kench et al., 2009; Woodroffe, 2000). To predict the response of atoll islands to sea level rise and to adapt to it, we need to understand dynamics and formation process of their landforms.

Production, Transportation and Sedimentation Process for Island Formation

Formation and maintenance of atoll islands are controlled by ecological processes (Fig. 3). Firstly, corals piled up to form a rigid structure of coral reefs as a basis for island. But the corals themselves never exposed above the sea. Then coral gravels tossed up to the ocean-side of the coral reef to form ocean-side storm ridges, which reaches the highest elevation of 4 m in the island. Then sand deposited behind the storm ridge to form the main body of the island. We found that more than half up to three-fourths of the island sand consists of foraminifera sand. Therefore, the main contributor of the island sediment is foraminifera sand, which constitutes the major body of the island. In Fongafale Island, foraminifera sand are formed by *Baculogypsina* and *Amphistegina*.

Living foraminifera distribute in an intertidal zone of the ocean-side reef flat with a density of 10,000 to 100,000 individuals/m^2 along Fongafale Island (Fig. 4). The highest density was observed at Fuakea Island, southwest island in Funafuti Atoll, where 1,000,000 individual foraminifera was found over one meter square. Potential production of sand per unit area by the foraminifera is roughly estimated as 0.002m^3 (2 L)/m^2/year. The produced sand is first washed into the lagoon-side coast through channels between the islands. Then the sand is delivered along the island by coastal currents,

and deposited to nourish lagoon-side beach. As the islands grew, the channels had been closed and sand transportation from ocean to lagoon is blocked. Therefore, the formation of atoll islands is self-limiting process.

At present, the sand supply to Fongafale Island is from the causeway between Tengako and Fongafale Islands to the north, and from the southern end of Fongafale Island to the south. Fongafale Island is located at the terminal of sand transportation both from north and south. Figure 5 shows rough budget estimate of Fongafale Island. Approximate mass of Fongafale Island is estimated as 1,400,000 m^3 (area: 1/2 x 2000 x 700 m^2 x thickness: 2m), and as we estimate half of the mass is composed of foraminifera, the amount of foraminifera sand forming Fongafale Island is 700,000 m^3. Sand production on the outer reef flat along Fongafale and Tengako Islands are roughly estimated as 1000 m^3/year (production: 0.002m^3 /m^2/year times habitat area: 10000m x 50m), and thus the island is estimated to be formed in 700 years, which matches with geological estimation of age of the island (about 1800 years). The rough estimate shows that sand production actually had a potential to form the island. Naturally, sand production, transportation and sedimentation process is fundamental to form and maintain atoll islands.

Degradation of the Island Formation Process

However, the natural process of production, transportation and sedimentation has severely been degraded due to increasing human stresses in Fongafale Island. Along the coast of the most densely populated area of Fongafale Island, coral community shifted to fresh macro algae (Fig. 6). This ecosystem degradation has been driven by deterioration of water quality as a result of disposal of human waste from residents through porous island sediment both into the outer reef flat and lagoon coast. Corals are thrived in oligotrophic water, and a slight rise in nutrient level shifts coral community to algae (Lapointe, 1997). Coral acts to form coral reefs as a natural breakwater against the ocean swells, and corals and foraminifera produce gravels and sand for island formation. Fresh algae have no such function. Therefore, this community shift from coral to algae has degraded ecosystem function of coral reef formation and sand production.

Transportation process has also been prevented by artificial construction. The channel between Tengako and Fongafale Islands, which is the first pass-way of sand from the ocean to the lagoon, is blocked by the construction of the causeway, which blocks the sand transportation from the ocean to the lagoon (Fig. 7). Sand should be transported along the lagoonal coast by longshore current, but it is also blocked by jetties and dredged channels along the lagoonal coast. Along the lagoonal coast of Fongafale, boat channels were dredged during the WWII, along which sand transported along the coast leaks into the lagoon, and the jetties, which were also constructed during the WWII, prevent the sand to deliver (Fig. 8).

Sand sedimentation is also prevented by artificial seawalls. Webb (2006) already pointed out that reclamation and upright seawall construction during WWII is the main reason for loss of sandy beach (Fig. 9). It is well known that erosion rather than accumulation prevails at the foot of upright seawall, and results in loss of sandy beach. Another problem is loss of coastal vegetation (Fig. 10). Traditionally island people carefully preserved coastal vegetation, as they knew that it maintains the beach profile by consolidation of sand. Preservation of coastal vegetation links to protection of land. At present, however, the residential area has expanded to the coastline, and coastal vegetation has almost been lost, and its function has also been lost.

Before WWII, the Fongafale coast was fringed with sandy beach, but now sand beach distributes only along a limited area, which indicates loss of natural island formation process. All these local factors destructed the natural island formation process: sand production, transportation and sedimentation. The problem in Tuvalu is not as simple as submergence of island by sea level rise, but most of the problems are derived from local issues. But they significantly spoiled natural island formation process and increased vulnerability against the future projected sea level rise and the global change.

Eco-technological management of the Tuvalu coast

Countermeasure plan to adapt to the future projected rise in sea level must be based on the fundamental understanding of the natural island formation process and the present problems in Tuvalu. It should promote natural island formation process (sand production and sedimentation processes, and the traditional land/vegetation management system) and must not conflict with natural resilience potential. Human activities and engineering countermeasures will be evaluated based on a production, transportation and sedimentation process. If we construct seawalls to counteract sea level rise, they will spoil the sand beach formation, and natural island formation process will be lost.

We launched “Eco-technological management of Tuvalu against sea level rise” under Science and Technology Research Partnership for Sustainable Development (SATREPS) funded by JICA (Japan International Cooperation Agency) and JST (Japan Science and Technology Agency). The goal of this project is to regenerate sandy beach along Fongafale Island, Funrafuti Atoll, Tuvalu by rehabilitation of production, transportation and sedimentation process including establishing foraminifera culture system (Fig. 11). The major focus of this project is foraminifera (foram) sand, and thus it is called “Foram Sand Project” (Fig. 12). Participating institutes are University of Tokyo, Ibaraki University, National Institute for Environmental Studies, University of the Ryukyus and National Institute for Land Infrastructure and Management for Japan side; Department of Environment, Fisheries Department and Land and Survey for Tuvalu side; SOPAC-Applied Geoscience and Technology Division and University of South Pacific as regional nodes in Fiji.

To recover sand transportation from the ocean to the lagoon, the causeway should be open-cut and replaced by a new bridge below which water and sand can be transported. It should be carefully designed not to deliver the sand to the lagoon bottom. For transportation, the jetties should be removed and boat channels should be filled up for smooth sand transportation along the coast.

To enhance foraminifera production, eco-technology to enhance sand production and sedimentation, including foraminifera farming, will be developed and applied to the Fongafale coast. To develop foraminifera culture for enhancement of its sand production, we set an aquarium at Fongafale Island, and using this facility, we will understand and to enhance foraminifera sand production (Figure 12). Now we culture three species of foraminifers, three of them are the most dominant species in Tuvalu: *Baculogypsina* or star sand, *Amphistegina* and *Marginopora*. One individual foraminifer split into several hundreds within a year (Fig. 13). The density of foraminifers on the ocean-side reef flat is up to one million for one square meter, and thus production potential of foraminifers is 500 million for a year. If we enhance foraminifer production in this aquarium, we will transplant the mats on the reef where no foraminifers live.

At the end of the project, a sandy beach will be recovered at a site along Fongafale Island as a result of the production and sedimentation processes and the eco-technological measures to enhance foraminifera sand production. This is a bilateral collaborative project between Tuvalu and Japan, and the capacity to monitor and maintain coastal rehabilitation will also be established (Fig. 14).

This is the world-first challenge to establish eco-technology to enhance island formation against sea level rise. Japanese have no experience of this technology, and thus we need to establish it as an equal partnership between Tuvalu and Japan. We owe entirely to Tuvaluan counterparts in maintenance this aquarium and establishing technology. If we succeed in establishing the new eco-technology it will be applied to other atoll island countries, Marshall, Tokelau, Kiribati and Maldives (Fig. 15).

References

Church, J.A., White, N.J., Hunter, J.R. (2006): Sea-level rise at tropical Pacific and Indian Ocean islands. *Global and Planetary Change* **53**, 155-168.

IPCC (2007): Climate Change 2007 - The Physical Science Basis. Cambridge Univ. Press, 996p.

Kayanne, H. (2010): Pacific island states' coral reefs and their ecological response to changing environments. *Proc. Int. Seminar on Islands and Oceans 2010,* 96-107.

Kench, P.S., Parnell, K.E. and Brander, R.W. (2009): Monsoonally influenced circulation around coral reef islands and seasonal dynamics of reef island shorelines. *Marine Geology* **266**, 91-108.

Lapointe, B.E. (1997): Nutrient threshold for bottom-up control of macroalgal blooms on coral reefs in Jamaica and southeast Florida. *Limnology and Oceanography* **42**, 1119-1131.

Patel, S.S. (2006): A sinking feeling. *Nature* **440**, 734-736.

Webb, A. (2006): Tuvalu technical report – coastal change analysis using multi-temporal image comparisons – Funafuti Atoll. SOPAC Project Report **54**, Suva.

Woodroffe, C.D. (2000): Reef-island sedimentation on Indo-Pacific atolls and platform reefs. *Proc. 9th Int. Coral Reef Symposium* **2,** 23-27.

Yamano, H., Kayanne, H., Yamaguchi, T., Kuwahara, Y., Yokoki, H., Shimazaki, H., Chikamori, M. (2007): Atoll island vulnerability to flooding and inundation revealed by historical reconstruction: Fongafale Islet, Funafuti Atoll, Tuvalu. *Global and Planetary Change* **57**, 407-416.

Figure 1. Aerial photo of Fongafale Island, Funafuti Atoll, Tuvalu, taken from north.

Figure 2. During spring high tide from January to March, sea reaches about one meter below the residential area. Inland area is also immersed. Local residents say that they never had experienced this situation before.

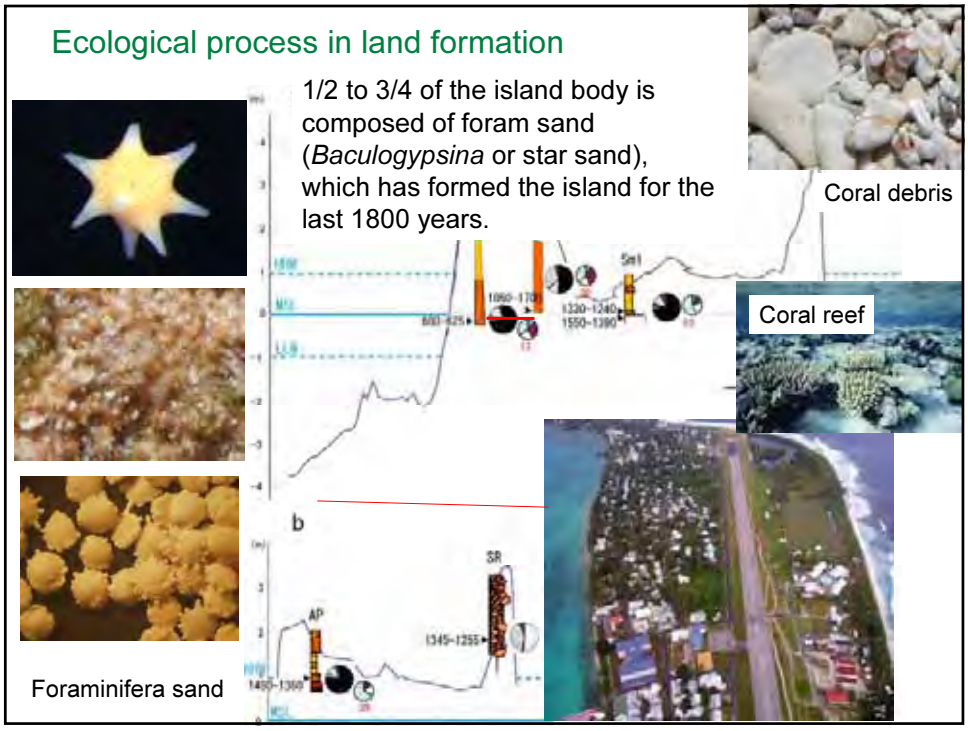


Figure 3. Ecological process is most important in constructing atoll island landform. Corals piled up to form coral reefs, which act as a natural breakwater against ocean swells. Half to three fourths of the island sediment is composed of faraminifera sand. And foraminifera are important contributor to island formation process.

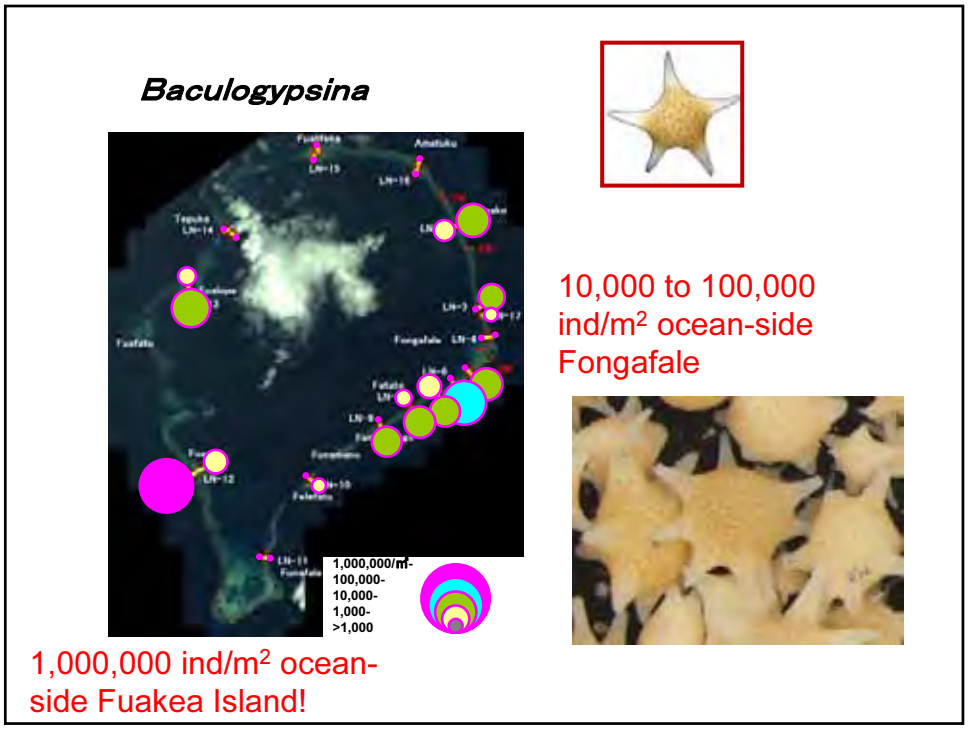


Figure 4. On the ocean-side reef flat along Fongafale island, density of Baculogypsina reaches to 10,000 to 100,000 individuals/m^2. Highest density was observed on the ocean-side reef flat of Fuakea island, southwest of Funafuti Atoll, where 1 million individuals live over one meter squares.

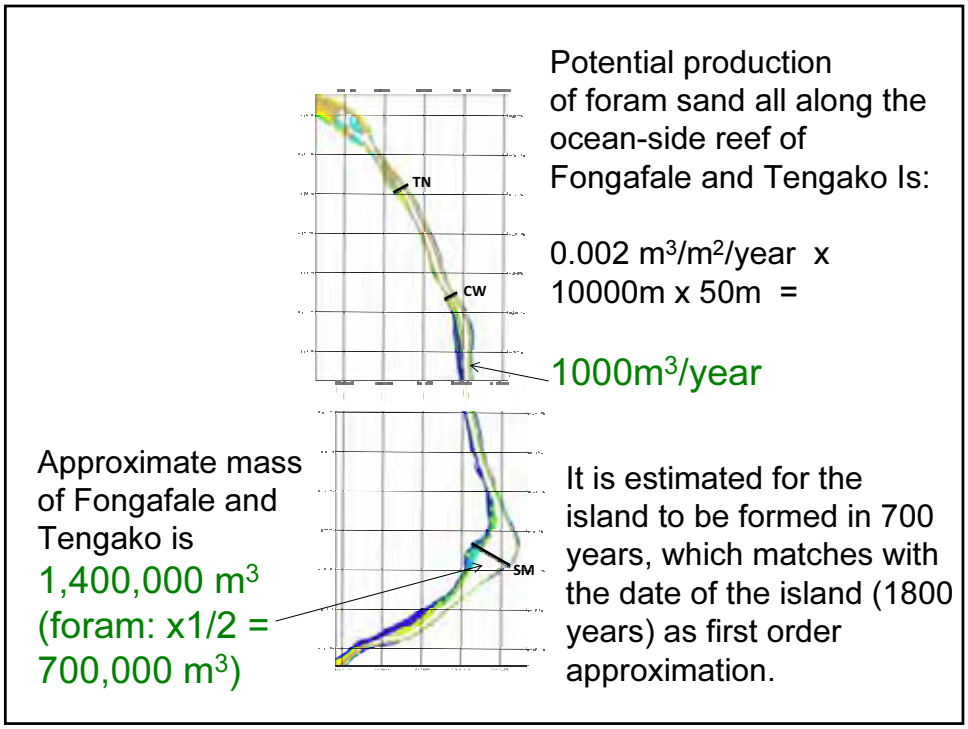


Figure 5. Rough budget estimate of Fongafale Island.

Figure 6. Coral community shifted to macro algal community along the lagoonal coast of most densely populated area of Fongafale Island.

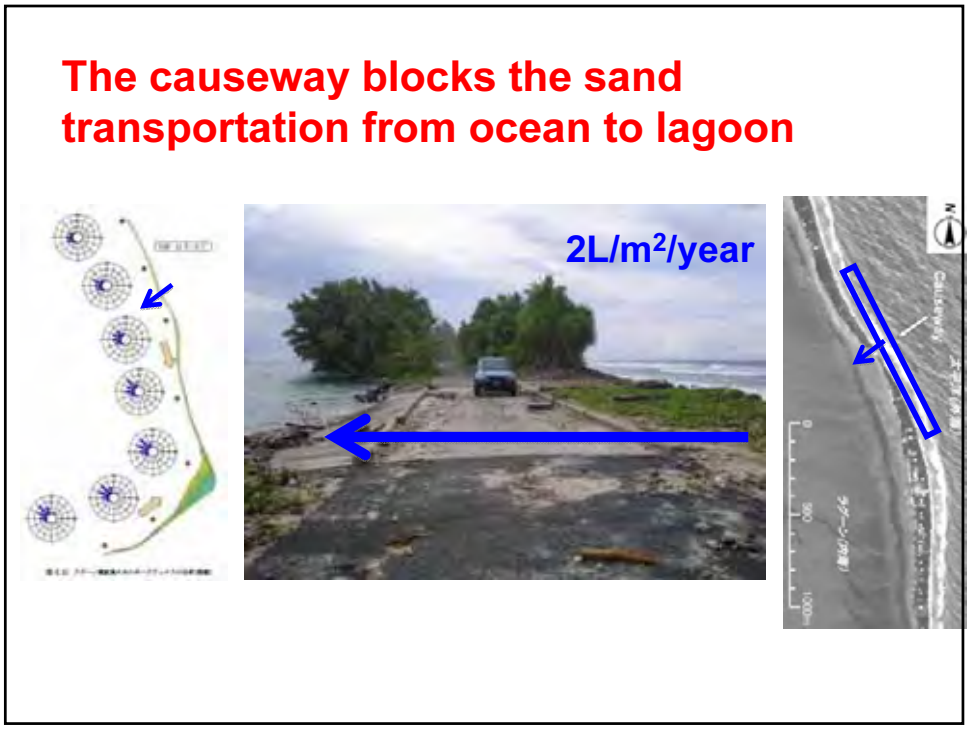


Figure 7. Foraminifera are densely populated on the outer reef flat with a production rate of 2L/m^2/year. However, the causeway blocks the sand transportation from ocean to lagoon.

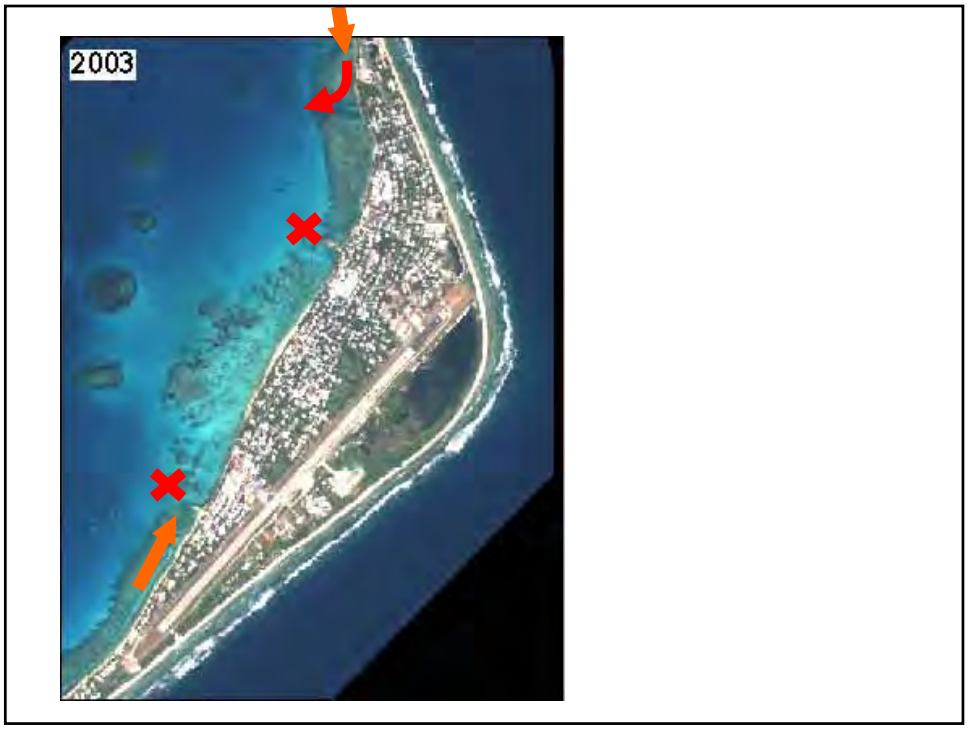


Figure 8. Sand transportation along the lagoon-side coast is blocked by the jetties and leaked through the dredged boat channels.

Figure 9. Collapsed seawalls.

Figure 10. Originally beach is protected by coastal vegetation (photo in right, Funafala Island). But now it is lost by expansion of residential area (photo in left).

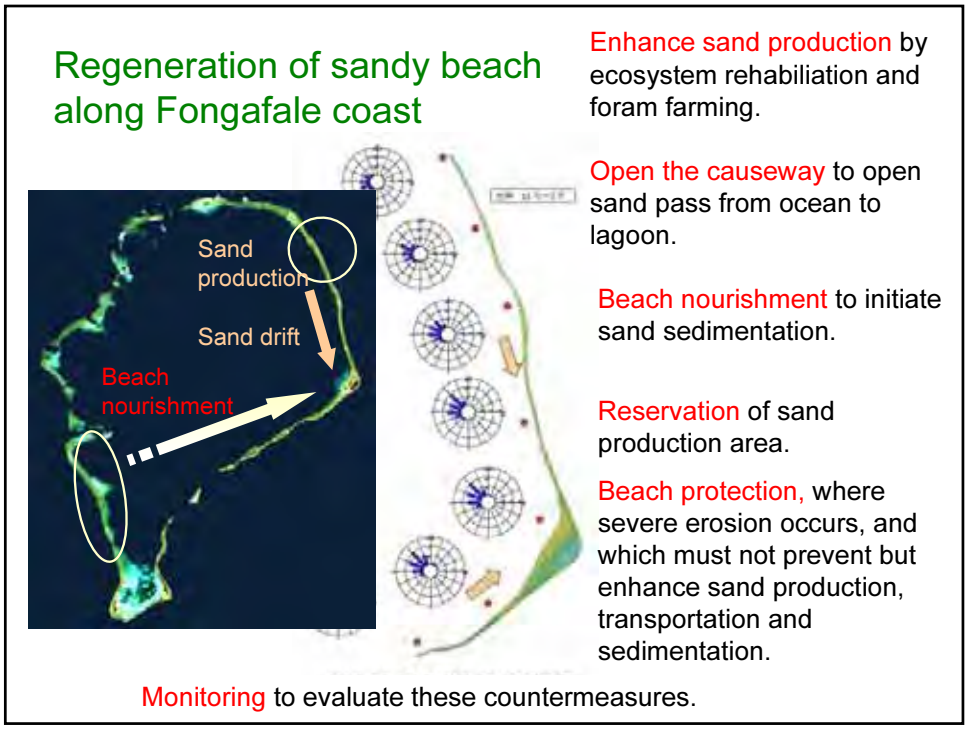


Figure 11. Goal of the Foram Sand Project.

Figure 12. Logo of Foram Sand Project (Eco-technological management of Tuvalu against sea level rise) under Science and Technology Research Partnership for Sustainable Development (SATREPS) funded by JICA and JST.

Figure 13. Foraminifera culture experiment at Tuvalu.

Figure 14. Collaboration with local counterparts.

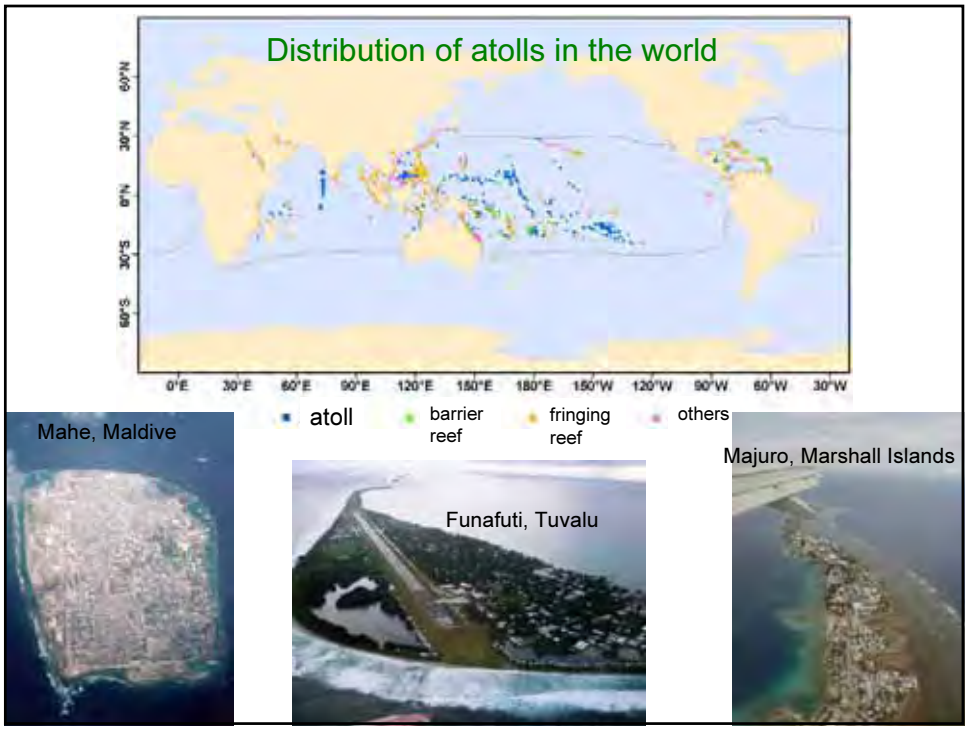


Figure 15. Distribution of atolls in the world.

Multi-sectoral management approaches for the Pacific Islands Region.

Richard Kenchington
Professor, Ecosystem and Resource Management
Australian Centre for Ocean Resource Security
University of Wollongong
NSW 2522, AUSTRALIA

Abstract
The need for management to address the adverse effects of climate change adds urgency to complex and difficult multisectoral issues. For many Pacific island nations the small land mass, isolation, high levels of cultural and resource dependency on coastal lands and waters and the challenges of maintaining an economy that can meet reasonable expectations of the health and wellbeing of the community.

The term ecosystem based management is one of many that address the complexities of multisectoral management of activities with competing objectives and increasing impacts on ecosystem services, cultural values and biological diversity. Many Pacific nations already have complex interlinked problems resulting from land use, management of the freshwater cycle and declining productivity, particularly in nearshore waters. These can lead to loss or decline of culturally significant landscapes and biological diversity and of potential opportunities for new economic activities. The gradual but increasingly significant impacts expected as a consequence of climate change add to the existing problems and it is increasingly urgent for Pacific nations to implement management that can slow, halt and reverse impacts of island based activities in order torestore and maintain the resilience of self repair capacity of natural ecosystems. Ths capacity will be needed to minimise and respond to the expected impacts of climate change.

This paper discusses the elements of ecosystem based management and argues that individual national solutions have to developed through processes that reflect community values and governance systems in objective based solutions that will be implemented, respected, monitored and adapted as necessary in the light of experience and new information.

Introduction

The close and immediate linkage of marine and terrestrial ecological processes is a fundamental issue in management of small islands. For most islands the resource base is restricted to materials and products that can be harvested or grown from limited areas of land and nearshore seas. The opportunities for management to maintain or increase economic activity to meet the needs of the present generation are limited and decline and loss of ecosystem resources and services such as beach or island maintenance or the freshwater cycle can have long lasting and economically devastating impacts.

For any nation, coastal zone management involves complex multi-sectoral decision making. The case for a multi-sectoral approach to coastal and marine ecosystem management has been made many times. It was a component of the United Nations Conference on the Human Environment (United Nations, 1972) and the World Conservation Strategy (WCED, 1987); it was elaborated in chapter 17 of the 1992 Rio de Janiero "Earth Summit" WCED, 1992-1993) and subsequently at the 2002 World Summit on Sustainable Development (United Nations, 2002). The importance of Pacific island and ocean management is emphasised by the the growing challenges of environmental change through sea level rise, increased severity and frequency of extreme weather events and the expected biophysical consequences of warming and acidification of the ocean.

The issues are complex, dynamic and socio-environmental. Geographic, sectoral and often jurisdictional boundaries are typically fuzzy. The biophysical and socioeconomic dynamics preclude an absolute or permanent solution because any interim solution generates further issues. These are the characteristics of a wicked problem in the sense of Rittel and Weber, (1973) who point out that solutions to such problems are not true or false, not good or bad, generally not permanent but the best that can be achieved at a point in time.

Wicked problems may be contrasted with tame problems that can be solved within or with little change to existing frameworks of inquiry, legislation, community engagement anf decision-making. (Rittel and Weber, 1973).

This paper discusses briefly the challenges and the opportunities and constraints of multi-sectoral management approaches for island nations and the global community concerned seeking to address the addition of the expected impacts of environmental change to the existing wicked problems in Pacific island and ocean management.

Components of the challenge

Community use and dependency

For most of their history, the human communities of Pacific Islands have been substantially if not totally isolated from others and dependent on the natural resources their islands and the shallow seas and waters surrounding them. Subject to the variations of seasons, longer climatic processes and occasional catastrophic events, customary management practices generally maintained a balance between human demands and the capacity and constraints of the ecological resource base.

From the 19th century onward increasing global contact and economic engagement have changed the the nature of the relationship of island communities with their environment and natural resource base. Opportunities and expectations for engagement with the global economy, have reduced the direct dependence of island communities on the immediate biophysical environment and resource base. But in responding to those opportunities many communities have been exposed to unforeseen and unintended impacts. These include reduced fishery productivity, loss of shoreline protection, contamination of fresh and salt water and gradual loss of environmental quality and cultural amenity.

The benefits of reduced dependence on the capacity of local environmental systems have come at the cost of increased dependence on trade, intergovernmental agreements and international linkages for support in addressing growing and changing pressures.

Competing uses, objectives and pressures

Increasing economic engagement changes the relationship between people and natural resources. Resources are traded and the proceeds used to purchase goods and services. Offshore tuna fisheries have become a major driver broadening many Pacific Island economies. The factories and infrastructure needed to support fisheries and other activities provide employment and lead to concentration of human populations in urban centres with access to government and commercial services and a growing range of economic options,. This is reflected in expectations of an increasing range of possibilities for economic use and development and of competing pressures for provision of public and private sector services and for financial, resource and human skills to provide them..

The ecological systems of Pacific Islands have evolved with pressures of climatic extremes of the El Nino Southern Oscillation, severe storms, volcanic events, tsunamis, and variations in the strength and direction of current systems. Human uses and impacts are relatively new and place additional demands on the resilience or self-repair capacity of ecosystems.

Upstream/downstream effects and cumulative impacts

The development of urban centres and the economic activities and land uses that support them can involve major changes to ecosystems and the services they provide. The effects and impacts on ecosystems typically grow slowly. Without management, the costs and pressures of development can gradually overwhelm the capacities to prepare for or respond to the growing degradation of ecosytem services and amenity.

Many Pacific islands have a history of development with inadequate resourcing for infrastructure and face substantial challenges in management of the fresh water cycle, treatment and disposal of wastes and the integrity of shorelines.

In many cases the management of the freshwater cycle and treatment of liquid and solid wastes results in nutrient, chemical and silt pollution that prevents or reduces production of sand and rubble from coral reef communities that is essential for building and maintaining coral islands and beaches.

In other cases poorly designed reclamation, shoreline protection, causeways or flood prevention measures alter sediment flows and cause erosion around structures or at other locations on island shorelines.

These are matters of immediate and major concern in several Pacific Island nations and with, technical and resource support, they can be addressed within the jurisdiction of the affected nations.

Climate Change

The expected additional and cumulative effects of climate change over coming decades include increased frequency and severity of severe storm events, and potentially major ecosystem changes for coral reefs and coastal marine ecosystems. These are expected as a consequence of increasing temperature and acidity of sea water and rising sea level. Climate change is a an additional and major concern for Pacific Island nations.

The expected consequences of climate change include inundation of coastal lands, major shoreline changes, damage to infrastructure, decreased productivity of coastal ecosystems, contamination of natural freshwater and loss of ecosystem services that maintain and protect islands and coastlines. Island managers generally have very limited capacity beyond diplomacy and international advocacy to address the human uses that drive atmospheric pollution.
.
The needs for national and regional management for climate change in the Pacific adds to the importance of the existing difficult internal challenges of addressing island, nearshore marine and offshore ecosystem health and functions while sustaining the resource base of fisheries and other ecosystem services.

The Management context

Integration and coordination

Addressing, adapting in preparation for or mitigating the impacts of climate change for Pacific nations requires multi-sector integration within nations and co-ordination between nations in the Pacific region.

Kenchington and Crawford (1993) drew a distinction between integration, where the component management agencies of a government are required to operate consistently within an overarching framework of policy objectives, and coordination where agencies or, in a global region, nations agree to work within such a framework but are not statutorily bound to do so.

Most governance systems are based on substantial sectoral independence and initiative with clear allocation of responsibilities. Within the allocations, agencies typically have considerable autonomy reflected a sayings such as “Good fences make good neighbours”. Matters of substantial inter-sectoral conflict of objective are addressed as they arise within heirarchical systems of cabinet and executive government.

The complex linkages of biophysical and socio-economic systems of islands, coastal lands freshwater and marine ecosystems present major challenges in sectoral governance. Causes and effects, costs and benefits are often widely separated between sectors and between jurisdictions.

Ecosystem Based management

The concept of ecosystem based management is simple, managing the totality of human and uses and impacts within levels that do not compromise the natural resource base, ecosystem services and

biological diversity of the world's ecosystems. The reality of ecosystem based management challenges and threatens existing sectoral managers and advocates of the new paradigm to because it requires clarity in defining and addressing competing objectives within a framework that addresses the sustainability of ecosystems. Tallis et al (2010) discuss perceived barriers to ecosystem based management. They show that it can be approached from a range of starting points and suggest key steps in an integrated management process that makes ecosystem base management feasible

The complexity of the challenge is reflected in a large and growing number of acronyms that mainly reflect specific solutions developed for particular contexts. A World Bank report (2006) examined 32 marine-management systems and derived 4 main clusters that reflect sectoral origins or priorities :

- Marine protected area tools, primarily for biodiversity conservation and habitat protection;
- Multi-use management tools, primarily for balanced conservation and socioeconomic uses;
- Sustainable use marine-resource management tools, primarily for extractive use; and
- Cultural/ecological/social Protection reserves, Primarily for indigenous and traditional non-indigenous communities.

There are particular challenges for ecosystem based management design in the Pacific.

- Many of the problems, including climate change, are largely beyond the jurisdictional reach of nations.
- Many of the solutions impose information and technological demands that are largely beyond the resources of the nations; and
- Some of the solutions with respect to fisheries and marine protected areas need adaptation to achieve consistency with customary law, practice and ownership of marine resources and areas

There is a substantial literature and many web-based of case studies and approaches to marine EBM. (eg. UNEP, ELI (2009) and the EBM Tools website). They reflect the range of approaches to robust and systematic development and implementation of policy with substantial common elements which include:

- Long Term Goals for the desired state of the system and outcomes of management;
- National objectives, consistent with the goals that can be applied in plans at local to national scales ;
- Principles to guide decision making;
- Culturally appropriate and effective engagement of stakeholders in development and implementation of management;
- Consistent policy integration
  locally within sectors and jurisdictions
  nationally between sectors and jurisdictions
- Clear allocation of precedence and responsibility for resolution of differences and overseeing

implementation

- Performance indicators and independent monitoring of outcomes for resources, ecosystems and human behaviour in relation to management conditions

- Commitment of human , financial and technical resources to implementation

EBM and Climate Change in the Pacific

Addressing or mitigating the effects of climate change, ocean warming, acidification and linked consequences requires multi-sectoral integration within nations and multinational and global coordination for the region.

This requires substantial interdisciplinary and multidisciplinary integration of biophysical and socio-economic sciences to address complex intersecting and dynamic "wicked" problems. These include interactions between, biophysical resource status, the consequences of human uses and impacts, the feedback to expectations of resource availability and support for reasonable economic expectations for growing populations. Brown et al (2010) discuss the use of the term trans-disciplinary to address the need to engage biophysical and socio-economic disciplines and action based programs to address wicked problems. A core element of the concept is to reach beyond cause and effect observation of human behaviours to engage people as actors in the development, longer term implementation and adaptation of strategies and solutions to address dynamic problems. However great the medium and long term biophysical and economic need for a different approach and balance in management, the change can only flow through changes in human behaviours and the values and understandings that drive those behaviours.(Kenchington and Day, 2011).

The elements of the problems in the Pacific islands are familiar. Economic development is based substantially on natural resource trade – particularly wild-caught fish. Reasonable expectations of human welfare in terms of quality of life, health, education, culture have to be addressed within the constraints of remoteness, land, water, resource and and capacity constraints to developing and maintaining critical and sustainable population masses for diverse economies. The impacts of economic activity can include deterioration of local natural seafood resource base, cultural amenity and ecosystem services such as sand supply for shoreline maintenance, protection of shoreline from storm waves by coastal vegetation.

The framework for addressing these problems is characterised by complex interactions of government and non-government organisations or less formal groupings. . At the local level to national level are measures of customary land and resource management, individual and family resource access, business interest relationships to communities through employment, with broader economic opportunities but competition for land, resources and labour changing cultural dynamics. At the regional to national levels there are more formal political and governance structures and objectives that have far reaching implications for ecosystems and existing social and cultural systems. At the international and regional levels engagement through treaties and conventions can help to address problems from the perspective of sectoral concepts of development, health, environment, trade and security.

There is much to be learned from examples in different parts of the world but because of the complexity or wickedness of the problems the solutions are rarely directly transferrable from one location to another.

Conclusions

Multi-sectoral management in preparation for climate change will require major changes in human behaviours within and beyond the Pacific. Achieving these changes will require information, understanding and trust at levels from the village to the international economic management community. These will develop from increasing understanding in a range of discplines and cultures addressing:

- uses, impacts, rights, responsibilities, expectations and sustainability.
- upstream/downstream, tidal , current and atmospheric cross boundary effects
- quality and expectation of life, food security, economic options, poverty
- conflicting and cumulative uses and impacts

The normal academic processes of information gathering, analysis, discussion are important but not adequate for communicating and addressing the urgency of the issues that are expected to be exacerbated by climate change. But there are many approaches to ecosystem based management that can be adopted and evolve with the changing circumstances facing the Pacific.

Keywords

Ecosystem based management, Climate change, Pacific, Island, Coastal, Impacts, multi-sectoral

References

Brown, V.A., Deane, P.M., Harris, J.A. And Russell J.Y. Towards a just and sustainable future pp 3 – 15 in Brown, V.A., Harris, J.A and Russell (Eds) Tackling Wicked Problems. Earthscan. (2010)London and Washington 312pp.

Environmental Law Institute. 2009. Ocean and Coastal Ecosystem-Based Management: Implementation Handbook. Washington, DC: Environmental Law Institute. 158 pp.

Kenchington, R.A. and Crawford, D. "On the meaning of integration in Coastal Zone Management", *Ocean and Coastal Management,* vol.21(2), pp.109–127.

Kenchington, R. A .& Day J. C. (2011) Zoning, a fundamental cornerstone of effective Marine Spatial Planning: lessons learnt from Australia's Great Barrier Reef. Journal of Coastal Conservation (147) in press

Rittel, H. and Weber, M.(1973) Dilemmas in a general theory of planning. *Policy Sciences* (4) 155-169

Tallis, H.,Levin, P. S.,Ruckelshaus, M.,Lester, S. E.,McLeod, K. L., Fluharty, D. L.and Halpern, B. S.(2010) The many faces of ecosystem-based management:Making the process work today in real places, Marine Policy 34(2) 340-348

United Nations. 1972. Report of the United Nations conference on the human environment. United Nation, Geneva, Switzerland. Available at: <http://www.unep.org/Documents.Multilingual/Default.asp?documentID=97> Accessed 12 September 2009.

United nations (2002). Report of the World Summit on Sustainable Development. Johannesburg, South Africa, 26 August-4 September 2002. United Nations New York. 147pp. Accessed 25 March 2011 on http://daccess-dds-ny.un.org/doc/UNDOC/GEN/N02/636/93/PDF/N0263693.pdf

WCED (World Commission on Environment and Development). 1987. Our common future. Oxford Univ. Press, Oxford and New York. 400 p.

_____. 1992–1993. Agenda 21 and the UNCED proceedings. Oceana Publications, New York. Six volumes.

World Bank (2006) Scaling Up Marine Management The Role of Marine Protected Areas. Report No. 36635 – GLB. Washington DC

The Adverse Impacts of Sea Level Rise on the Rights of Islands and Island States over their Surrounding Sea Areas: Procedural Options of International Legal Measures for Mitigating Impacts

Moritaka Hayashi
Special Fellow, Ocean Policy Research Foundation

Key words: Baselines, sea level rise, law of the sea, UNCLOS, small islands

Abstract

In the paper presented at the last International Seminar, the author reviewed various problems which would be caused by the ambulatory nature of baselines under UNCLOS provisions. Coastal State are normally obliged to shift their baselines landward as sea level rises, and this would involve the loss of sovereignty or sovereign rights over some maritime areas along the outer limits of the various zones they have been validly claiming. In most serious cases, when an island is totally submerged, the State to which it belongs would lose its entitlements over the surrounding maritime zones. A prominent exception to this rule is the case where the extended continental shelf is permanently established on the basis of the recommendation of the Commission on the Limits of the Continental Shelf.

As one of the possible means to limit the adverse impacts of sea-level rise as much as possible, the author suggested that a rather simple amendment be made to UNCLOS provisions aimed at freezing the baselines currently drawn or to be drawn under those provisions. Such an amendment would be of particular benefit for those island States which are facing the threat of submergence due to sea-level rise.

The present paper focuses on the case of total or near total submergence of islands or island States. First, it recapitulates the effects of such phenomena on the rights over their surrounding maritime areas under the current UNCLOS rules. It highlights then the merits of the proposed amendment. The greatest merit of the amendment is to enable coastal States to secure the sovereignty and sovereign rights which they currently enjoy over their maritime zones even after they suffer major adverse effects to their baselines. Such a solution would be fair and equitable because sea-level rise is something which is not attributable to the affected coastal States, and certainly not to them alone even if some of them could be major contributors to the green-house gas emissions.

The paper then examines various procedural options for adopting such an amendment to UNCLOS. It is concluded that, among various options, the best one would be the negotiation of an agreement supplementary to UNCLOS through an informal forum within the UN, and the formal adoption of its text by the General Assembly.

I. Introduction

In the paper presented at the last International Seminar held in January 2010[1], I reviewed

[1] M. Hayashi, "The International Legal Implications of Climate Change/Variability for the Rights of Island States over Their Surrounding Waters", *Proceedings of International Seminar on Islands and Oceans 2010, January 20-22, 2010, OPRF*, p. 127. See also M. Hayashi, "Sea Level Rise and the Law of the Sea: Legal and Policy Options", *Proceedings of International*

international legal rules relating to baselines, which play important roles for measuring the territorial sea, the contiguous zone, the exclusive economic zone (EEZ), and the continental shelf of coastal States. It was also pointed out that baselines are often important for establishing maritime delimitation lines between neighboring States.

I then examined various impacts that sea level rise could cause on baselines, stressing in particular their *ambulatory* nature. Simply stated, the ambulatory nature of baselines obliges the coastal State to shift its baselines landward as sea level rises, and this would entail the loss of sovereignty or sovereign rights over certain maritime areas along the outer limits of the various zones it has been validly claiming, with the exception of the case of extended continental shelf which is permanently established on the basis of the recommendation of the Commission on the Limits of the Continental Shelf (CLCS). Furthermore, a serious rise in sea level could cause small islands submerged totally or almost totally.

I also discussed briefly the special problems which small island States would have to face when their islands become totally submerged, or mostly submerged to the extent that makes them uninhabitable or unable to sustain economic life of their own. As one of the best legal solutions to mitigate the adverse impacts of sea level rise, I suggested that an amendment to the UN Convention on the Law of the Sea (UNCLOS) be adopted.

In this paper I shall focus more squarely on the suggested amendment and in particular the procedural options available to the international community for formally adopting such an amendment. Before doing that, however, I shall elaborate on some of the points which were not sufficiently covered by my previous paper, and recapitulate my arguments. Here, in order to highlight the most serious cases involving small islands, I shall deal only with the cases where islands become totally or mostly submerged due to sea level rise, thus leaving aside less serious cases where baselines may have to be merely shifted because of the physical change of coastlines. It should be understood that, although the paper deals typically with the phenomena of sea level rise due to climate change, the same arguments would apply also to the cases of total or near total submergence of islands caused by other natural processes.

II. Effects of Total or Near-total Submergence of Islands or Island States on Surrounding Sea Areas under the Law of the Sea

The possible effects *under the existing law of the sea* caused by the total or near-total submergence of an island or island State could be discussed under four different situations: (1) where an island belonging to a State becomes totally submerged; (2) where such an island becomes mostly submerged to the extent that it is considered a “rock” under Article 121 (3) of UNCLOS; (3) where all the islands constituting an island State become totally submerged; and (4) where some of the islands constituting an island State become totally submerged and the remaining islands become mostly submerged to the extent that they are considered “rock[s]” under Article 121 (3).

(1) Total submergence of an island belonging to a coastal State

In the case where an island belonging to a coastal State becomes totally submerged:

- The State loses its sovereignty, sovereign rights or any other rights over the territorial sea, the contiguous zone and the EEZ around the island since the baseline for measuring

---

Symposium on Islands and Oceans, January 22 and 23, 2009, OPRF, p. 78.

such maritime zones would no longer exist, and hence no such zones themselves would exist.

- With regard to the continental shelf, which belongs to the coastal State *ipso facto* and *ab initio*[2], the State continues to enjoy its sovereign rights up to its outer limits which are established on the basis of the recommendation of the CLCS and permanently described on the charts deposited with the UN Secretary-General in accordance with Article 76 (8) and (9) of UNCLOS. No provision exists in UNCLOS for those States which do not claim any outer continental shelf extending beyond the 200 nm limit. However, it would be unjust and unfair for such States to lose their continental shelf up to 200 nm when the island becomes submerged, while other States may secure their continental shelf even beyond 200 nm. Therefore the coastal State should be able to make use of the same procedure for depositing charts with the Secretary-General under Article 76 (9) in order to establish the outer limit of its continental shelf at 200 nm as well;
- With regard to the seabed area created by the submerged island itself, no clear conclusion may be drawn from UNCLOS provisions. It would however be reasonable to consider it as constituting a special kind of territorial sea in light of the principle of general international law that the territory of a State consists not only of the land but of its airspace and its subsoil,[3] and the fact that the seabed area concerned used to be precisely the subsoil of the land territory. This conclusion may be supported also by an unusual situation which would otherwise arise where the coastal State would lose all the rights over the central seabed area while it may in certain cases maintain the sovereign rights over the surrounding continental shelf up to 200 nm or more.

(2) Near total submergence of an island to the extent that it becomes a "rock" under Article 121 (3)

In the case where an island belonging to a coastal State becomes mostly submerged and it is considered a "rock" which can no longer sustain human habitation or economic life of its own under Article 121 (3):

- The territorial sea and the contiguous zone, if established, of the island remain, though adjustment may have to be made to the location of baselines (Art. 121 (2)):
- The State may no longer claim its EEZ around the island (Art. 121 (3));
- With regard to the continental shelf, the same rule as for the situation under (1) above applies, i.e., the coastal State would lose its sovereign rights thereover unless it has permanently established its outer limits in accordance with UNCLOS provisions.

(3) Total submergence of all the islands constituting an island State

In the case where all the islands constituting an island State become totally submerged, i.e., where an island State loses the entire land territory, and assuming that the State survives somewhere else under arrangements for some kind of union or federation with another State (hereinafter "successor Sate")[4]:

---

[2] The North Sea Continental Shelf Cases, *ICJ Reports 1969*, p. 23.

[3] R. Jennings and A. Watts, eds., *Oppenheim's International Law*, 9th ed., vol. I (1996), pp. 572-573,

[4] For possible forms of such union or federation, see M. Hayashi, "Sea Level Rise and the Law of the Sea: Legal and Policy Options", *Proceedings of International Symposium on Islands and Oceans, January 22 and 23, 2009, OPRF,* p. 78 and R. Reyfuse, "W(h)ither Tuvalu? Oceans Governance and Disappearing States", *ibid.*, p. 91.

- With regard to the territorial sea, the contiguous zone, and the EEZ, the same conclusions as in the case under (1) above apply, i.e., the successor State has no rights over these zones;
- As for the continental shelf, as well as the seabed area formed by the submerged islands, the same conclusions as those stated in the case under (1) above apply, and any rights over the continental shelf and the seabed area formed by submerged islands could be exercised by the successor State, or in some other manner that would be agreed upon by the States concerned.

(4) Near submergence of an island State where all the un-submerged islands become "rocks" under Article 121 (3)

In the case where some of the islands of the island State are totally submerged but the remaining un-submerged islands become uninhabitable and considered as "rocks" under Article 121 (3), forcing the government and the entire population to move out of the islands and form a new State (successor State):

- The territorial sea and the contiguous zone of the un-submerged islands remain, over which the successor State exercizes the sovereignty and jurisdiction;
- The island State loses the sovereign rights over its entire EEZ;
- The island State loses the sovereign rights over the continental shelf unless it has permanently established its outer limits in accordance with UNCLOS provisions. The sovereign rights thus retained may be exercized by the successor State.

III. Proposed Amendment to the Existing Law

With a view to finding a legal remedy to the adverse effects of sea level rise against coastal, and in particular island, States, I suggested at the last International Seminar that a rather simple amendment should be made to UNCLOS. With a slight change made subsequently at the end of the sentence in order to cover broader natural processes than sea level rise alone, the core provision of such amendment would read as follows:

> *A coastal State may declare the baselines established in accordance with the provisions of UNCLOS as permanent once it has shown them on charts of an adequate scale or described them by a list of geographical coordinates, and given due publicity thereto, notwithstanding subsequent changes in geographic features of coasts or islands caused by climate and other natural processes.*

The main purpose of the proposed modification of the existing law is, in short, to freeze the baselines as currently drawn or to be drawn by coastal States in accordance with UNCLOS provisions. The proposed amendment would, however, introduce a fundamental change to the legal consequences of total or near-submergence of islands as described above. Once a coastal State has established its baselines as permanent in accordance with the amendment, the following consequences would be brought under the four different situations:

(1) In the case where an island belonging to a coastal State totally submerges,

- The State may maintain the baseline points which were fixed originally on the island, as well as the territorial sea, the contiguous zone, the EEZ and the continental shelf which the island concerned had generated, up to the limits established according to the existing

provisions of UNCLOS;

- With regard to the seabed area created by the submerged island itself, it should be considered as forming a special kind of the territorial sea since it used to be the subsoil of the land territory and would be located totally within the territorial sea.

(2) In the case where an island belonging to a coastal State becomes mostly submerged, to the extent that it is considered a "rock" under Article 121 (3),

- The State may maintain the baseline points which were originally fixed on the island, as well as the territorial sea, the contiguous zone, the EEZ and the continental shelf which the island concerned had generated up to the limits established according to the existing provisions of UNCLOS;
- The submerged areas of the island which are located within the originally fixed baseline should be considered as internal waters since they would be situated between the territorial sea and the remaining land territory.

(3) In the case where all the islands constituting an island State are totally submerged, forcing the government and population to move elsewhere to form a new State, the same conclusion may be reached as (1) above, and the rights over the submerged islands and their maritime zones could be exercised by the successor State.

(4) In the case where most of the islands constituting an island State are totally submerged, and the remaining islands are mostly submerged to the extent that they are considered "rocks" under Article 121 (3), forcing the government and population to move elsewhere to form a new State, the island State may maintain the baseline points which it fixed originally on its islands, as well as the various maritime zones up to the limits as established according to UNCLOS. The island State may regard the submerged areas of its partially submerged islands within the original baseline as internal waters. All the rights of such State could be exercised by its successor State.

The greatest merit of the proposed amendment is to enable coastal, including island, States to secure the sovereignty and sovereign rights which they currently exercize over their maritime zones even after they suffer major adverse effects to their baselines due to, eg., climate change or variability. Such a solution would be fair and equitable because the cause of climate change/variability is something which is not attributable to the affected coastal States, and certainly not to them alone even if some of them could be major contributors to the green-house gas emissions. This is particularly so in case of small island States, whose contribution to climate change and variability is patently negligible.

Another merit of the amendment is the fact that by freezing the currently claimed maritime areas of the coastal States, it would not deprive other States of any of their rights with respect to their maritime zones. It would therefore not increase the chances of disputes between States on account of changed geographic features due to climate change/variability or other natural processes.

IV. Procedural Options for Adopting Proposed Amendment

If the above-mentioned proposal for amending the existing rules appears to be generally acceptable for the international community, what options are available for adopting it formally or otherwise achieving practically the same legal, binding, effect? It appears that, given the specific UNCLOS provisions laying down the existing rules as discussed above, the only

effective way of doing so would involve the revisiting of the relevant provisions.[5] At least three options are available for this purpose. These are (1) formal amendment to UNCLOS provisions, (2) their *de facto* amendment by a decision of the Meeting of States Parties to UNCLOS, and (3) adoption of a supplementary agreement for the modification or "implementation" of its provisions.

(1) Formal amendment to UNCLOS provisions

UNCLOS provides that any State Party may, by written communication to the UN Secretary-General, propose specific amendments to its provisions and request him/her to convene a conference to consider such amendments. The Secretary-General must convene the conference (of the States Parties) if not less than one half of the States Parties reply favourably within 12 months after the date of the circulation of the request (Art. 312 (1)).

Alternatively, a State Party may propose an amendment to be adopted by the "simplified procedure" without convening a conference and request the Secretary-General to circulate the proposal to all States Parties. If a State Party objects to the proposed amendment or to the proposal for its adoption by the simplified procedure within 12 months from the date of its circulation, the amendment shall be considered rejected (Art. 313).

The above-mentioned formal amendment procedure has been available since late 2004, and the simplified procedure since 1994. They have however not been used so far. Because of the fact that UNCLOS was adopted as a "package deal" after prolonged and difficult negotiations, it is understandable that any proposal for amendment would be likely to invite strong resistance in an effort to ensure the unified character and the integrity or balance achieved in the UNCLOS text. There appears to be a strong feeling that allowing a chance to one amendment would lead to a series of other amendments, thus unraveling the carefully constructed package of the Convention. The simplified procedure, for its part, appears to be an unrealistic method since only one State Party can block a proposed amendment without giving even a chance of discussion. In any case, in order to utilize the formal amendment procedure, it is essential that careful preparatory work be conducted through, eg., the UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea (UNICPOLOS), an *ad hoc* informal forum established within the UN General Assembly or the Meeting of States Parties to UNCLOS.

(2) Decision of the Meeting of States Parties to UNCLOS

A second option is the *de facto* amendment of UNCLOS provisions through consensus decisions of the Meeting of States Parties (SPLOS). No provision is found in UNCLOS on such procedure; but this method has actually been used on four occasions to change some of the provisions, in the Annexes, of UNCLOS. Thus, in 1995, SPLOS decided to postpone until 1 August 1996 the first election of the judges of the International Tribunal for the Law of the Sea (ITLOS), which was stipulated, in Article 4 (3) of Annex VI to the Convention, to be held

[5] The European Commission suggested that with the projected major changes such as receding coastlines and submergence of large areas resulting in possible loss of territory, 'there might be a need to revisit existing rules of international law, particularly the Law of the Sea, as regards the resolution of territorial and border disputes. *Climate Change and International Security*. Paper from the High Representative and the European Commission to the European Council, S113/08 (14 March 2008), p. 4. Available at http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/reports/99387.pdf

"within six months of the date of [its] entry into force".[6] Later in the same year, SPLOS similarly postponed until March 1997 the first election of the members of CLCS, which Article 2 (2) of Annex II to the Convention specified to be held "as soon as possible but in any case within 18 months after the date of entry into force of this Convention".[7] In 2001, SPLOS decided that the time limit for a coastal state to make submission of its claimed limits of continental shelf beyond 200 nm to CLCS "shall be taken as having commenced on" 13 May 1999, in derogation from the specific requirement in Article 4 of Annex II to the Convention to do so "within 10 years of the entry into force of this Convention for that state".[8] Lastly, in 2008, revisiting this 2001 decision, SPLOS decided that "[i]t is understood that the time period referred to in article 4 of annex II to the Convention …and [the above-mentioned 2001 decision] may be satisfied by submitting to the Secretary-General preliminary information indicative of the outer limits of the continental shelf… and a description of the status of preparation and intended date of making a submission".[9]

With respect to these four decisions of SPLOS, there was no agreement among States Parties or among commentators as to their legal nature, particularly whether they are amendments or "understanding" of the specific provisions of the LOS Convention. It is however clear that they do have the legal effect of changing the clear letters of the relevant provisions. Nevertheless, it is also clear that such changes are limited only to those provisions which relate to certain time limits for States Parties to take action. These provisions are certainly not comparable with those relating to baselines and status of islands, which are designed to lay down substantive rules affecting, *inter alia,* the exercise of sovereignty or sovereign rights of coastal states.

The question of whether SPLOS is legally competent to deal with such issues of substantive provisions of UNCLOS will be further discussed below together with other possible forums for negotiating and adopting an agreement supplementing UNCLOS.

(3) Agreements supplementary to UNCLOS

A third option for modifying UNCLOS provisions is the adoption of agreements which are aimed at supplementing, interpreting or implementing UNCLOS. Such agreements may be negotiated and adopted in various forums. The main forum could be a SPLOS meeting, but a diplomatic conference open for all interested States, or the UN General Assembly could also adopt such agreements. Each of these three forums will be discussed briefly in turn below.

First, can SPLOS, which has adopted certain decisions modifying some of UNCLOS provisions as discussed above, serve as a forum for negotiating a supplementary agreement? The Convention has no provisions regarding the adoption of such agreements or protocols. It is generally understood that under Article 319, SPLOS meetings are convened by the

---

[6] *Report of the Meeting of States Parties* (Doc. SPLOS/3 (1995)), para. 16. The last day "within six months" was 16 May 1995.

[7] *Report of the Third Meeting of States Parties* (Doc. SPLOS/5 (1996)), para. 20. The last day of "the 18 months" was 16 May 1996.

[8] SPLOS, *Decision regarding the date of commencement of the ten-year period for making submission to the Commission on the Limits of the Continental Shelf set out in article 4 of Annex II to the United Nations Convention on the Law of the Sea* (Doc. SPLOS/72 (2001)).

[9] SPLOS, *Decision regarding the workload of the Commission on the Limits of the Continental Shelf and the ability of States, particularly developing States, to fulfill the requirements of article 4 of annex II to the United Nations Convention on the Law of the Sea, as well as the decision contained in SPLOS/72, paragraph (a)* (Doc. SPLOS/183 (2008)), para. 1 (a).

Secretary-General only "in accordance with the Convention" and the Convention has specifically assigned to such meetings the tasks for electing members of ITLOS and CLCS, as well as discussing administrative and financial matters of these institutions.[10] It appears that States Parties are divided on whether SPLOS has the mandate to deal with matters of a substantive nature relating to the implementation of the Convention,[11] which presumably include the adoption of a protocol or similar agreement. Since SPLOS is a body consisting of all the Parties to the Convention, however, there should be no legal obstacle for it to decide, particularly by consensus, to convene an *ad hoc* conference of States Parties specifically to negotiate and adopt a protocol or other agreement for the interpretation or implementation of, or for supplementing, provisions of the Convention.[12]

Secondly, a conference may be convened, typically by the General Assembly, to which all interested States, including non-parties, are invited to negotiate and adopt an agreement relating to UNCLOS. This is the procedure that was actually followed when the UN Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks was convened and adopted the Agreement for the Implementation of the Provisions of the Law of the Sea Convention relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (UN Fish Stocks Agreement). The Agreement does not amend UNCLOS provisions, but supplements and expands them with detailed rules and strengthens the basic principles.[13] One of the advantages of this option is the possibility of the conference to include as full participants not only the parties but also non-parties to UNCLOS.

Thirdly, the General Assembly itself may adopt the text of an agreement after it is negotiated in a subsidiary forum like a special committee or working group, or in another body or informal consultations outside the Assembly. Once the text of the agreement is completed by such a forum, it is then submitted to the General Assembly normally in the form of an annex to a draft resolution. In such resolution the Assembly typically recommends Member States to sign and ratify the agreement. This is the formula followed by the Assembly when it adopted the Agreement relating to the Implementation of Part XI of UNCLOS, the text of which had been negotiated in informal consultations convened at the initiative of the Secretary-General. Although in its title the Agreement purports to "implement" Part XI provisions, in fact it contains a number of provisions to drastically change them, including the suspension of their application. This process was unique in that all substantive negotiations were conducted in informal meetings, which enabled any interested States, including the United States, to participate in the actual re-negotiation of formally adopted provisions without forcing committed States to lose their face. Another important factor contributing to the successful *de facto* revision of UNCLOS was the fact that fundamental changes in political and economic situations which had not been foreseen during the negotiations occurred since the adoption of its text.

---

[10] See, e.g., Annex II, Art. 2; Annex IV, Arts. 4, 18 and 19.

[11] See *Report of the eighteenth Meeting of States Parties*, *13-20 June 2008* (Doc. SPLOS/184), para. 118.

[12] The Parties must however respect Article 311 (3), which provides *inter alia* that such agreements shall not relate to a provision derogation from which is incompatible with the effective execution of the object and purpose of the Convention and that they shall not affect the application of the basic principles embodied therein.

[13] See M. Hayashi, "The 1995 Agreement on the Conservation and Management of Straddling and Highly Migratory Fish Stocks: Significance to the Law of the Sea Convention", *Ocean and Coastal Management*, vol. 29 (1995), p. 51.

V. Final Remarks

With the predictions of increasing adverse effects of climate change or variability particularly against islands and island States, it is possible that current rules of the law of the sea relating to baselines cause serious loss or reduction of maritime entitlements of some coastal States. Such phenomena were not foreseen at the time of the Third UN Conference on the Law of the Sea. The current rules are clearly inequitable and unfair for such States.

In order to mitigate such adverse effects legally, an amendment to UNCLOS provisions would be desirable. The proposed legal rules discussed above are aimed at freezing the baselines and boundaries drawn under UNCLOS, thus enabling States to maintain, despite future sea level rise or other physical effects, the rights they have legally established over their maritime zones.

Among the three possible approaches for adopting such new rules, a most practicable one would be the adoption of an agreement supplementary to UNCLOS provisions. For that purpose, three possible procedures were discussed. All of such procedures are available, together with the combination of their various elements. The first procedure, i.e., a meeting or conference of the States Parties, appears to be a best option should it become possible for the conference to find a way to allow the full participation of non-parties as well. Unless that possibility realizes, the second procedure, i.e., a conference open for full participation of all interested States to negotiate and adopt an agreement, would be more appropriate. The third procedure, i.e., adoption of an agreement by the General Assembly after negotiation in its subsidiary bodies or informal consultations, appears to be also attractive since climate change or variability may be considered to be a fundamental change of circumstances like the one that prompted the re-negotiation of Part XI of UNCLOS. The informal consultations would be particularly useful if a future agreement is aimed at revising *de facto* some of UNCLOS provisions since revision or amendment would be too delicate a matter to raise at formal meetings and may risk the re-opening of negotiations on other provisions.

Session III

Island-based Management of Ocean Areas

Evaluation of the Pacific Oceanscape to Manage the Pacific Islands and Ocean Environment

Martin Tsamenyi
Director - Australian National Centre for Ocean Resources and Security, University of Wollongong

Joytishna Jit
PhD Candidate - Australian National Centre for Ocean Resources and Security, University of Wollongong

Abstract

The forty-first meeting of Pacific Island Forum (PIF) in Port Vila, Vanuatu in August 2010 endorsed the new concept of 'Pacific Oceanscape' to support development, management and conservation of the Pacific Islands region. The leaders also encouraged all Pacific Islands regional organisations to implement the concept in partnership with other relevant organisations. The Pacific Oceanscape concept is a renewed effort to implement the Pacific Islands Regional Oceans Policy (PIROP). It reflects all PIROP principles and aligns them with urgencies associated with climate change impacts on small island developing states. It also promotes regional cooperation in the establishment and management of large-scale marine protected areas (MPAs). MPAs are expected to minimise imminent threats to the marine environment and optimise opportunities for scientific studies and monitoring. Threats are minimised because large MPAs increase the resilience of the ecosystems and therefore protect associated conservational values for Pacific Islanders. Some challenges anticipated in implementing the Pacific Oceanscape relate to timeframe, funding integrity and sustainability, harmonisation mechanisms within the existing national and regional institutions and programs and compliance and enforcement.

Introduction

Impacts of climate change will affect the livelihoods, security and wellbeing of Pacific Islanders and therefore pre-empt a response to mitigate adverse consequences.[1] A warming of the ocean surface around small island states has already begun and it is predicted to be the cause of increased heavy rainfall events and more intense or frequent cyclones.[2] With climate change, coral reefs can be adversely affected by bleaching, oceans by acidification, mangroves by sea level rise. An increase in extreme weather events, and shift or depletion in fish stocks by changing ocean parameters are also likely to occur.[3] The concentration of large settlements at or near the coast is characteristic of small islands in the Pacific region making them particularly vulnerable to climate change impacts. Villages are mainly located on the sand terrace or on the beach itself.[4]

Islands in the Pacific region share similar economic and sustainable development challenges including a small but rapidly growing population, rapid urbanisation, poverty, geographic remoteness, waste management and a high dependence on coastal marine resources for

[1] Forum Communiqué, Forty-First Pacific Islands Forum, Port Vila 4-5 August 2010 2.
[2] Secretariat of the United Nations Framework Convention on Climate Change 'Vulnerability and Adaptation to Climate Change in Small Island Developing States' (2007) 4.
[3] Ibid 8.
[4] Ibid 16.

livelihood and well-being.[5] Climate change is likely to exacerbate problems. Island states also have to contend with lack of economies of scale and costly public administration.

Pacific Island Countries and Territories (PICTs), geopolitical and technical agencies under the Council for Regional Organisations (CROP) are mandated by Pacific Island Forum Leaders to implement specific regional initiatives to assist in sustainable development.[6] In 2010, Forum Leaders endorsed an oceans framework covering the largest marine area in the world. This is an area of 38.5 million square kilometers of ocean, larger than the land territories of the United States, Canada and Mexico combined. The framework was designed to mitigate increasing threats to the integrity of the marine environment, particularly climate change. The concept of Pacific Oceanscape was initiated by Kiribati in response to the need to collaboratively manage conservation and sustainable development of the marine environment, principally through a series of Pacific Ocean Arcs or large-scale marine protected areas (MPAs).[7]

MPAs are an important tool for managing climate change impacts on biodiversity. This is because MPAs can increase the resilience of the marine environment to imminent damages caused by climate change.[8] The major impact of climate change on reef ecosystems is coral bleaching, and scientific evidence suggests that increasing the magnitude of protected areas minimise its damaging impacts.[9] In the last decade, MPAs that have been listed as world heritage area in accordance with the World Heritage Convention [10] have increased in magnitude to increase the resilience of the ecosystems to climate change impacts. Examples in the South Pacific include the Great Barrier Reef in northeast Queensland, Australia and Phoenix Island Protected Area (PIPA) in Kiribati. In July 2004, the proportion of protected zones in the Great Barrier Reef was increased from 4.5 per cent to over 33.3 per cent.[11] Kiribati announced the largest marine protected area in the world in 2010 by declaring the entire archipelagic systems of the Phoenix Islands and Line Islands as the first two Pacific Ocean Arcs.[12]

The management of climate change impacts through planning in coastal developments can reduce its adverse social and economic impacts. Scientific uncertainties and the long term scales relative to more immediate problems generally act as barriers to the development and

---

[5] Hugh Govan (2009) *Community Conserved Areas: A Review of Status and Needs in Melanesia and Polynesia,* ICCA regional review for CENESTA /TILCEPA /TGER/IUCN/ GEF-SGP 12; Commonwealth of Australia (2006) *Pacific 2020: Challenges and Opportunities for Growth* 29.

[6] See Pacific Island Forum Secretariat 'CROP' Available at http://www.forumsec.org.fj/pages.cfm/about-us/crop/; See also discussion Martin Tsamenyi, 'The institutional Framework for Regional Cooperation in the Ocean and Coastal Management in the South Pacific' (1999) 42 *Marine Policy* 465-481.

[7] President Anote Tong (Kiribati), 'Pacific Oceanscape: A Secure Future for Pacific Island Nations Based on Ocean Conservation and Management', Pacific Island Leaders Meeting.

[8] *PACT 2020: Protected Areas and Climate Turnaround, Climate Change and Protected Areas Summit*, Grenada, Spain, 16-19 November 2009 Available at http://whc.unesco.org/en/conventiontext/ http://www.iucn.org/about/union/commissions/wcpa/wcpa_events/wcpa_climatepasummit/wcpa_pact2020/

[9] IPCC 'Climate Change and Biodiversity' (2002) *Intergovernmental Panel on Climate Change (IPCC) Technical Paper V*.

[10] World Heritage Convention, opened for signature 16 November 1972 (entered into force 17 december 1975)

[11] 'Impact of Climate Change on World Heritage Properties', *Expert Meeting on Issues Related to the State of Conservation of Properties Inscribed on the World Heritage List* WHC-06/30.COM/7.1, 2.

[12] President Anote Tong (Kiribati), 'Pacific Oceanscape: A Secure Future for Pacific Island Nations Based on Ocean Conservation and Management', Pacific Island Leaders Meeting. See also: UNESCO 'Phoenix Islands Protected Area' Available at http://whc.unesco.org/en/list/1325/

adoption of management responses.[13] Coping strategies such as the Pacific Oceanscape should fully integrate climate change and implement mitigation measures that ensure long-term sustainability of coastal resources in the Pacific region.

This paper analyses regional policy development and evaluates the role of the Pacific Oceanscape in implementing ocean governance principles in PICTs. The source of ocean governance principles in the context of this paper is the PIROP. The Pacific Oceanscape is perceived by Forum Leaders as a 'catalyst for action' to implement PIROP.[14]

Pacific Islands Regional Oceans Policy

PIROP is the first policy framework that has been developed at a regional scale.[15] The development of the policy began following a recommendation at the 1999 Pacific Regional Follow-up Workshop on the Implementation of the United Nations Law of the Sea Convention[16] (LOSC). This recommendation was endorsed by Forum Leaders in the same year.[17] Consultants were engaged at different stages in the regional policy process to identify the elements of PIROP.[18] A draft policy was produced from the background papers in 2002 and circulated among stakeholders before it was endorsed by Forum Leaders in 2002.[19] The development of the regional policy was a four year process which was accepted by Pacific Island Leaders from the inception of the concept.

Through PIROP, the region has an agreed reference point for developing and presenting regional positions at the international level.[20] The goal of the PIROP is to 'ensure sustainable use of our ocean and its resources by Pacific Island communities and partners'.[21] The policy adopts five guiding principles:[22]

- improving our understanding of the oceans
- sustainably developing and managing the use of ocean resources
- maintaining the health of the ocean
- promoting the peaceful use of the ocean, and
- creating partnerships and promoting cooperation

---

[13], Donald Boesch, John Field and Donald Scavia 'The Potential Consequences of Climate Change Variability and Change on Coastal Areas' (2000) *Decision Analysis Series Number 21,* NOAA's Coastal Ocean Program, xv.

[14] *Our Sea of Islands – Our Livelihoods – Our Oceania: Framework for Pacific Oceanscape*, Forty-First Pacific Islands Forum, Port Vila 4-5 August 2010 3.

[15] Pacific Islands Regional Ocean Forum Communiqué, *The Pacific Islands Regional Oceans Policy – From Policy to a Framework for Integrated Strategic Action*, 2-4 February 2004.

[16] *United Nations Law of the Sea Convention*, opened for signature 10 December 1982 (entered into force 16 November 1994).

[17] Endorsed at the 30th Pacific Island Forum Meeting, 3-5 October 1999, Koror.

[18] For background papers, see Martin Tsamenyi (2001) *A Pacific Regional Oceans Policy* Available at http://www.spc.int/coastfish/Asides/Ocean/PROPscope.pdf; Seremaia Tuqiri (2002) *Overview of an Oceans Policy for the Marine Environment* Available at http://wwwx.spc.int/coastfish/Asides/Other_orgs/SPOCCMSG/PIROP_overview_seremaia.pdf

[19] Endorsed at the 33rd Pacific Islands Forum Meeting, 15-17 August 2002, Suva.

[20] Pacific Islands Regional Ocean Forum Communiqué, *The Pacific Islands Regional Oceans Policy – From Policy to a Framework for Integrated Strategic Action*, 2-4 February 2004.

[21] Ibid 8.

[22] Ibid 5.

The five principles commit Pacific Island nations to meet national obligations under the United Nations Millennium Development Goals on environmental sustainability, reduction of poverty, improving health and livelihood of the people.[23] Due to the high dependence of the region on donor funding, the principles are also to encourage the international community to guide development in this context.[24] PIROP provides the framework for integrated and sustainable development by dealing with multi-sectoral issues that cut across the institutionalised roles and responsibilities of the CROP agencies. PIROP adopts an ecosystem-based approach to ocean management wherein it also seeks to sustain livelihoods of its people.[25] Ecosystem-based approaches are also multi-sectoral and require a coordinated and integrated strategy for implementation.

Implementation of PIROP Prior to the Pacific Oceanscape Concept

Concurrent to the endorsement of PIROP, Forum Leaders called for follow-up actions, including the development of a Framework Integrated Strategic Action to implement PIROP. PIROP's Framework Integrated Strategic Action (PIROP-FISA) was endorsed by a newly formed Pacific Islands Regional Oceans Forum.[26] The Oceans Forum consisted of PICTs, development partners, non-state actors, private sector and civil society representatives. The implementation strategy was released in 2004 and aimed to assist in the implementation of PIROP.

PIROP-FISA identifies the need for a central coordinating agency to streamline marine sector development and conservation to achieve the aspirations of PIROP through national ocean policies. National ocean policies were intended as the outcome of stewardship and ownership objectives of PIROP-FISA. However, implementation of PIROP under FISA has been limited by lack of funding and resources at the regional and national levels. To date, national oceans policies have not been developed among PICTs. This reflects a lack of political will to implement national programmes that may conflict with sectors supporting national economic growth.[27] In effect, this means that international and regional policies emphasising sustainable ocean management have limited impact at the level of grassroots people in rural communities.[28]

Nations generally do not have adequate legislation to protect traditional knowledge to inform management actions and processes or to institute systematic mechanisms such as environmental impact assessments which are a prerequisite for sustainable development.[29] Some of the inconsistencies between international and national laws are currently being met with the enactment of fisheries legislation encompassing resource conservation issues and

[23] United Nations Millennium Development Goals.
[24] Ibid.
[25] Ibid.
[26] Pacific Islands Regional Ocean Forum Communiqué, 2-4 February 2002, Suva, Fiji.
[27] Pio Manoa and Joeli Veitayaki 'Regional Ocean Governance in the Pacific Revisited' (2009)23 *Ocean Yearbook* 503.
[28] Rudolfo Dorah, 'Towards Integrated National Ocean Policy in the South Pacific: competing and Conflicting Issues in Ocean Policy – Solomon Islands' (2007) UN-Nippon Fellowship Thesis 4. Available at http://www.un.org/Depts/los/nippon/unnff_programme_home/fellows_pages/fellows_papers/dorah_0607_solomon_islands.pdf accessed 24/10/2010.
[29] Laurence Cordonnery, 'Implementing the Pacific Islands Regional Oceans Policy: How Difficult is it Going to Be?' (2005)36 *Victoria University of Wellington Law Review* 728.

tuna management plans in the Pacific Islands. In terms of integrating aid donor support and implementing the regional policy principles, there is also potential for conflicts of interests, particularly between donor agencies that also have fishing interests in the region.[30]

One of the major drivers for the PIROP process was the need to coordinate and integrate all marine sectors to fully implement United Nations Law of the Sea Convention (LOSC) as a precondition to achieve sustainable development of the marine environment. All forum members have ratified LOSC, with Tuvalu and Kiribati being the last to ratify in 2002 and 2003, respectively. Since the release of FISA, a number of key developments in marine biodiversity conservation have occurred.

In 2006, the 8th Conference of Parties (COP) to the Convention of Biodiversity[31] (CBD) called for action on the protection of seamounts and cold water coral reef ecosystems encouraging the establishment of MPAs beyond national jurisdictions.[32] A UN consultative process on oceans and LOSC in 2006 also invites states to implement an ecosystem-approach through the establishment of MPAs and the elimination of destructive fishing practices.[33] In 2008, scientific criterion for MPAs and representative networks of MPAs was adopted at COP 9.[34] In 2008, a United Nations General Assembly Ad Hoc working group acknowledged an urgent need for the implementation of existing agreements on conservation and sustainable use of marine biological diversity on areas beyond nation jurisdictions.[35] Developments in marine biodiversity conservation at the international level together with regional and national conservation aspirations have led to the development of an updated framework for implementing the guiding principles under PIROP in 2010. This is through the Pacific Oceanscape.

Pacific Oceanscape

At the Forty First Pacific Islands Forum Leaders Meeting in Port Villa, Vanuatu at Heads of State and Governments from 15 nations endorsed a draft Pacific Oceanscape framework for a secure future based on sustainable development, management and conservation of the ocean guided by PIROP principles.[36] The concept was initiated by Kiribati founded on its announcement to expand PIPA (first established in 2006). The expansion resulted in a twofold increase in PIPA's area in 2008. PIPA covers 408,250 km^2 and is the largest marine protected area in the world. Kiribati also declared a second Pacific Ocean Arc, the Line Islands Protected Area. The Pacific Ocean Arcs have been developed with funding and technical assistance from the non-governmental organisation, Conservation International, as

[30] Quentin Hanich and Martin Tsamenyi, 'Managing Fisheries and Corruption in the Pacific Islands Region' (2009) 33 *Marine Policy* 386.
[31] *Convention on Biological Diversity*, opened for signature 5 June 1992 (entered into force 29 December 1993). Available at www.cbd.int/convention/ accessed 3 March 2008.
[32] COP 8 held 20-31 March 2006, Curitiba, Brazil.
[33] *UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea* A/61/156.
[34] COP 9 held 19-20 May 2008, Bonn.
[35] *UN General Assembly Ad Hoc Open-ended Informal Working Group on Conservation and Sustainable Use of Marine Biological Diversity in Areas Beyond National Jurisdiction* held April-May 2008.
[36] Forum Communiqué, Forty-First Pacific Islands Forum, Port Vila 4-5 August 2010. Countries include Australia, the Cook Islands, the Federated States of Micronesia, the Republic of Kiribati, Nauru, New Zealand, Niue, Palau, Papua New Guinea, the Republic of Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.

part of a broader conservation project known as the Coral Reef Initiative of the South Pacific (CRISP).

Forum leaders welcomed Kiribati's Pacific Oceanscape concept and Pacific Oceans Arc initiative as an opportunity for investing in MPAs, learning and networking within the region. The Forum Leaders gave the concept precedence under the Pacific Plan. This is an important decision because the Pacific Plan reflects the region's priorities consistent with and in support of international frameworks. It provides a solid platform for regional cooperation guiding collective positions through international forums that advocate the 'special case' of small island developing states (SIDS).[37] Forum Leaders recognise that the success of the Pacific Oceanscape will depend on the level of regional cooperation in responding to 'national development aspirations and priorities which in turn would ... focus attention on critical issues such as climate change'.[38] The Leaders' focus on national development priorities is significant because it aims to create and maintain political will at the national level, a commitment that was absent during the earlier implementation under PIROP-FISA.

There are three broad objectives of the Pacific Oceanscape to be implemented through six strategic priorities. Objectives in the Pacific Oceanscape are:

1. Integrated ocean management that responds to nations aspirations and priorities.
2. Adaptation to environmental and climate change through the development of baselines and monitoring.
3. Liaising, listening, learning and leading through facilitative and collaborative processes, systems and research to achieve the first two objectives.

These objectives integrate the five guiding principles under PIROP. In addition, the actions and strategies allude to climate change adaptation strategies for the region and encourage PICTs to implement PIROP principles through the national development mechanisms.

Priority Actions

The six priority actions are listed in the Pacific Oceanscape as: jurisdictional rights and responsibilities; good ocean governance; sustainable development management and conservation; listening, learning, liaising and leading; sustaining action; and adapting to rapidly changing environment. A number of these priority actions are agreed to by Leaders at the regional level for implementation at the by nations. Each nation's implementation of specified priority actions is integral to the success of the Pacific Oceanscape concept. Priorities for both national and regional implementation are discussed below.

The majority of boundaries in the Pacific are yet to be formalised.[39] Nations are to deposit with the United Nations baseline coordinates and charts delineating their maritime zones. PICTs have substantial maritime opportunities with respect to claims to jurisdiction to around

[37] The Pacific Plan: For Strengthening Regional Cooperation and Integration. See http://www.forumsec.org.fj/resources/uploads/attachments/documents/Pacific_Plan_Nov_2007_version.pdf accessed 25/03/2009.
[38] *Our Sea of Islands – Our Livelihoods – Our Oceania: Framework for Pacific Oceanscape* (Draft), Forty-First Pacific Islands Forum, Port Vila 4-5 August 2010 3.
[39] Ibid 6.

28 per cent (about 30 million km^2) of the EEZ claims worldwide.[40] In addition, some PICTs were able to assert rights over the continental shelf beyond the area of EEZs.[41] Currently submissions have been made to the United Nations from Fiji, Cook Islands, Palau, Tonga, the Federated States of Micronesia, Solomon Islands and Papua New Guinea (some of these are joint submissions).[42] Kiribati and Tuvalu may also make submissions within the ten years of ratifying LOSC. Maritime delimitation is an important priority not only due to deadlines imposed by United Nations. Sea level rise and coastal erosion due to climate change impacts are likely to change coastlines challenging baselines, which are imaginary lines systematically outlining the low water mark. The Pacific Oceanscape urges PICTs to cooperate in maritime delineation to finalise maritime jurisdictions as a matter of urgency, including the finalisation of 28 notational claims that are yet to be negotiated between countries (Figure 1).[43] Clear jurisdictional boundaries are important for managing resource utilisation in these areas, for the conservation of fragile ecosystems, and to facilitate collaborative mechanisms to keep oceans secure.

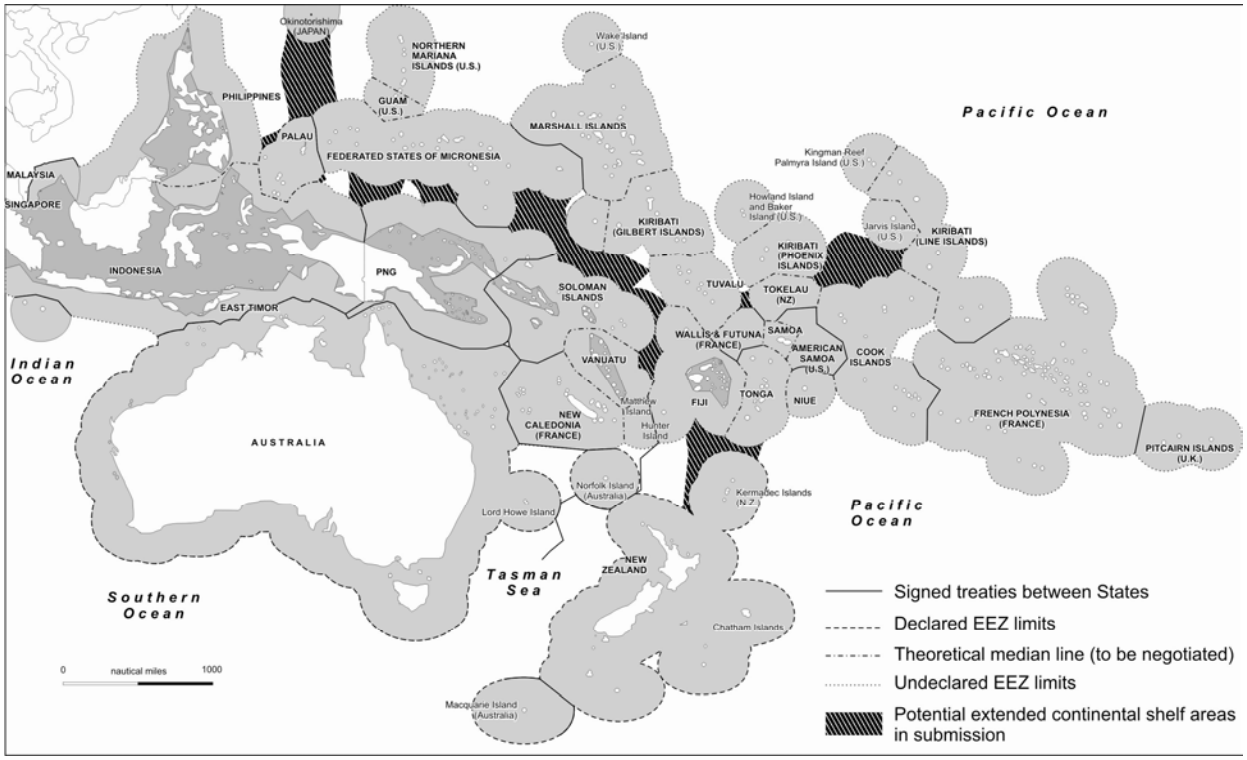


Figure 1. Status of maritime boundaries in the Pacific August 2010 (Source of data: SOPAC 2010[43]).

The Pacific Oceanscape also urges PICTs to incorporate principles relating to sustainable ocean and coastal development into national policy and planning, along with the establishment of coordinated institutional mechanisms for transparent implementation of

[40] Robert Gillet, 'Pacific Islands Countries Region', Review of the State of the World Marine Resources, FAO Fisheries Technical Paper 457 (2005) 144.
[41] SOPAC, 'Race Against Time as the Deadline to Claim Extra Seabed Resources Draws Closer' Available at www.sopac.org/tiki-index.php?page=extended+continental+shelf+activities
[42] Submissions, through the Secretary-General of the United Nations, to the Commission on the Limits of the Continental Shelf, pursuant to article 76, paragraph 8, of the United Nations Convention on the Law of the Sea of 10 December 1982 Available at http://www.un.org/Depts/los/clcs_new/commission_submissions.htm
[43] SOPAC 'Pacific Islands Regional Maritime Boundaries Project' Available at http://map.sopac.org/Pacific+Island+Regional+Maritime+Boundaries+Project#_Status_of_Maritime_Boundaries_Treaties_in_the_Pacific_in_2009_br_

PIROP principles.[44] Importantly, the Pacific Oceanscape concept also highlights the need to incorporate strengths and traditions of coastal communities to attain 'sustainable island life'.[45] PICTs are also encouraged to adopt marine spatial planning mechanisms for improved management of multiple users towards both economic and environmental benefits, particularly in the context of MPAs (small traditional closures to large-scale reserves).[46] The Pacific Oceanscape requires nations to adopt cost-effective management approaches to PIROP principles within the national development framework with considerations for economic development opportunities within the coastal and marine sector. Overall, the priorities for national implementation are targeted towards self-sustainable activities that would complement priorities in the context of wider regional implementation actions listed in the Pacific Oceanscape.

The extent to which PICT governments succeed at implementing the Pacific Oceanscape in at the national level would determine the effectiveness of complementary regional strategies for climate change adaptation as well as other existing regional projects. Some long-term projects and programs of relevance that are underway include the Pacific islands Applied Geoscience Commission's (SOPAC) Pacific Islands Regional Maritime Boundaries Project, coastal and fisheries projects and the maritime programme under the Secretariat of the Pacific Community (SPC), Marine Affairs Studies programme and locally managed marine areas network (LMMAs) with the University of the South Pacific and other partner organisations. Each agency or organisation has a defined mandate in the region and operate under separate structured work programs that, in unison, fulfil commitments under the Pacific Plan. The challenge of integrating ocean management is to harmonise relevant programs and projects among the diverse stakeholder CROP agencies, and possibly include other non-governmental organisations in the region.

Leaders have agreed to mandate the establishment a Regional Oceans Commissioner with professional support to provide a high level representation that is 'urgently required to ensure dedicated advocacy and attention to ocean priorities' under the Pacific Oceanscape.[47] The Regional Ocean Commissioner will also be tasked to facilitate a centralised mechanism among existing organisations to cope with the rapidly changing environment, particularly in the economic and environmental context.[48] Multi-sectoral and long-term strategies are required to adapt to climate change impacts at national and regional levels. The Pacific Oceanscape states that a comprehensive regional adaptation assessment is required, probably also the development new relevant regional instruments to govern adaptation strategies.[49] The main instruments for climate change adaptation in the region are the Pacific Islands Framework for Climate Change (PIFCC) and the Pacific Adaptation to Climate Change (PACC).

The Regional Ocean Commissioner is also to facilitate a Regional Ocean Alliance or Partnership for cooperation on matters of interest to the region but beyond the jurisdiction of one nation, such as the high seas and to fulfil extraterritorial responsibilities under multilateral environmental agreements. In addition, regional intergovernmental bodies are

[44] *Our Sea of Islands – Our Livelihoods – Our Oceania: Framework for Pacific Oceanscape* (Draft), Forty-First Pacific Islands Forum, Port Vila 4-5 August 2010 8.
[45] Ibid 9.
[46] Ibid.
[47] Ibid 8.
[48] Ibid 12.
[49] Ibid 13.

encouraged to develop conservation and management approaches for high seas resources and deep sea ecosystems for common good. The Pacific Oceanscape is innovative in that it acknowledges the importance of regional institutions and mechanisms for the management of high seas MPAs.[50]

The framework also seeks to optimise learning opportunities within the region, from traditional marine management to government level approaches. This includes workshop and training, internships, mentoring, targeted scholarships, succession planning and on-the-job learning exchange opportunities. In acknowledgement of the Pacific way of life, the Pacific Oceanscape also urges the region to maintain an active presence in regional and international forums.[51]

One of the key priorities under the Pacific Oceanscape concept is discovering financial mechanisms to assist institutional set-up and processes arising from implementation, both regionally and nationally. In the future, donor harmonisation and aid effectiveness will be guided by regional and national priorities under the Pacific Oceanscape. The Paris Declaration on Aid Effectiveness and Accra Agenda for Action provide the platform for funding.[52] Both the Paris Declaration and the Accra Agenda state that central parliaments play an integral role in ensuring effective development cooperation by defining development strategies and budgets. Under the Paris Declaration, donor countries committed to providing timely, transparent information to developing countries, enabling them to administer comprehensive budget planning at national level. Aid effectiveness is important for good ocean governance because it ensures that national development priorities are aligned to sectoral priorities.[53] This vision was in its infancy during the PIROP-FISA planning stage, although the need for developing partnerships and financial arrangements was recognised then.[54]

Priorities and actions as they appear in the Pacific Oceanscape re-organise and strengthen initiatives under the PIROP-FISA. The re-organisation is mostly to reflect urgent and emerging issues in the region. The new framework also devolves clear and specific responsibilities to nations to increase ownership and stewardship of PIROP principles. In this context, nations have agreed to prioritise sustainable coastal and ocean development particularly in their national development strategies and to undertake a number of actions already outlined to assist in the implementation of PIROP principles. Finally, the Pacific Oceanscape also depicts climate change as a major threat to ocean and coastal development in SIDS based on the latest findings of the Intergovernmental Panel of Climate Change (IPCC).[55]

---

[50] Ibid 9-10.
[51] Ibid 10.
[52] Paris Declaration on Aid Effectiveness (signed in March 2005) Available at http://www.oecd.org/dataoecd/11/41/34428351.pdf
[53] See also, PIFS (2010) *Tracking the Effectiveness of Development Efforts in the Pacific Region* Available at http://www.forumsec.org.fj/resources/uploads/attachments/documents/PIFS_2010_Tracking_Report.pdf
[54] Pacific Islands Regional Ocean Forum Communiqué, *The Pacific Islands Regional Oceans Policy – From Policy to a Framework for Integrated Strategic Action*, 2-4 February 2004 19.
[55] Secretariat of the United Nations Framework Convention on Climate Change, above n 22, 14.

Evaluation of the Pacific Oceanscape

The Pacific Oceanscape provides a renewed framework for implementing PIROP principles. The jurisdictional scope of the Pacific Oceanscape includes waters in the national jurisdiction of member nations and the high seas pockets within the region. In this vast ocean space, the Pacific Oceanscape aims to implement, inter alia, strategies for adapting to climate chance impacts, multiple user management in MPAs, and ocean security. There are a number of strengths in the new framework, and some implementation challenges are also evident. As the second implementation framework after PIROP-FISA, the Pacific Oceanscape demonstrates that PIROP is a living policy since its implementation is flexible depending on the urgent and emerging issues agreed to by Forum Leaders. Both frameworks encourage a holistic approach to marine issues in the region.

The Pacific Oceanscape is designed to promote stewardship at local, national, regional and international levels. One of the key challenges in the PIROP-FISA was the absence of directives and assistance programmes for nations that would encourage ownership and stewardship of the policy. The lack of political will among nations to implement PIROP in the past is partially addressed in the new framework through clear directives (including an outlook on financial aid), the scope for integrating the framework into the Pacific Plan, and through the integration of sustainable ocean management into national development plans. In the Pacific Oceanscape much needed emphasis is placed on incorporation of the marine sector priorities in national governance mechanisms, and therefore its implementation success will partly be a reflection of this. Since the impacts of climate change are also multi-sectoral in scope with adverse environmental consequences for coastal livelihoods and the economy, its incorporation into the Pacific Oceanscape provides significant impetus for parliaments to prioritise coastal and ocean issues.

One of the solutions for mitigating the impacts of climate change is the designation of a network of large-scale MPAs. An effective marine protected area system is needed to ensure that the oceans recuperate, continue to store carbon dioxide, that fish stocks recover and that coastlines are protected from harsh climatic conditions.[56] MPAs are also encouraged by the International Union of Conservation Networks (IUCN) under multilateral environmental agreements. The COP to CBD actively promote conservation of biodiversity beyond areas of national jurisdiction through the adoption of measures such as the United Nations Resolutions and the implementation of international and regional network of MPAs.[57] The Pacific Oceanscape prioritises the establishment of MPAs at local and national levels and in the high seas. This can contribute to the wider management of the Pacific Ocean which contains a biodiverse array of marine life, processes and geological structures that are intrinsically linked within the Pacific Ocean. MPAs such as Pacific Ocean Arcs provide an opportunity to best conserve natural resources and conduct research. The first of Pacific Ocean Arcs, PIPA, will offer scientists opportunities to study impacts of climate change and variability in the Pacific Ocean. An extended network of high seas MPAs will be possible if more Pacific Ocean Arcs are established. Administration of Pacific Ocean Arcs would merit innovative ocean management approaches that can attest Pacific Island leadership in high seas oceans policy and management. The creation of the Pacific Oceanscape has the potential to provide legal protection and regulation of regionally protected marine areas such as PIPA. However,

[56] IUCN, 'Marine Protected Areas – Why have them?' Available at 01 February 2010 http://www.iucn.org/about/work/programmes/pa/pa_what/?4646/Marine-Protected-Areas--Why-have-them

[57] Decision VII/5 adopted by the Conference of Parties to the CBD at its 7th Meeting, Marine and Coastal Biodiversity, 9-14 February 2004, UNEP/CBD/COP/7/21.

compliance and enforcement of large MPAs remains untested and potentially problematic given the resource constraints of SIDs.

Ocean policy development and implementation in the Pacific Islands is dynamic and complex. At the core of the regional policy implementation in the Pacific are the prevailing governance regimes of nations and intergovernmental organisations. Strategic priorities and actions under the Pacific Oceanscape are clearly designed for implementation by member countries and territories as well as CROP agencies, and with the assistance of non-governmental organisations. To implement PIROP principles in the region, the Pacific Oceanscape must be aligned with existing regional activities, and also sustain a central coordinating authority to maintain to integrity of PIROP. There is, however, a need for a formal review and gap analysis of existing regional projects to ascertain the way forward in terms of implementing some of the more challenging priorities in the Pacific Oceanscape. This is to streamline the implementation process to avoid duplication, enhance collaboration and avoid conflicts of interest.

The roles and responsibilities of the Regional Oceans Commissioner needs to be clearly defined, particularly where there may be administrative conflicts with the program facilitators under current regional projects and programmes within CROP. Formalised arrangements to facilitate the role of the Commissioner in the context of existing regional projects and programmes within CROP agencies are important. For example, a memorandum of understanding among regional organisations to coordinate projects and programmes under the premise of PIROP in collaboration with the Regional Oceans Commissioner may be a means to satisfactorily separate roles. Similarly, it is unclear what role the Commissioner may have, if any, in all the strategic actions under the framework.

The Pacific Oceanscape lists priorities and actions for 'immediate' implementation of PIROP principles. No additional timeframe is provided for implementation of the priorities and actions and neither is a chain of events or actions illustrated to clearly demonstrate how the full implementation phase can gradually unfold. A sequence or clear chain of events would be useful given the different levels of governance involved. For example, adoption of ocean management priorities in national development plans would be facilitated well partially on the precondition that supporting donor harmonisation and aid effectiveness is first achieved at regional and national levels.

During national consultations on adapting strategies for climate change in five participating Pacific Island nations, coastal management was confirmed as a priority sector due to their vulnerability to climate change.[58] The Pacific Oceanscape does not detail strategies for keys areas such as coastal fisheries, domestication of tuna industry, maritime transportation, and strengthening of fisheries, conservation and aquaculture legislation.[59] Even though it may be assumed that these areas are not priorities for 'immediate' implementation, and therefore not strategised in any detail in the framework, it is nonetheless reflected in the PIROP principles and therefore need to be addressed. For example, coastal fisheries can also be assisted by means of poverty alleviation strategies in the region, but the Pacific Oceanscape does not

[58] Kinch et al. (2010) *Outlook Report on the State of Marine Biodiversity in the Pacific Region*, SPREP and UNEP 32.
[59] Nathan Evans, Joytishna Raj (Jit) and Duncan Williams (2003) *Review of Aquaculture Policy and Legislation in the Pacific Islands*, SPC Aquaculture Technical Papers; Jeff Kinch 'Summary Report on the Status of Coastal Fisheries in the Southern Pacific Island Countries and Territories', Regional Workshop on Ecosystem Approach to Management of Coastal Fisheries in Pacific Islands, 17-21 November 2008.

offer enabling strategies for this to occur. In this case, however, the implementation of climate change adaptation strategies will address some coastal fisheries issues which are exacerbated by climate change, such as fish stock dynamics. Multiple user management of MPAs in coastal waters also have the scope to address issues resulting from overexploitation, lack of environmental or fisheries management, and inadequacies in fisheries regulation and enforcement.

In 2010, a number of key marine environmental issues in the Pacific Islands were identified. These include climate variability and climate change, habitat loss and the effects of coastal modification, invasive species, fishing pressure, increased sedimentation and nutrient loading and other forms of land-sourced and marine pollution.[60] While MPAs are an important solution to minimise several of these issues, there will remain a need for a more comprehensive set of management tools to overcome some of these issues, such as environmental impact assessments to protect coastal marine ecosystems.

A recent Pacific Island marine biodiversity status report reaffirmed that there is a lack of human, technical, institutional and financial capacity in the region that compromise national and regional efforts to conserve and manage the marine environment.[61] These limitations are addressed in the Pacific Oceanscape concept, particularly through its strategy for sustained action and cost effectiveness. Long term and coordinated funding will be required to complete implementation. Core funding is also a prerequisite to sustain implementation. Since the Paris Declaration and Accra Agenda are based on the premise that developing countries having clear strategies and budgets to direct donor funding from partner countries, there is a need to develop these for the marine sector.

Regional and national cost-effectiveness may be achieved if the framework objectives can be more carefully aligned to ongoing and emerging regional projects where synergies exist (such as coastal fisheries and poverty alleviation) and close gaps through new or modified projects. Synergies can occur in national level programmes, CROP agencies and non-governmental organisations, even through collaborative efforts. Implementation of strategies by utilising prevailing synergies can minimise duplication of efforts and strengthen ongoing initiatives that are relevant.

Conclusions

The development of the Pacific Oceanscape is another step towards improving the development, management and conservation of coastal and ocean resources in Pacific Islands. Since the release of PIROP, a lack of political will and financial and resource limitations impeded the early implementation through FISA. Some of these limitations are addressed through the Pacific Oceanscape.

First, the concept or framework recognises the need for ownership and stewardship of PIROP principles by each PICT. The Pacific Oceanscape concept is given precedence in the Pacific Plan, the governing document for sustainable development in the region. The strategic priorities and actions that require national implementation are clearly identified. In addition, the concept encourages nations to integrate sustainable ocean development into national development plans and establish mechanisms to centrally coordinate actions identified in the

[60] Kinch, above n 58, 6.
[61] Kinch, above n58, 38.

concept. Implementation by targeting central governments is expected to create and maintain political will and improve ocean governance.

Second, the Pacific Oceanscape concept mitigates the financial and resource constraints by encouraging cost effectiveness and harmonising donor funding and aid effectiveness. Cost-effectiveness is enhanced by broadening existing national level or CROP agency programmes to include sustainable ocean development, such as in ongoing climate change adaptation projects. Donor harmonisation and aid effectiveness in the marine sector is challenging because of the lack of a clear strategy on precise funding needs.

Apart from addressing some of the shortfalls during the early implementation of PIROP-FISA, the Pacific Oceanscape provides an updated implementation framework for PIROP in the context of recent international, regional and national marine biodiversity aspirations. Key strengths include climate change adaptation strategies and the scope for the protection of areas beyond national jurisdiction.

On the contrary, the Pacific Oceanscape does not include a strategy to implement the priorities and actions described within in terms of timelines and cost of implementation. In particular, The Pacific Oceans Commissioner and a Regional Ocean Alliance appear to be critical for the effective implementation of a number of actions and priorities. In addition, other strategies such as for the alleviation of poverty are not emphasised in detail. In the context that poverty is intrinsically linked to livelihood and food security in PICTs coastal communities adversely affected by climate change, climate change adaptation strategies must incorporate poverty alleviation considerations.

Overall, the Pacific Oceanscape concept provides a renewed outlook at regional ocean governance, and incorporates new and emerging threats and opportunities. There are a number of challenges, very few of which are new in the realm of regional governance in general. However, these need to be elucidated in the context of ocean governance under the premise of PIROP principles and the Pacific Oceanscape. The Pacific Oceanscape concept is timely and consistent with the Pacific Plan. It is also a concept that the PICTs will have to work in unison to implement successfully.

References

Commonwealth of Australia (2006) *Pacific 2020: Challenges and Opportunities for Growth.*

Convention on Biological Diversity, opened for signature 5 June 1992 (entered into force 29 December 1993). See www.cbd.int/convention/ accessed 3 March 2008.

Decision VII/5 adopted by the Conference of Parties to the CBD at its 7th Meeting, Marine and Coastal Biodiversity, 9-14 February 2004, UNEP/CBD/COP/7/21.

Donald Boesch, John Field and Donald Scavia 'The Potential Consequences of Climate Change Variability and Change on Coastal Areas' (2000) *Decision Analysis Series Number 21,* NOAA's Coastal Ocean Program, xv.

Forum Communiqué, Forty-First Pacific Islands Forum, Port Vila 4-5 August 2010.

Forum Communiqué, Forty-First Pacific Islands Forum, Port Vila 4-5 August 2010. Countries include Australia, the Cook Islands, the Federated States of Micronesia, the

Republic of Kiribati, Nauru, New Zealand, Niue, Palau, Papua New Guinea, the Republic of Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu.

Hugh Govan (2009) *Community Conserved Areas: A Review of Status and Needs in Melanesia and Polynesia,* ICCA regional review for CENESTA /TILCEPA /TGER/IUCN/ GEF-SGP.

IPCC 'Climate Change and Biodiversity' (2002) *Intergovernmental Panel on Climate Change (IPCC) Technical Paper V*.

IUCN, 'Marine Protected Areas – Why have them?' Available at 01 February 2010 http://www.iucn.org/about/work/programmes/pa/pa_what/?4646/Marine-Protected-Areas--Why-have-them

Jeff Kinch 'Summary Report on the Status of Coastal Fisheries in the Southern Pacific Island Countries and Territories', Regional Workshop on Ecosystem Approach to Management of Coastal Fisheries in Pacific Islands, 17-21 November 2008.

Kinch et al. (2010) *Outlook Report on the State of Marine Biodiversity in the Pacific Region*, SPREP and UNEP.

Laurence Cordonnery, 'Implementing the Pacific Islands Regional Oceans Policy: How Difficult is it Going to Be?' (2005)36 *Victoria University of Wellington Law Review*.

Martin Tsamenyi (2001) *A Pacific Regional Oceans Policy* Available at http://www.spc.int/coastfish/Asides/Ocean/PROPscope.pdf

Martin Tsamenyi, 'The institutional Framework for Regional Cooperation in the Ocean and Coastal Management in the South Pacific' (1999) 42 *Marine Policy*.

Nathan Evans, Joytishna Raj (Jit) and Duncan Williams (2003) *Review of Aquaculture Policy and Legislation in the Pacific Islands*, SPC Aquaculture Technical Papers

Our Sea of Islands – Our Livelihoods – Our Oceania: Framework for Pacific Oceanscape (Draft), Forty-First Pacific Islands Forum, Port Vila 4-5 August 2010.

Pacific Island Forum Secretariat 'About us' Available at http://www.forumsec.org.fj/pages.cfm/about-us/crop/

Pacific Island Forum Secretariat 'CROP' Available at http://www.forumsec.org.fj/pages.cfm/about-us/crop/

Pacific Islands Regional Ocean Forum Communiqué, *The Pacific Islands Regional Oceans Policy – From Policy to a Framework for Integrated Strategic Action*, 2-4 February 2004.

PACT 2020: Protected Areas and Climate Turnaround, Climate change and Protected Areas Summit, Grenada, Spain, 16-19 November 2009 Available at http://www.iucn.org/about/union/commissions/wcpa/wcpa_events/wcpa_climatepasummit/wcpa_pact2020/

Paris Declaration on Aid Effectiveness (signed in March 2005) Available at http://www.oecd.org/dataoecd/11/41/34428351.pdf

Pacific Islands Regional Ocean Forum Communiqué, 2-4 February 2002, Suva, Fiji.

PIFS (2010) Tracking the Effectiveness of Development Efforts in the Pacific Region Available at http://www.forumsec.org.fj/resources/uploads/attachments/documents/PIFS_2010_Tracking_Report.pdf

Pio Manoa and Joeli Veitayaki 'Regional Ocean Governance in the Pacific Revisited' (2009)23 *Ocean Yearbook*.

President Anote Tong (Kiribati), 'Pacific Oceanscape: A Secure Future for Pacific Island Nations Based on Ocean Conservation and Management', Pacific Island Leaders Meeting. See also: UNESCO 'Phoenix Islands Protected Area' Available at http://whc.unesco.org/en/list/1325/

Quentin Hanich and Martin Tsamenyi, 'Managing Fisheries and Corruption in the Pacific Islands Region' (2009) 33 *Marine Policy*.

Robert Gillet, 'Pacific Islands Countries Region', review of the State of the World Marine resources, FAO Fisheries Technical Paper 457 (2005) 144.

Rudolfo Dorah, 'Towards Integrated National Ocean Policy in the South Pacific: competing and Conflicting Issues in Ocean Policy – Solomon Islands' (2007) UN-Nippon Fellowship Thesis 4. Available at http://www.un.org/Depts/los/nippon/unnff_programme_home/fellows_pages/fellows_papers/dorah_0607_solomon_islands.pdf accessed 24/10/2010.

Secretariat of the United Nations Framework Convention on Climate Change 'Vulnerability and Adaptation to Climate Change in Small Island Developing States' (2007).

Secretariat of the United Nations Framework Convention on Climate Change 'Vulnerability and Adaptation to Climate Change in Small Island Developing States' (2007).

Seremaia Tuqiri (2002) *Overview of an Oceans Policy for the Marine Environment* Available at http://wwwx.spc.int/coastfish/Asides/Other_orgs/SPOCCMSG/PIROP_overview_seremaia.pdf

SOPAC 'Pacific Islands Regional Maritime Boundaries Project' Available at http://map.sopac.org/Pacific+Island+Regional+Maritime+Boundaries+Project#_Status_of_Maritime_Boundaries_Treaties_in_the_Pacific_in_2009_br_

SOPAC, 'Race Against Time as the Deadline to Claim Extra Seabed Resources Draws Closer' Available at www.sopac.org/tiki-index.php?page=extended+continental+shelf+activities

Submissions, through the Secretary-General of the United Nations, to the Commission on the Limits of the Continental Shelf, pursuant to article 76, paragraph 8, of the United Nations Convention on the Law of the Sea of 10 December 1982 Available at http://www.un.org/Depts/los/clcs_new/commission_submissions.htm

The Pacific Plan: For Strengthening Regional Cooperation and Integration. See http://www.forumsec.org.fj/resources/uploads/attachments/documents/Pacific_Plan_Nov_2007_version.pdf accessed 25/03/2009.

United Nations Law of the Sea Convention, opened for signature 10 December 1982 (entered into force 16 November 1994).

WHC 'Impact of Climate Change on World Heritage Properties', *Expert Meeting on Issues Related to the State of Conservation of Properties Inscribed on the World Heritage List* WHC-06/30.COM/7.1, 2.

2nd International Seminar on Islands and Oceans
Tokyo, Japan, 29 November - 1 December 2010

The Pacific Oceanscape: A Secure Future for Pacific Island Nations based on Ocean Conservation and Management?

Rosemary Rayfuse*

Abstract
The Pacific Oceanscape, endorsed by the Pacific Forum leaders in August 2010, is intended to provide a framework for cooperative Pacific Island based stewardship in ocean conservation and management across a large part of the Pacific. It is an extremely ambitious framework aimed at understanding the connectivity of existing initiatives and considering what future actions need to be taken to designate 'protected' areas and respond to climate change and ocean security. The concept has been heralded by some as a new era in island-based and island-centric management. This paper will examine the potential utility of the Pacific Oceanscape concept for improving island-based management of ocean areas.

Keywords
Pacific Ocean, Pacific Islands, Oceanscape, Ocean Policy, Oceans Governance, Oceans Management, Conservation and Management, Law of the Sea

Introduction:

Recent studies have shown that no ocean area is unaffected by human activities.[1] Indeed, 41% of the earth's ocean area is strongly affected by multiple human activities while only 4% of ocean, that lying near the poles and largely protected from human activities by seasonal or permanent ice cover, is 'very lightly impacted'. Like all ocean areas, the Pacific Ocean is increasingly affected by, and vulnerable to, the strains placed on it by human activities. The question is – how to stop the decline?

At the 41st Pacific Islands Forum at Port Vila, Vanuatu, 4-5 August 2010, Pacific Forum leaders[2] endorsed a draft framework for the long-term sustainable and cooperative management of 38.5 million sq kms surrounding their collective islands. The framework, called the Pacific Oceanscape, "aims to address all ocean issues from governance to climate change, as well as design policies and implement practices that will improve ocean health, increase resources and expertise, and encourage governments to factor ocean issues into decisions about economic and sustainable development".[3]

Endorsement of the Pacific Oceanscape has been heralded in the press and by NGOs as "the dawning of a new era for marine management"; an "unprecedented agreement to improve ocean health at massive scale"; "among the most ambitious, innovative and collaborative marine instruments on earth"; and "the kind of leadership that brings about real, positive change".[4] The purpose of this paper

* Professor of International Law, Faculty of Law, University of New South Wales, Sydney, Australia
[1] Benjamin S. Halpern et al, "A Global Map of Human Impact on Marine Ecosystems" (2008), *Science* 319 (5865), 948-953
[2] Members of the Pacific Forum are: Australia, Cook Islands, Federated States of Micronesia, Kiribati, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Republic of Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu.
[3] See Communique, para 68, available at http://www.forumsec.org.fj/pages.cfm/documents/forum-communiques/
[4] See, eg, Kim McCabe, "New 'Pacific Oceanscape' Makes History" http://www.celsias.com/article/new-pacific-oceanscape-makes-history/ ; Molly Bergen, 'Creating an Oceanscape' http://www.conservation.org/FMG/Articles/Pages/marine_pacific_creating_an_oceanscape.aspx; "Massive New 'Pacific Oceanscape' Makes History; The Dawning of a New Era for Marine Management" Underwater times.com News service, available at http://www.underwatertimes.com/news.php?article_id=64825100137; and CI Press release available at https://www.conservation.org/newsroom/pressreleases/Pages/Pacific_Oceanscape_creation.aspx

is to critically assess the Pacific Oceanscape and its utility as a means of improving island-based management of the Pacific Ocean.

The Origins of the Oceanscape concept

The Oceanscape concept has its origins in the Seascape concept pioneered by the NGO, Conservation International (CI). The Seascape concept is designed to integrate management of broad ocean areas through collaborations between governments and NGOs, conservation organisations, coastal communities and the private sector. In recent years Seascapes have been established in Bird's Head Papua (eastern Indonesia), the Sulu and Sulawesi Seas (Indonesia, Malaysia and the Philippines) and the Eastern Tropical Pacific where Panama, Costa Rica, Colombia and Ecuador, where, the four states agreed, pursuant to the San Jose Declaration of April 2004, to seek the support of international and regional organisations, including CI, to improve stewardship of their shared marine life and environment. [5]

The objective of the Seascape programmes, as articulated by CI, is to engage in cooperative marine stewardship by establishing biodiversity reserves, declaring critical areas, improving procedures for assessing the environmental impacts of development, and helping to establish a coordinated legal framework for management by neighbouring countries. Other Seascapes are also being promoted in Brazil, Hawaii and the Western Indian Ocean.

Building on their Seascape concept, CI worked with other NGOs, including the Nature Conservancy and WWF, to scale up the concept into to creation of the Coral Triangle Initiative which is intended to assist 6 states (Malaysia, Indonesia, Papua New Guinea, Philippines, Solomon Islands and Timor L'Este) to promote their coral reefs, fisheries and food security.[6] CI's ultimate success appears to have been winning the support of President Tong of Kiribati to champion the, even grander, Pacific Oceanscape to focus attention and investment into the broader Pacific area.

The Pacific Oceanscape concept and its companion Pacific Ocean Arc Initiative were first introduced by President Tong as a country initiative announcement to the Pacific Forum Leaders at their 40th meeting in 2009.[7] The objective of the Oceanscape was to provide a larger framework, consistent with the Pacific Islands Regional Ocean Policy (PIROP)[8] and Pacific Plan,[9] to connect existing ocean protection initiatives. The rationale for the Oceanscape was strongly linked to the current and future, perceived and real, threats to the region from climate change. As expressed by President Tong:

> "Climate change threatens our very existence. With rising sea levels, overfishing, warming ocean temperatures, pollution and acidification, our oceans are changing in ways that our ancestors could not have imagined. There is an urgent need for us to join together and face these common threats. If we are to successfully manage and conserve the ocean's precious resources for present and future generations. The new Pacific Oceanscape will help us build resilience in ocean ecosystems so that marine life has the best chance of adapting. Only by doing this can there be some assurance that the oceans, and millions of people who depend on them directly for their livelihood and well-being, will survive the onslaught of global climate change'.[10]

---

[5] For more information on these Seascapes see:
http://www.conservation.org/sites/marine/initiatives/seascapes/pages/seascapes.aspx
[6] See http://www.conservation.org/sites/marine/initiatives/oceanscapes/cti/pages/overview.aspx
[7] See Pacific Oceanscape: A Secure Future for Pacific Island Nations Based on Ocean Conservation and Management, Presented to the 40th Pacific Islands Forum by the Republic of Kiribati (Briefing Paper) available at, www.marinenz.org.nz/documents/pacific_oceanscape.pdf
[8] See www.forumsec.org/resources/uploads/attachments/documents/PIROP.pdf
[9] See http://www.forumsec.org.fj/pages.cfm/about-us/the-pacific-plan/
[10] Quoted in "Massive New 'Pacific Oceanscape' Makes History; The Dawning of a New Era for Marine Management" Underwater times.com News service, available at http://www.underwatertimes.com/news.php?article_id=64825100137

Three key components of the Oceanscape concept were identified. The first component, proposed as a major building block of the Oceanscape, was a system of "Pacific Ocean Arcs", or integrated marine and terrestrial protected areas, including marine protected areas in areas beyond national jurisdiction (ie, on the high seas). Consistent with contemporary calls for the establishment of Marine Protected Areas (MPAs), and invoking notions of 'stewardship', the purpose of these Arcs would be to promote the overall conservation and sustainable management of the coral reef based marine and island ecosystems in the region on a large, integrated and holistic scale. In a demonstration of his country's resolve, President Tong reminded the Forum Leaders that Kiribati had nominated the Phoenix Islands Protected Area, an area covering some 400,000 sq kms of Kiribati exclusive economic zone, to the UNESCO World Heritage List as an outstanding natural site. He called on the other parties to the World Heritage Convention to ensure the site was listed highlighted the need for international investment in the establishment and protection of protected areas, particularly, in the Central Pacific.

The second key component of the proposed Oceanscape was "Climate Change and Ocean Security and Governance". In the opinion of Kiribati, climate change impacts on the oceans had not yet been sufficiently recognised, particularly as regards their impacts on the Pacific and even more particularly, their impacts on small low-lying atoll states. The Oceanscape concept would provide an opportunity for the region to unite on climate change and ocean management issues. This component of the proposal was therefore designed to further investigation and solutions regarding the emerging issues that impact on the ocean's health, such as ocean acidification and ocean warming and to investigate governance issues relating to environmental, resource, human and national security in the EEZ and beyond.

The third component of the Kiribati proposal related to "Leadership and Learning" and was aimed at finding ways to support capacity development and implementation across all aspects of the Oceanscape initiative.

At the conclusion of the 40th meeting, Forum Leaders agreed that the success of the Pacific Oceanscape would be "predicated on strong Forum leadership and regional cooperation which would in turn focus urgent and timely attention on critical issues such as climate change impacts on Pacific peoples, their islands and their ocean".[11] They then called on the Secretariat and relevant agencies and partners to work together to draft a framework for the Pacific Oceanscape.[12]

The Pacific Oceanscape Framework

The Framework for a Pacific Oceanscape, which was adopted in 2010, states that the Pacific Oceanscape "is seen as a catalyst for action for the Pacific Islands Regional Ocean Policy to protect, manage, maintain and sustain the cultural and natural integrity of the ocean for our ancestors and future generations and indeed for global well-being. ... [It] is a vehicle to build pride, leadership, learning and cooperation across the ocean environment. Overall the intent is to foster stewardship at scale – local, national, regional and international to ensure in perpetuity to health and wellbeing of our ocean and ourselves."[13]

The Framework sets out the legal and policy context in which it operates noting that the Pacific Island Countries and Territories (PICs) have already committed to "a plethora of other policy and legal agreements and frameworks at the national, regional and international levels that relate to and have implications for the sustainable development and use of islands, coasts, seas and the ocean within the Region". At the global level these include, for example, the UN Convention on the Law of the Sea, the Biodiversity Convention, the Framework Convention on Climate Change, the Basel Convention

[11] Cristelle Pratt and Hugh Govan "Our Sea of Islands, Our Livelihoods – Our Oceania Framework for a Pacific Oceanscape, November 2010 at 9, available at http://www.sprep.org/publication/PEIN_Regional_Frameworks.asp

[12] See 2009 Forum Communique, Cairns, Australia, 5-6 August, para 69, available at, http://www.forumsec.org.fj/pages.cfm/documents/forum-communiques/

[13] The Draft Framework as adopted is reproduced at pp 51-64 in Pratt and Govan, above n 11

on the Transboundary Movement of Hazardous Wastes and a number of agreements relating to marine pollution including the London Dumping Convention and its Protocol, and the MARPOL Convention. In addition to legal instruments the PICs have also signed on to a wide array of policy frameworks for sustainable development such as the Johannesburg Program of Action and the Mauritius Strategy for the Further Implementation of the Barbados Program of Action for the Sustainable Development of SIDS. These instruments are complemented at the regional level by the Pacific Plan and the PIROP and nationally by a range of National Sustainable Development Strategies, Action Plans, Adaptation Programmes and Development Planning instruments.

The Framework then sets out a number of guiding principles for the implementation of the Framework. These include:

- Improving ocean governance through engaging leaders and other decision-makers in strengthening governance mechanisms;
- Sustainably managing ocean resources through educating and training scientists, policymakers and other stakeholders in better management practices, including multi-use marine protected areas;
- Maintaining ocean health by reducing the negative impacts of human activities, protecting and conserving biodiversity;
- Expanding our understanding of the ocean through increasing scientific knowledge to better inform decision-making;
- Protecting ocean security by bringing together the economic, environmental, political and military sectors to fight illegal and criminal practices; and
- Facilitating partnerships and cooperation by fostering collaboration to make conservation efforts more effective.

Like the PIROP, the Framework applies to "that part of the Pacific Ocean in which the island countries and territories (Pacific Communities), that are members of the organisations comprising the Council of Regional Organisations of the Pacific (CROP) are found. As such, the extent of the region includes not only the area within the 200 nautical miles Exclusive Economic Zone (EEZ) boundaries circumscribing these island countries but also the ocean and coastal areas that encompass the extent of the marine ecosystems that support the region. In other words, the Framework applies to both the EEZs of member states *and* the high seas areas within the region. 'Ocean' is defined as including "the waters of the ocean, the living and non-living elements within, the seabed beneath and the ocean atmosphere and ocean-island interfaces". In all the Oceanscape applies to 38.5 million sq kms of ocean., some of which lies in areas beyond national jurisdiction.

Consistent with the Kiribati proposal, the Framework has three broad objectives focusing on integrated ocean management, adaptation to environmental and climate change, and the articulation and use of appropriate facilitative and collaborative processes, mechanisms and systems, referred to as "liaising, listening, learning and leading". Ultimately these objectives are aimed at improving management of fisheries, protection and conservation of biodiversity, furthering scientific understanding of the marine ecosystem, and reducing the negative impacts of human activities.

To meet these objectives the Framework establishes a number of strategic priorities and actions.

- As a first priority PICs are called upon to formalise their jurisdictional entitlements over maritime zones and resources by formalising their maritime claims through, inter alia, definitively fixing their baselines, delineating their maritime zones and delimiting their maritime boundaries.
- The second priority relates to 'good ocean governance' and calls for the setting, at the national level, of integrated cross sectoral policies and plans of action that promote the sustainable management and development of the ocean and its resources. Creation of an institutional mechanism for coordination is envisaged through the establishment of a Regional Ocean Commissioner and regional Ocean Alliance/Partnership mechanism.
- The third priority calls for integration of traditional knowledge with modern approaches to marine conservation and management to ensure effective stewardship of coastal marine resources,

economic and environmentally sustainable management of EEZ resources and effective stewardship of high seas and deep sea ecosystems for the common good.

- The fourth priority calls for capacity building to ensure research needs are targeted, achievable and effective and to that adequate information sharing processes are in place to ensure the needs of PICs and the issues of sustainable oceans management are adequately represented at national, regional and international levels.
- The fifth priority calls for the establishment of cost effective solutions through the innovative use of regional economic, trade and investment alliances providing, for example, "cross-border investments and trading, shared access, common branding and consolidated marketing of marine resources".
- The sixth and final priority relates to adaptation to a rapidly changing environment and calls for the establishment of a centralised mechanism to assess and explore emerging issues and ensure effective coordinated action in responding and adapting to the threats posed by environmental change.

The Pacific Oceanscape: A Critical Assessment

While the Pacific Oceanscape and its emphasis on island-based management of ocean areas has been promoted as a new concept, it is useful to remember that the idea of island-based management of ocean areas is nothing new. Indeed, it was that idea which unpinned the development of the concept of 'archipelagic' states in the law of the sea. Now enshrined in Part IV of the Law of the Sea Convention (LOSC) the archipelagic state concept recognises the connection of oceans and islands and the importance of ocean areas to people living in these islands. As defined in article 46, an archipelago is group of islands, including parts of islands, interconnecting waters and other natural features which are so closely interrelated that such islands, waters and other natural features form an intrinsic geographical, economic and political entity, or which historically have been regarded as such. An archipelagic state is one constituted wholly or by one or more archipelagos and, possibly, other islands. The concept thus applies directly to, at least many of, the PICs. As the LOSC makes clear, islands and island/archipelagic states – as with all coastal states – already have both rights and responsibilities in respect of their ocean areas. Certainly, the Pacific Oceanscape may be seen as a reaffirmation of both the benefits and the burdens of stewardship that come with island 'ownership'. However, the question is what, if anything, can it deliver?

Probably the first and most obvious critique of the Pacific Oceanscape is that the Framework is long on rhetoric but short on substance. While the document certainly reflects and incorporates all that is, today, generally accepted as relevant to 'best practice' in oceans management, it is essentially nothing more than a hortatory exhortation to act. The document clearly belies its NGO origins, providing what is essentially a long wish list with little or no effective guidance on how its goals are to be achieved. Indeed it is difficult to see how adoption of the Oceanscape Framework adds anything to the existing regional initiatives, the PIROP and the Pacific Plan, other than one more layer of policy obfuscation. Of course, it is early days for the Pacific Oceanscape. But the absence of detail in the Framework document invites a presumption of ineffectiveness rather than confidence in concrete outcomes.

A second critique relates to its consistency with established international law. For example, the Framework purports to apply the Oceanscape concept to all ocean spaces in the Forum Area, *including* areas beyond national jurisdiction. Implementation or application of the Oceanscape concept in these areas may directly conflict with the interests of all other states in the high seas. This begs the question as to whether the Oceasncape concept is, among other things, an attempt to exert what is euphemistically known as 'creeping jurisdiction'. As Chile, Canada and others have learned, the international community has been quick to condemn such assertions in the past. Clearly the wording of the Framework is open to raising objections which, in its implementation, the PICs will have to be sensitive to. This applies, as well, to the exhortation to use regional trade and investment alliances to achieve desired goals, the implementation of which will have to be sensitive not only to

global trade and investment flows but also to the international legal framework by which these things are governed.

A third critique relates to the question of implementation. The Framework calls for the establishment of a Regional Oceans Commissioner, with dedicated professional support, to provide high level representation and commitment to ensure dedicated advocacy and attention to ocean priorities, decisions and processes at national, regional and international levels. The Commissioner is to facilitate a Regional Ocean Alliance or Partnership mechanism to provide effective ocean policy coordination and implementation, facilitate regional cooperation for the high seas, as well as support for national ocean governance and policy processes when required.

There is no doubt that the PICs have experience with establishing mechanisms to facilitate and harmonise regional cooperation and to represent their interests on the world stage. The Forum Fisheries Agency works assiduously and successfully to protect the interests of the PICs in their fisheries resources. Other regional mechanisms include the South Pacific Commission, the South Pacific Regional Environmental Program and the South Pacific Geosciences Commission. However, it is difficult enough to envisage the extent of authority of the proposed Commissioner and Alliance to influence and harmonise the vast range of necessary national laws and policies, let alone the resolution of competing and conflicting national and institutional interests at the regional and international level. This is not to suggest that such a Commissioner is not a good idea. Indeed, in many respects it is reminiscent of Canada's experience with its 'Ocean's Ambassador' and, more recently, its 'Fisheries Ambassador'. Rather it is simply to suggest that the Framework, as drafted, provides no substantive guidance on the mechanisms for appointing and defining the competencies of the proposed Commissioner and implementation of such a proposal in an international setting will be fraught with difficulties.

A number of other implementation related questions are raised by the Framework, including the relationship of the Oceanscape to existing regional and global conventions to which the PICs are parties, including its relationship to existing institutions such as the International Seabed Authority, the Western and Central Pacific Fisheries Commission and the recently adopted South Pacific Regional Fisheries Management Organisation. What institutional mechanisms exist, or will be needed, to ensure the requisite levels of cooperation is also unclear as is how, precisely, the Oceanscape is going to further climate change research, adaptation and related policy and legal activities. The question can best be summed up by reference to the concept of 'additionality'. What does the Oceanscape provide that is not either already in existence or already sought after?

A third critique relates to the absence of any framework for assessing the success of the Oceanscape. It is important not only to determine how improvements in ocean health and resilience, national institutional or human capacity, social and political conditions and legal and policy frameworks will be implemented but also how they will be measures and against what standards they will be assessed. This also relates to the question of enforcement. The concern here can be illustrated by reference to the Phoenix Islands Protected Area which was established by Kiribati in 2008. The PIPA closes off more that 11% (400,000 sq kms) of the Kiribati EEZ to fishing and other extractive activities in a bold bid to protect biodiversity and fish stocks. The proposal for World Heritage listing was successful and the area has now been declared a World Heritage area in recognition of its 'pristine nature and importance as a migration route and reservoir'. While a laudable contribution to international efforts to establish marine protected areas (MPAs), enforcement of the closures has proved notoriously elusive, in part because Kiribati simply lacks the resources to effectively police such a vast area.

This brings us to a fourth critique which relates to the question of how implementation of the Oceanscape is to be financed. In his speech to the UNGA on 25 September 2010 announcing endorsement of the Pacific Oceanscape by the Forum Leaders, President Tong of Kiribati, who spearheaded the introduction of the concept, stated:

> "Our message to the international community is that conservation of biodiversity and ecosystems in the Pacific is not only important to the sustainable development of Pacific peoples; it is of vital importance to the rest of the world. Support from the international community in protecting ecosystems in the Pacific and indeed elsewhere should not be viewed as a hand out but as an investment for future generations of the planet".[14]

The efficacy of the Oceanscape concept appears thus, in large measure, to be dependent on external resources, the availability of which is unknown and uncertain. In other words, at its most elemental, the Pacific Oceanscape appears designed as simply a new way of asking for financial assistance, aid and support for capacity building. It is unclear whether the international community will come to the table with new commitments or, if they do, whether those commitments will be genuinely responsive to the needs of the Pacific peoples. In this respect the Oceanscape concept walks a fine line. By putting themselves forward as stewards, or trustees, of the ocean environment for the international community, it is the international community's interests the PICs will be required to protect – not their own.[15] The Oceanscape concept may, ironically, result in more interference from the rest of the international community rather than in less.

Nevertheless, while it might be tempting to dismiss the Pacific Oceanscape as pure hyperbole, an alternative assessment would suggest that it is a concept of great aspiration, inspiration and vision which sets the stage for a new era in ocean management in the Pacific based on the concept of stewardship and incorporating modern principles, tools and techniques of ocean management. Indeed its 'eye on the future' is particularly evident in the articulation of the first strategic priority in the Framework document: the definitive establishment of maritime zones and boundaries.

As has been discussed extensively by commentators, and in previous symposia in this series,[16] the issue of sea-level rise poses particular problems for low-lying island states, many of which lie in the Pacific. A state's maritime zones extend seaward from its baselines, usually drawn along the low-water mark. Although the matter is not free from doubt, the prevailing interpretation of the LOSC rules on baselines holds that, in general, they are ambulatory. In other words, as sea level rises, the baselines recede along with the outer edge of maritime zones. Sea level rise may therefore lead to a diminution of maritime zones. In the case of low-lying islands, the transition from an inhabited island to a rock incapable of sustaining human habitation or economic life may even lead to a near total loss of all maritime zones.

Given the critical economic importance of their maritime zones to the PICs, it makes sense to take steps, as a matter of highest priority, to ensure no diminution of these assets. Although again, not entirely free from doubt, it appears that this can most efficiently be achieved by ascertaining and declaring baselines and agreeing on maritime boundary delimitations. With respect to the former, the legislation of many PICs merely refers to their maritime zones as extending from the low water line. This legislation should be amended to provide that the maritime zones extent from baselines fixed by regulation. These baselines should then be definitively set by subsidiary regulation as a series of geographical coordinates and lodged with the United National Division on Ocean Affairs and the Law of the Sea as provided for in the LOSC. Once lodged, these geographic coordinates need not be

---

[14] See Statement by His Excellency Anote Tong, President of the Republic of Kiribati, General Debate, 65th United Nations General Assembly, 25 September 2010, available at http://www.un.org/en/ga/65/meetings/generaldebate/View/SpeechView/tabid/85/smid/411/ArticleID/189/reftab/231/t/Kiribati/Default.aspx

[15] R. Rayfuse and R. Warner, "Securing a Sustainable Future for the Oceans Beyond National Jurisdiction: The Legal Basis for an Integrated Cross-Sectoral Regime for High Seas Governance for the 21st Century" 23(3) *International Journal of Marine and Coastal Law* 399-421 (2008

[16] See, eg, Rayfuse, "W(h)ither Tuvalu? Oceans Governance and Disappearing States", International Symposium of Islands and Oceans, Oceans Policy Research Foundation, Tokyo, Japan, January 2009, Ocean Policy Research Foundation *Proceedings of the International Symposium on Islands and Oceans* 91 – 93 (March 2009) and Rayfuse, "Sea Level Rise and Disappearing States: Protecting Maritime Entitlements to Resolve the Statehood Dilemma" available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1704835

changed. Thus, the ‘baselines’ (and the corresponding outer limits of maritime zones) stay the same regardless of regression of the low water line. With respect to the latter, by operation of the law of treaties, the delimitation of maritime boundaries by treaty similarly resolves the issue of shifting maritime zones as between the delimiting opposite or adjacent states.

Conclusion

The Pacific Oceanscape is an interesting idea. There is no doubt that centralised, specific, scientifically verifiable mechanisms are needed to measure and evaluate oceans health. Similarly the need for capacity building of nations, institutions and communities to create effective management of their marine resources is incontestable as is the continuing need for encouragement of social and political support for actions that promote the health and productivity of marine systems. But none of this is new. The challenge for the Pacific Oceanscape is to move beyond the rhetoric to the reality of effective policy, legal and practical developments which achieve its goals. Whether the Pacific Oceanscape will live up to the ‘hype’ only time will tell.

The Status and Challenges of Maritime Boundary Development in the Pacific Region

Emily Artack (presenter)
Project Officer - Maritime Boundaries (Cartographer)
Applied Geoscience & Technology Division (SOPAC)
Secretariat of the Pacific Community (SPC)
Suva,
FIJI ISLANDS
E-mail: emily@sopac.org

Abstract

The mandate to develop maritime boundaries solutions to the Pacific Islands Countries (PICs) was transferred to SOPAC from the Forum Fisheries Agency (FFA) in 2000. The SOPAC Maritime Boundaries Sector has a Geographical Information System (GIS) database PIRMBIS (Pacific Islands Regional Maritime Boundaries Information System) which holds PIC baseline as well as maritime boundary data and information. As well as maritime boundary delimitation SOPAC also assist PIC with the implementation of Article 76 of the United Nations Convention on the Law of the Sea (UNCLOS) to claim extended continental shelf territory (eCS). The regional effort coordinated by SOPAC to determine potential eCS territory and submit claims and over the last few years has built considerable member country capacity and this in turn has assured that PICs have secure the right of eight PICs to claim 1.8 million square kilometres of additional seabed territory (by the 13th of May, 2009). This historical regional effort was possible as a result of a series of seven intensive regional training workshops bringing together country teams from Cook Islands, Fiji, Federated States of Micronesia, Kiribati, Papua New Guinea, Solomon Islands, Palau, Tonga, Tuvalu, Vanuatu, as well as international and regional technical experts; Geoscience Australia (GA) and the UNEP Shelf Programme, the Commonwealth Secretariat, Geolimits and Geocap. The enhanced skills and capacity built during these Australia Government funded (AusAID) technical workshops is now being redirected towards PIC efforts to develop their respective maritime baselines, zones, outer limits and shared boundary solutions, many of which are not yet defined in accordance with UNCLOS.

Keywords: Pacific Islands; Maritime Boundaries; Pacific Islands Maritime Boundaries Information System; SOPAC Maritime Boundaries Sector; Extended Continental Shelf claims.

Introduction

The Pacific Ocean is the largest Ocean in the World with an area of approximately 180 million square kilometres covering approximately one third of the Earth's surface. It contains approximately 25,000 islands being in the Pacific Islands Region. To date SOPAC has assisted 14 PICs (Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu and Vanuatu) in the development of maritime boundaries solutions via is Ocean & Islands Programme based Maritime Boundaries Sector. All PICs are signatories of UNCLOS and were involved in the UNCLOS negotiations from 1973 to 1982, with Fiji being the first State to sign the Convention in Jamaica in 1982. However, at the time of writing few PICs have developed and declared their maritime zones and limits in accordance with the provisions of UNCLOS.

In 1987 leaders of PICs signed the "***Treaty of Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America"*** in Port Moresby, Papua New Guinea. This treaty defined regional maritime zones, which at that time, were taken to represent the fisheries jurisdictional areas of the Pacific Island parties. This Treaty entered into force on the 16th of June 1992. The status of the treaty is shown in Table 1.

Table 1: Treaty of Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America (Multilateral Fishing Treaty)

Parties	**Date of Signature**	**Date of Ratification/ Other**	**Entry Into Force**	**Domestication Legislation (where available)**
Cook Islands	2 April 1987		15 June 1988	Exclusive Economic Zone (Foreign Fishing Craft) Regulations
Federated States of Micronesia	2 April 1987		15 June 1988	Titles 18 and 24 of the Code of the Federated States of Micronesia, as amended by Public Law Nos. 2-28, 2-31, 3-9, 3-10, 3-34, and 3-80
Fiji	2 April 1987		15 June 1988	Fisheries Act, (Cap. 158)
Kiribati				Fisheries Act, 1979
Marshall Islands	2 April 1987		15 June 1988	Title 33, Marine Resources Act, as amended by P.L. 1989-56, P.L. 1991-43 and P.L. 1992-25 of the Marshall Islands Revised Code
Nauru	2 April 1987		15 June 1988	Interpretation Act, 1971
Niue	2 April 1987		15 June 1988	Niue Fish Protection Ordinance 1965

Palau	2 April 1987		15 June 1988	Palau National Code, Title 27
Papua New Guinea	2 April 1987		15 June 1988	Fisheries Act (Cap 214)
Samoa	2 April 1987		15 June 1988	Exclusive Economic Zone Act, 1977
Solomon Islands	2 April 1987		15 June 1988	Delimitation of Marine Waters Act, 1978
Tonga	2 April 1987		15 June 1988	Fisheries Act, 1989
Tuvalu	2 April 1987		15 June 1988	Fisheries Act (Cap 45)
Vanuatu	12 April 1987		15 May 1989	Fisheries Act 1982 (Cap 158)
Australia	2 April 1987		15 June 1988	
New Zealand	2 April 1987		15 June 1988	
United States of America	2 April 1987		15 June 1988	

Source: Pacific Islands Treaty Series *Status Report - Treaty of Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America (Multilateral Fishing Treaty)*, University of the South Pacific, updated 1998 available at < http://www.paclii.org/pits/en/status_pages/1987-2.html>.

In the early 1990s, the Maritime Regional Delimitation of Boundaries Project was established at the Forum Fisheries Agency (FFA) based in the Solomon Islands. The Project developed technical limits or notional boundary lines to serve the needs of the fisheries interests that were becoming major source revenue to PICs.

In 2000, the Project was transferred to SOPAC with funding from the Australian Government (AusAID) and since that time the Project has undertaken numerous baseline surveys and developed comprehensive and highly accurate GIS datasets which define baselines, zones and outer limits of PICs in accordance with the provisions of UNCLOS. The SOPAC Maritime Boundaries Sector maintains a secure database PIRMBIS (Pacific Islands Regional Maritime Boundaries Information System) which holds all data associated with the development of PIC maritime boundary solutions since 2000.

PIRMBIS (Pacific Islands Regional Maritime Boundaries Information System)

PIRMBIS has been established since 2004 to serve as a regional database and GIS containing all baseline and maritime boundaries data, map sheets, charts and information to develop UNCLOS compliant maritime boundary solutions. All information held securely and confidentially until such time as countries decide to declare and release this into the public domain.

As well as SOPAC collected data, PIRMBIS contains PIC data available in the public domain; for example data held by the United Nations are also incorporated into PIRMBIS. Signed shared boundary treaties between neighbouring and adjacent states are also held in PIRMBIS. Figure 1 shows the status of publically available maritime boundaries datasets for the 14 SOPAC project countries.

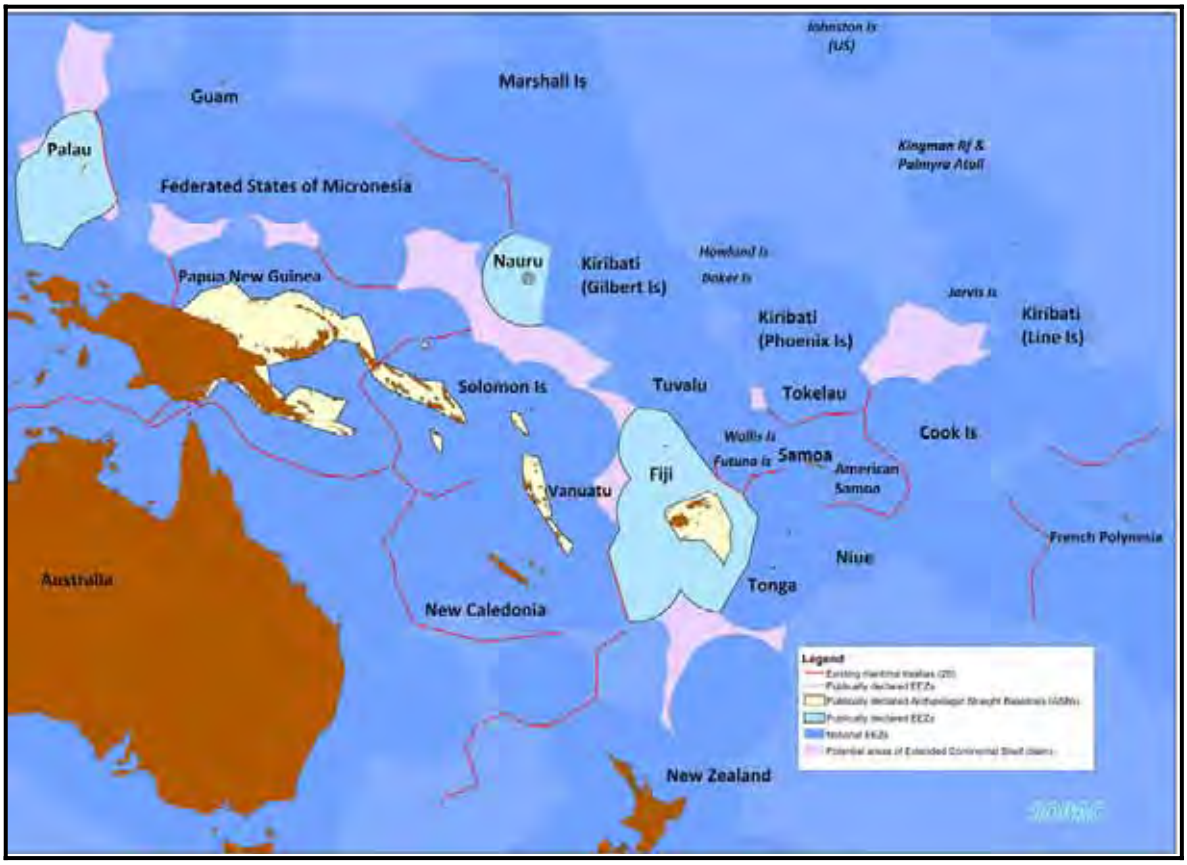


Figure 1: Status of the 14 SOPAC project countries who have publically declared geographical coordinates of the declared maritime boundaries on the United Nations website *Deposit of charts* updated 10th of November 2010. Available at <http://www.un.org/Depts/los/LEGISLATIONANDTREATIES/depositpublicity.htm>.

Global Positioning System (GPS) Field Surveys

Many existing chart and map products for PICs are out of date and inaccurate and the SOPAC Maritime Boundaries Sector has been providing a lead role in implementing highly accurate GPS field surveys to ascertain the precise positions of baselines from which PIC maritime limits will be computed. Field surveys were completed for Fiji in 2007 and 2008, as well as for Papua New Guinea in 2009/2010 and Kiribati in 2010. The data collected from these GPS surveys requires significant post processing effort, also provided by SOPAC and our technical partners, and is used to verify the positioning of the baselines for PICs.

Use of Satellite Imagery in the Verification Process of the Baselines

Recent advances in technological, especially high resolution satellite imagery with excellent positional accuracy parameters (+/- 15m) are now being made available to the Pacific and the use of this imagery to digitise the position baselines is also being undertaken for the SOPAC project countries.

Implementation of Article 76 of the UNLCOS for the Pacific countries

Since 2007 SOPAC in collaboration with its technical partners (Geoscience Australia (GA) and the UNEP Shelf Programme, the Commonwealth Secretariat, Geolimits and Geocap) have been coordinating capacity building technical workshops for PICs. The aim of the technical training is to provide a range of capacity building activities in preparing submissions, maps and other documents relating to the areas of potential seabed claim for the United Nations Commission on the Limits of the Continental Shelf (UNCLCS).

The aims of these training workshops have been to train the country technical staff to:

- Assess the results of their desktop study especially with regard to the quality and suitability of the existing data to construct a credible case for ECS;
- Become familiar with the GEOCAP UNCLOS software and the data available for inclusion in the submission;
- Prepare reports on the geology and morphology of the area in relation to Article 76 of UNCLOS in order to build the arguments for the delineation of the ECS;
- Develop a strategy and project plan for ECS definition, submission preparation and lodgement.

By the 13th of May, 2009, there were eight PICs which successfully lodged their submissions to the United Nations for an approximate total 1.8 million square kilometres of additional seabed territory. The regional success was possible as a result of a series of seven intensive regional training workshops bringing together country teams from Cook Islands, Fiji, Federated States of Micronesia, Kiribati, Papua New Guinea, Solomon Islands, Palau, Tonga, Tuvalu, Vanuatu, as well as international and regional technical experts to develop joint and individual submission documents. The list of countries that made the various submissions is available via the UNCLCS web site *http://www.un.org/Depts/los/clcs_new/commission_submissions.htm.*

Challenges

The paucity of adequate and accurate data to support maritime boundaries development in the region remains a major obstacle towards the development of maritime boundary solutions and PIC ability to complete their respective extended continental shelf claims (eCS). Additionally, the specialist skills and equipment agencies such SOPAC have at their disposal to assist PIC to address these critical data gaps and needs is inadequate given the urgency of the issue. In cases of deep sea floor data (bathymetry deeper than 2,000m) which is required in support of eCS claims, no regional agency has the equipment to collect this and PIC are reliant on the good will of neighbouring developed States or transiting international vessels to assist if they are willing – these opportunities are rarely secured.

Despite these technical challenges SOPAC has over the years completed a number of complete technical solutions for PIC maritime baselines, zones and outer limits to member States. However, even where these data sets are complete and appropriate for declaration purposes, few PIC have taken advantage of this and declared these accurate coordinates defining their marine zones to the Secretary of the United Nations despite all UNCLOS signatories being obliged to give due publicity to charts or list of geographical coordinates and deposit a copy of such charts or list with the Secretary General of the United Nations. Refer to Articles 16, 47(9), 75.

This highlights a further area of challenge for PIC in the development of regional maritime boundary solutions. The Law of the Sea / Maritime Boundaries orientated legal capacity of PICs is, in the cases where it is locally available, frequently fully engaged in issues pertaining to fisheries management. This means the ability of PICs to focus the necessary resources and efforts to towards review of their relevant marine spaces acts, acknowledge and promulgate new boundary data and ultimately declare this with the UN is critically under resourced. In a

number of PICs their existing marine spaces acts or legislative frameworks actually prevents the use of the new data developed by SOPAC.

SOPAC is not mandated to provide legal support to PIC on this issue and the Governing Council of SOPAC reaffirmed in 2010 that its mandate should not be extended in this way. As a result SOPAC attempts to coordinate strategic legal assistance to PIC in conjunction with its technical work via its technical partnership. Most recently the FFA has acknowledged the effectiveness of the SOPAC lead efforts in this regard and is expected to join the technical partnership in 2011, it is envisaged that this will significantly bolster the legal capacity and assistance available to PICs.

A final challenge is the incorrect perception of many PICs that the current use of the boundaries depicted by the "*Treaty of Fisheries between the Governments of Certain Pacific Island States and the Government of the United States of America*" (referred to in short as the "*US Treaty Lines*") are official, promulgated representations of their maritime zones and limits. The mounting number of failed fisheries prosecution cases is frequently due to ambiguous and poorly defined state of PIC boundaries and the fact that most are not adequately defined and few have been declared in accordance with UNCLOS.

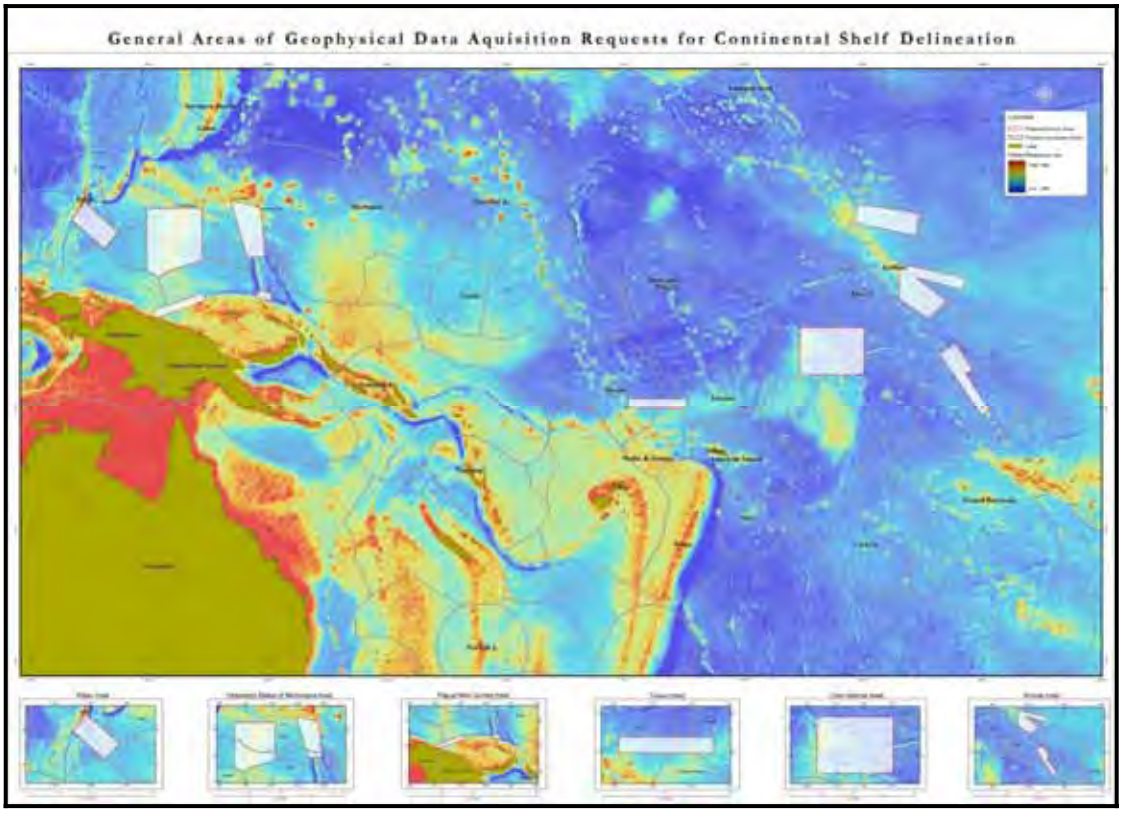


Figure 2: Areas of Geophysical Data Acquisition Requests for Continental Shelf Delineation. Source: Sweet, S, (2010) *SOPAC/GA/UNEP Shelf/COMSEC 6th Technical Workshop on Assisting PICs with the preparations submissions relating to Article 76 of UNCLOS,* February 2010, Sydney, Australia.

Acknowledgements

Acknowledgement for the preparation of this paper must be given to Dr Arthur Webb, Manager of the Ocean & Islands Programme at SOPAC and Mr Andrick Lal, Senior Project Officer- Surveying, who were unable to attend the 2nd International Seminar on Islands and Oceans due to urgent work commitments.

All of the technical workshops, as well as the ongoing Pacific Islands Regional Maritime Boundaries Sector activities have been funded by the Government of Australia through the Pacific Sector Support Program (PGSP) which is now referred to as the Pacific Public Sector Linkages Program (PPSLP) and also from AusAID in order to support the regionally coordinated efforts for the Pacific countries and ultimately build sound ocean governance and marine resource security for the region.

Setting Limits and Boundaries in the Pacific: The Essential Framework to Manage Marine Resources

Dr Clive Schofield
Director of Research, Australian National Centre for Ocean Resources and Security (ANCORS), University of Wollongong, Wollongong, NSW 2522, Australia (e-mail: clives@uow.edu.au).

Abstract

The paper explores the purpose and value of setting maritime limits and boundaries and, in particular, argues that to do so is crucial in order to provide a clear jurisdictional framework so as to better realise the benefits to be derived from the value marine resources contained within the maritime spaces claimed by coastal States. The problems associated with maritime jurisdictional uncertainty are also noted. The spatial limits of maritime claims under international law are outlined together with the key ways in which the limits of such claims can be established. Challenges and uncertainties in defining maritime limits and boundaries are then highlighted with particular reference to the Pacific island States regional context.

Keywords: baselines, maritime claims, overlapping claims, maritime delimitation, outer continental shelf, boundary disputes, marine resources.

Introduction

The clear definition of the limits to maritime jurisdiction provides the fundamental framework for the governance of maritime space and thus the management of valuable marine resources. In accordance with the terms of the United Nations Convention on the Law of the Sea (LOSC) of 1982,[1] this can be achieved through either through the definition of distance-based limits from baselines along the coast, the delimitation of maritime boundaries between neighbouring States where their maritime jurisdictional claims overlap, or through the establishment of outer continental shelf limits. However, some uncertainties persist in relation to the establishment of these three types of maritime limit.

This paper outlines the purpose and value of establishing maritime limits and delimiting maritime boundaries. The spatial limits to maritime jurisdictional claims consistent with LOSC are outlined together with the key ways in which maritime limits and boundaries can be defined with particular reference to the state-of-play in the Pacific islands region. A number of uncertainties arising are then highlighted, together with options to address these challenges.

Why Define Maritime Limits and Boundaries?

Fundamentally, the establishment of the limits of maritime jurisdiction and, where appropriate, the delimitation of maritime boundaries provides clarity and certainty to all maritime States and users and helps to minimise the risk of friction and conflict by

[1] United Nations, *United Nations Conventions on the Law of the Sea*, Publication No. E97.V10. United Nations, New York, 1983. Available at: <http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm > (hereafter "LOSC").

eliminating a source of bi-lateral and multilateral dispute. This can, arguably, remove barriers to cooperation, thus enhancing the potential for the sustainable management and governance of the oceans, including with respect to marine resources. This, in turn, has the potential to contribute to maritime and economic security for both coastal and user States.

Conversely, where the extent of maritime claims is uncertain or where the maritime claims of neighbouring States overlap with one another, this tends to exacerbate and complicate existing ocean management problems. Further, such jurisdictional uncertainty has the potential to undermine maritime security as, where jurisdiction is unclear, it follows that coastal state rights with regard to surveillance and enforcement will remain similarly uncertain. Additionally, where overlapping maritime claims exist, this can prove a source of bilateral friction, especially where rival naval vessels competitively attempt to exerts enforcement rights in what they regard as rightfully 'their' maritime space.[2]

Maritime Limits and Boundaries and Access to Marine Resources

A key advantage associated with the clear definition of maritime jurisdictional limits and boundaries relates to securing access to and rights over valuable marine resources. Where jurisdictional uncertainty exists, however, challenges arise in respect of safeguarding marine resources as well as protecting and preserving the marine environment.

With regard to living resources, the oceans remain an important source of living resources, with fisheries representing a major industry and playing a key food security role for many coastal states (despite increasing rates of stock depletion). In the Pacific context, extensive claims to exclusive economic zones (EEZs) on the part of the Pacific island States gives rise to a tremendous actual and potential benefit in terms of rights over marine living resources, especially in regard to the abundant and valuable tuna fisheries. For example, in 2007 the tuna catch in the WCPO was estimated at 2,396,915 metric tonnes (mt) and worth approximately US$3,895 million[3]. The total tuna catch in the Western and Central Pacific Convention Area in 2009 was estimated at 2,467,903mt, the highest annual catch recorded.[4] This represented 81% of the estimated total tuna catch for the Pacific Ocean as a whole (3,042,092mt) and 58% of the estimated global tuna catch (4,222,289mt).[5] These tuna fisheries represent the

---

2 Schofield, C.H. (2005), 'Cooperative Mechanisms and Maritime Security in Areas of Overlapping Claims to Maritime Jurisdiction', in Cozens, P. and Mossop, J. (eds.), *Capacity Building for Maritime Security Cooperation in the Asia-Pacific* (Wellington: Centre for Strategic Studies, New Zealand), 99-115.

3 Williams, P. and Terawasi, P. (2008) *Overview of Tuna Fisheries in the Western and Central Pacific Ocean, including Economic Conditions – 2007*. Paper presented to the Fourth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission, 11-22 August 2008, Port Moresby, Papua New Guinea, WCPFC-SC4-2008/GN WP-1. For further information see, Reid, C. *Value of WCPO Tuna Fisheries*, Pacific Islands Forum Fisheries Agency, Honiara, 2007.

4 Williams, P. and Terawasi, P. (2010) *Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions – 2009*, Western and Central Pacific Fisheries Commission, Paper prepared for the Scientific Committee, Sixth Regular Session, Nuku'alofa, Tonga, 10-19 August, p.2.

5 *Ibid*.

primary economic opportunity for many of the region's small island developing States.[6]

Where maritime claims are uncertain or overlap with those of a neighbouring State, the sustainable management of marine living resources can be severely hampered through, at the least, uncoordinated policies and, at the more severe end of the spectrum, potentially destructive and unsustainable competition for access to the resources in question. Such activities can lead to confrontation between rival fishing fleets and such friction can lead to the involvement of the armed forces of the coastal states concerned with the attendant potential for incidents, clashes and ultimately escalation towards conflict. In short, rival maritime claims can act as a major irritant in bilateral, and indeed multilateral, relations.

Offshore areas are also an established and increasingly important source of non-living resources such as hydrocarbons, especially in the context of dwindling near and on-shore reserves, growing populations and generally, therefore, resource demands. Indeed, according to some estimates we already depend on offshore sources for over 60% of global oil supplies (though not, it should be emphasised, reserves).[7] This trend is likely to be reinforced in the foreseeable future as oil prices rebound in response to plateauing and declining production (especially but not exclusively from terrestrial oil fields) coupled with increasing demand. Improved technology is increasingly allowing economically viable exploration and exploitation of offshore oil and gas resources in more hostile conditions including deeper waters further offshore [8] Notwithstanding the *Deepwater Horizon* disaster and the various moratoriums on offshore drilling that the accident has inspired, exploration in deep (that is, water depths in excess of 1,000 feet) and ultradeep (over 5,000 feet) water offshore areas is likely to increase. While to date the Pacific island States region has not proved to be a significant source of seabed oil and gas reserves, potential may exist on significant extended continental shelf areas, as well as with regard to other types of seabed mineral deposits (see below).

In this context it is important to note that the presence of overlapping claims generally tends to prevent access to any hydrocarbon resources that may be present in the disputed area. International oil and gas companies tend to be extremely reluctant to invest the enormous sums necessary to conduct offshore exploration, let alone exploitation, operations in the absence of fiscal and legal certainty and continuity. Seabed energy resources located in disputed areas, which could potentially have a crucial role to play in the economic well-being and political stability of the coastal

---

6 See, Hanich, Q., Schofield, C.H. and Cozens, P. (2009) 'Oceans of Opportunity?: The Limits of Maritime Claims in the South Pacific', pp.17-46 in Hanich, Q. and Tsamenyi, M. (eds), *Navigating Pacific Fisheries: Legal and Policy Trends in the Implementation of International Fisheries Instruments in the Western and Central Pacific Region*, (Wollongong: Ocean Publications), pp.25-26.

7 See, 'Offshore oil and gas around the World', Ministry of Energy, Mines and Petroleum Resources, Government of British Columbia, available at, <http://www.empr.gov.bc.ca/OG/offshoreoilandgas/Pages/OffshoreOilandGasAroundtheWorld.aspx>.

8 Kelly, P.L. (2004) 'Deepwater Oil Resources: The Expanding Frontier', pp.414-416 in *Legal and Scientific Aspects of Continental Shelf Limits*, M.H. Nordquist, J.H. More, and T.H. Heidar (eds), (Martinus Nijhoff Publishers): pp. 413-419.

states involved, therefore tend to remain untapped in the absence of maritime boundary delimitation or, alternatively, agreement on joint development.

While discussion of marine resources tends to be framed in terms of access to fish and oil, it should be noted that these are not the only resources that the oceans have to offer. While deep sea minerals such as polymetallic nodules have been under consideration since at least the 1960s, more recently advances have occurred in relation to the collection and utilisation of minerals such as phosphorites, evaporates, polymetallic sulphides, and non-traditional seabed hydrocarbons such as gas hydrates.[9] Although the exploitation of some of these resources does not appear to be commercially viable at present, this situation may well change over time as requirements and prices change and technologies develop. Current efforts to exploit sea floor massive sulphide deposits in the Bismarck Sea off Papua New Guinea illustrate the potential for such novel developments in the Pacific island States.[10] Indeed, Papua New Guinea granted the world's first deep sea mining lease to Nautilus Minerals Inc. for the development of the Solwara 1 project in January 2011.[11]

Also of note is growing interest and use of marine genetic resources which offer an additional dimension to traditional marine living resources. Marine biota (plants and animals) represent a relatively untapped resource offering developmental potential for a range of valuable applications in the fields of medicine, agriculture (providing specialist health foods and dietary supplements as well as agricultural chemicals such as herbicides and pesticides), in the cosmetics industry and in industry where marine products can provide valuable enzymes and catalysts in industrial processes.[12]

This has led to the emergence of "bioprospecting" and the deep seabed, including outer continental shelf areas, are likely to be a focus for these activities.[13] This represents a potentially rich resource and opportunity for coastal States, including Pacific island States. Indeed, marine biotechnology related products were estimated to

---

9 Schofield, C.H. and Arsana, A (2009), 'Beyond the Limits?: Outer Continental Shelf Opportunities and Obligations in East and Southeast Asia', *Contemporary Southeast Asia* 31(1): 28-63, pp.51-54.

10 Regarding developments in seafloor polymetallic massive sulphide mining see P.M. Herzig (2004) 'Seafloor Massive Sulfide Deposits and Hydrothermal Systems', pp.431-456 in *Legal and Scientific Aspects of Continental Shelf Limits*, M.H. Nordquist, J.H. More, and T.H. Heidar (eds), (Martinus Nijhoff Publishers).

11 Bashir, M. (2011) 'Deep sea mining lease granted, *The Post-Courier*, 19 January 2011, available at <http://www.postcourier.com.pg/20110119/news03.htm>.

12 Skropeta, D. (2011) 'Exploring Marine Resources for New Pharmaceutical Applications', pp.211-224 in W.Gullett, C.H.Schofield and J.Vince (eds), Marine Resources Management, LexisNexis Butterworths, Australia, pp.211 and 217.

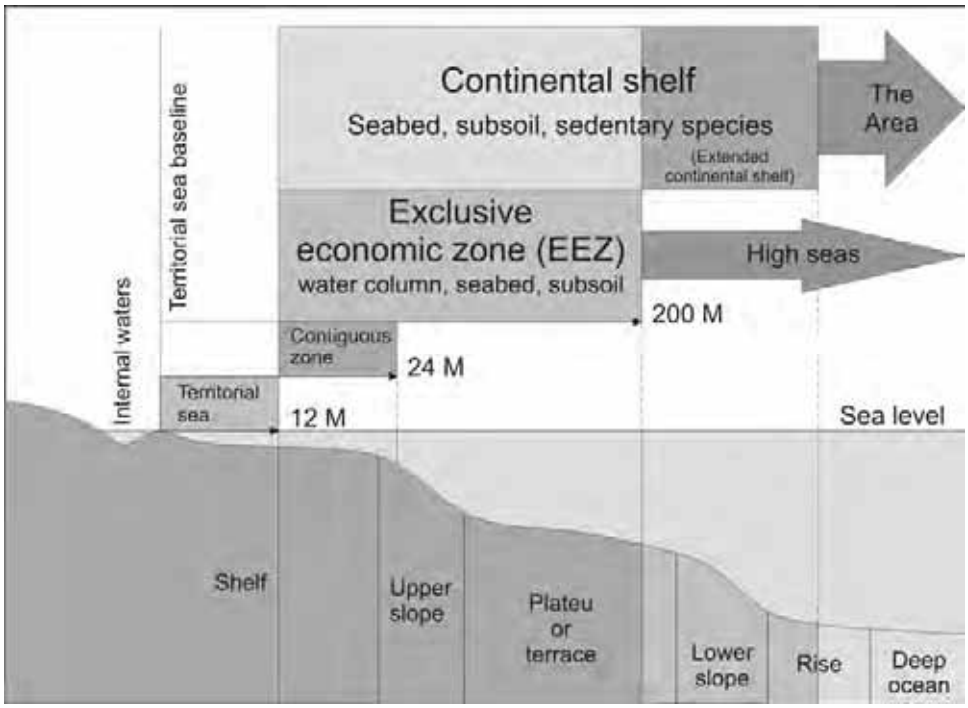
13 Bioprospecting has been defined as including "the entire research and development process from sample extraction by publicly funded scientific and academic research institutions, through to full scale commercialization and marketing by commercial interests such as biotechnology companies." See, United Nations (2007) 'An Update on Marine Genetic Resources: Scientific Research, Commercial Uses and a Database on Marine Bioprospecting', United Nations Informal Consultative Process on Oceans and the Law of the Sea Eight Meeting, (New York, 25-29 June 2007): p.7-7. See also, Arico, S. and Salpin, C. (2005) 'Bioprospecting of Genetic Resources in the Deep Seabed: Scientific, Legal and Policy Aspects', UNU-IAS Report, (United Nations University): pp.25-25, available at <www.ias.unu.edu/binaries2/DeepSeabed.pdf>.

be worth US$100 billion in 2000 alone.[14] The potential for further growth in marine bioprospecting is emphasised by the fact that of over 30,000 marine natural products reported since the 1960s, less than 2% derive from the deep sea organisms.[15]

The Limits of Claims to Maritime Jurisdiction

A key achievement of LOSC was the definition of clear spatial limits to national claims to maritime jurisdiction, something which had eluded earlier codification efforts (see Figure 1).

Figure 1 Claims to Maritime Jurisdiction



Source: Adapted from Geoscience Australia and Schofield and Arsana, 2009: 74.[16]

Landward of a coastal State's baselines lie either its land territory, including the inter-tidal foreshore landward of normal low-water line baselines, or internal waters.[17] Offshore, maritime claims are predominantly defined as extending to a set distance from baselines along the coast. Under LOSC agreement was reached on 12 nautical

---

14 Arico and Salpin, 2005: 17, See also, Mossop, J. (2007) 'Protecting Marine Biodiversity on the Continental Shelf beyond 200 Nautical Miles', *Ocean Development and International Law* 38 (2007), p.285.

15 Skropeta, 2011: p.221.

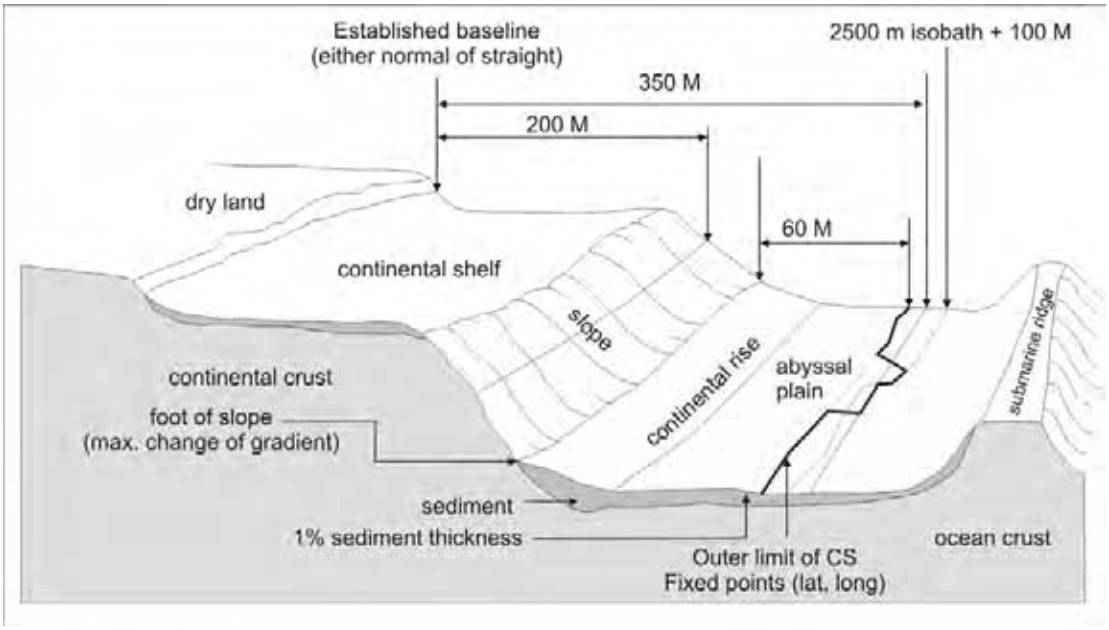
16 See, Geoscience Australia, 'Maritime Boundary Definitions', available at, <http://www.ga.gov.au/oceans/mc_amb-bndrs.jsp>. Adapted and redrawn by the author.

17 Internal waters lie landwards of straight baselines (LOSC, Article 7), landward of river closing lines (LOSC, Article 9), bat closing lines (LOSC, Article 10) and within ports (LOSC, Article 11). LOSC Article 8 provides that where internal waters have been created through the construction of a system of straight baselines, "which had not previously been considered as such, a right of innocent passage as provided in this Convention shall exist in those waters."

miles (nm) as the maximum extent of the territorial sea.[18] LOSC also provides for a contiguous zone out to 24nm from relevant baselines.[19] As most states claim a 12nm breadth territorial sea the contiguous zone, if claimed, generally extends from the 12nm to 24nm limits as measured from baselines along the coast. Additionally, and significantly, LOSC also introduced the concept of the exclusive economic zone (EEZ) which "shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured".[20] As most coastal States claim a 12nm territorial sea, the actual breadth of the EEZ is usually 188nm seaward of territorial sea limits (Figure 1).

The outer limits of the above-mentioned zones of maritime jurisdiction were relatively readily accepted at UNCLOS III. The definition of the outer limits of the continental shelf is a more complex task, especially where areas of 'extended' or 'outer' continental shelf seawards of the 200nm limit are under consideration.[21] Where the continental margin extends beyond 200nm from a State's baselines, the coastal state may be able to assert rights over that part of the continental shelf beyond the 200nm limit that forms part of its natural prolongation. However, in order to fulfil the complex series of criteria laid down in Article 76 and prepare a submission on extended continental shelf rights to the relevant United Nations technical body, the Commission on the Limits of the Continental Shelf (CLCS), a coastal state is therefore required to gather information related to the morphology of its continental margin and its geological characteristics as well as bathymetric information relating to water depth. Additionally, distance measurements are necessary in order to determine, for example, the location of 200nm and 350nm limit lines.[22]

Figure 2: Schematic of the Continental Shelf Showing Outer Continental Shelf Entitlement and Constraint Lines



[18] LOSC, Articles 3 and 4.
[19] LOSC, Article 33(2).
[20] LOSC, Article 57.
[21] LOSC, Article 76.
[22] Schofield and Arsana 2009: pp.31-35.

Source: Adapted from Schofield and Arsana, 2009: 79.

Although complex, the point here is that Article 76 of LOSC provides for a definable outer limit to the continental shelf claims of coastal States and this represents a major step forward as compared to the indeterminate scenario under the 1958 Convention on the Continental Shelf.[23]

The international zones beyond national jurisdiction comprise the high seas[24] seaward of the 200nm EEZ limits of coastal States and the "Area", beyond the continental shelf appertaining to coastal States.[25]

Setting Maritime Limits and Establishing Maritime Boundaries

The limits of a coastal State's maritime jurisdiction can be established in one of three ways. First, maritime claims can be generated to the full extent allowed for under international law, in the absence of analogous claims on the part of neighbouring States. Second, where overlapping claims to maritime jurisdiction exist, maritime boundaries may be delimited between neighbouring States. Thirdly, with respect to continental shelf limits, the definition of its outer limits involves a submission process to the United Nations Commission on the Limits of the Continental Shelf.

In this context several sources of uncertainty exist. These relate to the dependence of many distance-based maritime claims on measurements made from inherently unstable baselines, to the lack of comprehensive delimitation of potential maritime boundaries and to overlaps between extended continental shelf areas subject to submissions by coastal States.

Ambulatory Baselines and Shifting Limits

The key factors required for the definition of the outer limits of each of most maritime zones, where no overlaps exist with the claims of neighbouring States, is an understanding of the location of the baseline from which claims are to measured, coupled with a geodetically robust (that is, precise) means of calculating the relevant distance measurements of 12nm, 24nm and 200nm. However, numerous maritime jurisdictional limits are dependent on normal, low water line baselines that have the capacity to shift over time, leading to related changes in the location of the maritime limits derived from them.

---

23 McDorman has stated that the fact that "the real achievement" of LOSC lies not in the complexity of the provisions of Article 76 or in the establishment of the Commission but in the fact that it provides for "a definable limit" to continental shelf claims "however difficult the defining of that limit may be". See, McDorman, T.L. 'The Role of the Commission on the Limits of the Continental Shelf: A technical body in a political world', *International Journal of Marine and Coastal Law* 17, no. 3 (2002): 301-324, at 307.

24 Governed under Part VII (Articles 86-121) of LOSC.

25 Governed under Part XI (Articles 133-191) of LOSC. See also, the Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, available at, <http://www.un.org/Depts/los/convention_agreements/convention_overview_part_xi.htm>. As a consequence of the rights of certain coastal States to areas of outer continental shelf, the extent of the Area is necessarily less than that of the high seas.

Under usual circumstances and in the absence of other claims, a coastal State will have "normal" baselines coinciding with "the low-water line along the coast as marked on large-scale charts officially recognized by the coastal State."[26] Although a range of other types of baselines exist, notably straight baselines,[27] bay and river closing lines[28] and archipelagic baselines,[29] normal baselines represent the predominant type of baseline worldwide and, in effect, represent a state's 'default' baselines.[30] It has long been recognised that coastlines are dynamic, so normal baselines can change significantly over time or "ambulate".[31] Indeed, coastlines often change in a cyclical manner over time (alternately shifting seawards through deposition or accretion of material and then landwards as a consequence of erosion).[32] The location of normal baselines will therefore tend to move over time.

The traditionally generally accepted implication of this phenomenon is that as normal baselines change, so too will the maritime jurisdictional limits measured from them. Thus, where the baseline advances (for example, by the deposition of material along the coast) the outer limits of the maritime claims measured from that baseline will likewise expand seawards. Conversely, where the normal baseline recedes (through coastal erosion), the coastal state may "lose" maritime areas as their maritime limits are likewise pulled back.

In the Pacific context there is evidence that coral atolls can be remarkably robust features, capable of adapting, for example to incremental changes in sea level.[33] Nonetheless, island coastlines and thus their associated normal baselines do change over time. Consequently, the maritime jurisdictional limits derived from them will also shift. Similarly, where maritime delimitation is required between neighbouring Pacific island States, key basepoints for the calculation of equidistance lines (frequently at least the starting point in delimitation negotiations) are often located on normal baselines. Verification of baselines and basepoints with a view to calculating geodetically robust provisional equidistance lines then often becomes necessary. This technical work in

---

26 LOSC, Article 5.

27 LOSC, Article 7.

28 LOSC, Articles 9 and 10.

29 LOSC, Article 47.

30 See, Prescott, J.R.V. and Schofield, C.H. (2005) *The Maritime Political Boundaries of the World* (Leiden/Boston: Martinus Nijhoff Publishers): pp.94-97. If Australia is taken as an example, despite having a fairly extensive set of straight baselines and closing lines, 72% of Australia's baselines are comprised of normal baselines. See, Schofield, C.H. (2008) 'Australia's Final Frontiers?: Developments in Australian Delimitation', *Maritime Studies*, 158 (January/February): p.2.

31 Reed, M. (2000) *Shore and sea boundaries: the development of international maritime boundary principles through United States practice*, (Washington D.C.: US Department of Commerce): p.185; Prescott and Schofield, 2005: pp.100-101.

32 See, for example, Hirst, B. and Robertson, D. (2004) 'Geographic Information Systems, Charts and UNCLOS – Can They Live Together?', *Maritime Studies*, 136 (May-June): pp.1-6. See also, Schofield, C.H. (2009) 'Shifting Limits?: Sea Level Rise and Options to Secure Maritime Jurisdictional Claims', *Carbon and Climate Law Review*, Vol.4 (2009): 405-416, at pp.408-409.

33 Webb, A.P. and Kench, P.S. (2010) 'The dynamic response of reef islands to sea-level rise: Evidence from multi-decadal analysis of island change in the Central Pacific', *Global and Planetary Change*, 72:234-246.

support of boundary delimitation negotiations between Pacific island States is supported by SOPAC's Pacific Islands Regional Maritime Boundaries project.[34]

Maritime Delimitation: An Incomplete Mosaic

A key consequence of the enormous extension of maritime claims seawards that has occurred in recent decades has been the creation of a multitude of 'new' potential maritime political boundaries. Wherever a coastal state's claims to maritime space abut or overlap either an opposite coastal state's maritime area or an adjacent coastal state's maritime area, a potential maritime boundary situation will exist. As a consequence of the advance of national maritime claims offshore, coastal states 400nm or more distant from one another suddenly found themselves to be maritime neighbours with potentially overlapping maritime claims to jurisdiction. Indeed, in the case of extended continental shelf claims coastal states whose nearest land territories are located in excess of 700nm distant from one another may have a potential maritime boundary between them.

While significant progress has clearly been achieved in the delimitation of maritime boundaries with many contentious disputes having been resolved, the maritime political map of the world, in sharp contrast to the terrestrial political map, is far short of completion.[35] It is also worth noting that many of the maritime boundary agreements that have been reached among coastal states are only partial in character – relating to either only part of the length of the potential maritime or dealing with only one zone, such as continental shelf. Additionally, many agreements are interim, not in force or relating to the same boundary. Overall, it is safe to state that fewer than half of the potential maritime boundaries around the world have been even partially delimited.

It is recognised that several Pacific island States are in the process of fixing their maritime limits and boundaries and considerable progress has already been achieved in this regard, progress towards the delimitation of potential maritime boundaries has been relatively slow – while 15 maritime boundaries have been concluded to date, a further 30 remain to be delimited.[36]

Overlapping Outer Continental Shelf Submissions

Further, numerous additional 'new' maritime boundaries and extensive areas of overlapping claims have been created as a consequence of recently articulated coastal State assertions in respect of areas of so-called 'outer' or 'extended' continental shelf located seawards of the 200nm limit. Several States within the Pacific island States region have made submissions to the CLCS.[37] Globally, 95 extended continental shelf

---

34 See, <http://www.sopac.org/index.php/pacific-islands-regional-maritime-boundaries>.

35 Grundy-Warr, C.E.R. and Schofield, C.H. (2005), 'Reflections on the Relevance of Classic Approaches and Contemporary Priorities in Boundary Studies', *Geopolitics* 10:4, 650-62.

36 Prescott, J.R.V. and Boyes, G. *Undelimited Maritime Boundaries in the Pacific Ocean Excluding the Asian Rim*, Maritime Briefing, Vol. 2, No. 8, 2000, International Boundaries Research Unit, Durham; and, Prescott and Schofield, 2005: pp.397-428. See also, Schofield, C.H. (2010) 'The Delimitation of Maritime Boundaries among the Pacific Island States', pp.156-169 in Proceedings of International Symposium on Islands and Oceans 2010, (Tokyo: Ocean Policy Research Foundation).

37 See the CLCS website for details of full submissions and submissions of preliminary information at: <http://www.un.org/Depts/los/clcs_new/clcs_home.htm>. See also, Schofield, 2010.

submissions have been deposited with the UN, comprising 53 full submissions and 42 preliminary submissions.[38] These submissions collectively encompass an enormous area, in excess of 30 million square kilometres, of continental shelf located seawards of the 200 nautical mile limit from coastal baselines.

However, these submissions have given rise to numerous overlapping claims, including among the Pacific island States, to the same areas of extended continental shelf covering an area of well over 2.7 million square kilometres. Further, the process is not yet at an end as, a further nine more States are likely to (or may yet decide to) make submissions in due course but have yet to do so because the deadline for their submissions has yet to pass. This has given rise to multiple "new" outer continental shelf boundaries and, it would appear, a potential proliferation in potential outer continental shelf boundary disputes.[39]

Concluding Thoughts

The above is not to suggest that the establishment of maritime limits or the delimitation of maritime boundaries represents some kind of panacea which will necessarily engender transboundary maritime cooperation among neighbouring states. Indeed, it can be argued that arbitrary, invisible political boundaries do not readily fit the continuous, fluid ocean environment. Many marine living resources similarly pay scant regard to maritime boundaries and it is also the case that many marine activities are transboundary and transnational in character. Nonetheless, the definition of maritime limits and boundaries does provide a clear jurisdictional framework for cooperation. Importantly, even if spatially bounded national maritime spaces are not necessarily the ideal or only way to achieve sustainable oceans management and governance, they are one way to achieve these ends and, crucially, represent the approach overwhelmingly favoured by states.

Whilst encouraging progress has been made in the Pacific region, especially in terms of the articulation of maritime jurisdictional claims on the part of the Pacific island States, it is clear that much remains to be done. In particular, maritime limits are dependent on potentially ambulatory normal baselines (although this is, at present difficult to circumvent and in any case is an issue that should not be overplayed) many maritime boundaries remain undelimited and, indeed, a host of 'new' maritime boundaries (and overlapping claims) have resulted from submissions related to the extended continental shelf.

---

38 Noting that a number of these submissions are joint or partial and these figures are inclusive of multiple partial submissions for different areas by some States.

39 Van de Poll, R. and Schofield, C.H. (2010) 'A Seabed Scramble: A Global Overview of Extended Continental Shelf Submissions, paper presented at the Advisory Board on the Law of the Sea (ABLOS) conference on *Contentious Issues in UNCLOS – Surely Not?*, International Hydrographic Bureau Monaco, 25-27 October 2010. See also, Schofield, 2010.

Distributing the Conservation Burden Equitably in the Western and Central Pacific Fisheries

Quentin Hanich – Senior Research Fellow
Australian National Centre for Ocean Resources and Security (ANCORS)
University of Wollongong – Wollongong – NSW – 2522 – Australia

> … the decisions that we arrive at in order to achieve the long term goal of sustained utilization of the region's tuna resources will involve concessions from all those currently involved in the fishery. This is a fact of the situation. If the current levels of fishing are excessive and are not sustainable, steps will need to be taken to reduce the fishing effort in a way that does not unfairly disadvantage anyone that has a demonstrated long-term and dependent interest in the fishery.
>
> *His Excellency Joseph J. Urusemal*
> *President of Federated States of Micronesia*
> *2003 to 2007*[1]

Keywords
Pacific island fisheries, governance, regional cooperation

Abstract
The Western and Central Pacific Ocean is home to the world's most productive tuna fisheries, with the majority of tuna catches occurring inside the exclusive economic zones (EEZs) of the region's developing coastal States. It is important that these fisheries are managed effectively throughout their range, both within and between EEZs and on the high seas. Unrestrained exploitation in a particular EEZ or on the high seas has the potential to significantly impact on catches elsewhere with potentially devastating consequences for developing coastal States, some of which have few alternate resources.

The Western and Central Pacific Fisheries Commission (WCPFC) was established by the (mostly) developing coastal States and (mostly) developed distant water fishing States to manage the region's highly migratory tuna fisheries. The Commission's founding Convention prescribes specific recognition of the special requirements of developing States and the need to ensure that they do not carry a disproportionate burden of conservation.

This paper analysis the Commission and the region's tuna fisheries, and determines that the Commission is failing to adopt conservation and management measures that are sufficient to address overfishing of bigeye tuna. Through analysis of the various interests and influences involved in the fishery, the paper argues that overfishing will continue until the WCPFC addresses the question of how to distribute the conservation burden in a manner that is equitable and consistent with the special requirements of developing States.

[1] Opening welcome address to the Second Regular Session of the Western and Central Pacific Fisheries Commission. December 2005. Pohnpei, Federated States of Micronesia.

Introduction

This paper is the third in a series of studies on the Pacific islands region and its conservation and management of the region's tuna fisheries. The first paper was presented in 2009 and studied the national institutional and governance challenges to the management of these fisheries. It recommended key areas for capacity building and institutional strengthening. The second paper was presented in 2010 and reviewed the regional cooperative and institutional framework for the management of the tuna fisheries. This paper noted the strong level of cooperation that had occurred amongst the Pacific island coastal States but cautioned that the capability and effectiveness of these regional institutions would be tested over the coming years as increasing levels of overfishing challenged these institutions to adopt and implement complex conservation measures.

This paper studies the failure of the region to sufficiently respond to overfishing and suggests that this failure is due to the highly complex and difficult nature of the problem. The combination of the migratory, multi-species and multi-gear characteristics of the Western and Central Pacific Ocean (WCPO) tuna fisheries, with the nature of the participant's interests and influences, requires a solution that equitably distributes the burden of conservation in manner that recognises the special requirements of the coastal developing States. The paper argues that overfishing will continue until the WCPFC addresses the question of how to distribute the conservation burden in a manner that is equitable and consistent with the special requirements of developing States.

Western and Central Pacific Tuna Fisheries

The WCPO tuna fisheries are significantly different to other international tuna fisheries due to the unique regional characteristics. Unlike the predominantly high seas fisheries of the Eastern Pacific, Indian Ocean and Northern Atlantic, the WCPO tuna fisheries are predominantly harvested within waters under national jurisdiction. In 2008, 79% of all reported tropical tuna catches from the WCPO were caught in waters under national jurisdiction. Yellowfin was 88%, skipjack was 79% and bigeye was 58%. Much of this catch is concentrated in the equatorial waters of Indonesia, Philippines and the tropical Pacific island States. Only bigeye is reported to be extensively fished beyond these waters.

Distant water fishing fleets depend upon access to waters under national jurisdiction for their financial viability. No surface fishing fleet, distant water or locally based, can profitably operate pole and line or purse seine vessels without some access to waters under national jurisdiction. This gives the coastal States significant influence due to the sovereign rights they hold over the fisheries within their EEZ, and their absolute sovereignty over the fisheries within their territorial seas and archipelagic waters.

Unlike the migratory distant water fishing fleets that follow the tuna, the coastal States are permanently fixed in location and can not move their EEZ elsewhere if the fisheries decline. The immobility of their EEZ gives them a special interest in the long term sustainability of these fisheries, particularly for those who have few other alternative resource options. The equatorial Pacific islands States, Indonesia and the Philippines all depend significantly upon the tuna fisheries for food security, employment and economic development.[2]

[2] Robert Gillett, Fisheries in the Economies of the Pacific Island Countries and Territories (Mandaluyong City, Philippines: Asian Development Bank, 2009). -- Indonesia, "Indonesia Annual Report to the Commission Part 1: Information on Fisheries, Research and Statistics - " Fifth Regular Session of the Western and Central Pacific Fisheries Commission (Port Vila, Vanuatu: WCPFC Secretariat,, 2009), vol. -- Philippines, "Philippines Annual Report to the Commission Part 1: Information on Fisheries, Research and Statistics," Fifth Regular Session of the Scientific Committee to the Western and Central Pacific Fisheries Commission (Port Vila, Vanuatu: Western and Central Pacific Fisheries Commission, 2009).

In contrast to immobility of the coastal States, tuna are highly migratory and are distributed throughout the tropical and subtropical waters of the Pacific Ocean. Tagging data for each of the species has demonstrated considerable migrations with some individuals migrating over 4,000 nautical miles.[3] Despite some uncertainty over the extent of this migratory behaviour, it is clear that the key tuna species of commercial interest are sufficiently migratory in behaviour so as to require international cooperation to ensure effective management. For example, stock assessments demonstrate that the impact of tuna fishing in Indonesia and the Philippines extends into the WCPO region,[4] indicating a need for strong cooperation between States of both regions.

Within this context, the Western and Central Pacific Fisheries Convention [5] (WCPF Convention) was adopted in 2000 and subsequently entered into force in July 2004. The objective of the WCPF Convention, as described in Article 2, is to ensure the long term conservation and sustainable use of WCPO straddling and highly migratory fish stocks in accordance with the United Nations Convention on the Law of the Sea (LOSC)[6] and the United Nations Fish Stocks Agreement (UNFSA).[7] The WCPF Convention established the decision making WCPFC, which meets annually, and a secretariat which is headquartered in the Federated States of Micronesia.

The WCPF Convention closely follows the framework established by UNFSA and emphasises a precautionary and ecosystem based approach to fisheries management. The WCPF Convention applies to all waters of the WCPO, including both high seas and EEZs. However, the WCPF Convention clearly states in Article 4 that nothing in the Convention shall prejudice the rights, jurisdiction and duties of States under the LOSC and UNFSA, and that the WCPFC shall be interpreted and applied in the context of, and in a manner consistent with the LOSC and UNFSA.

The Pacific island States are a critical membership bloc of the WCPFC and were a key driver behind its development. Other WCPFC members include (amongst others): Indonesia, Philippines, Japan, Korea, China, Taiwan, USA and the European Community. The WCPF Convention binds these members to implement its provisions and WCPFC conservation and management measures. Since its establishment, the WCPFC has agreed on a number of conservation measures that impose specific obligations on all members.

---

[3] Selected readings include: Adam Langley, Shelton Harley, et al., "WCPFC-SC5-2009/SA-WP-03 Stock Assessment of Yellowfin Tuna in the Western and Central Pacific Ocean," Fifth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (Port Vila, Vanuatu: Western and Central Pacific Fisheries Commission, 2009). P49. -- Karen Evans, Adam Langley, et al., "Behaviour and Habitat Preferences of Bigeye Tuna (*Thunnus obesus*) and their Influence on Longline Fishery Catches in the Western Coral Sea," Canadian Journal of Fisheries and Aquatic Science 65 (2008). P2428. -- John Sibert, John Hampton, et al., "An Advection-Diffusion-Reaction Model for the Estimation of Fish Movement Parameters from Tagging Data, with Application to Skipjack Tuna (*Katsuwonus pelamis*)," Canadian Journal of Fisheries and Aquatic Science 56.6 (1999).

[4] Robert Gillett, Marine Fishery Resources of the Pacific Islands (Rome, Italy: Food and Agriculture Organisation of the United Nations, 2010). P53.

[5] WCPF Convention. (2000). Full title: is Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Signed September 2000. Honolulu, USA. Entered into force, 2004. Accessed online 10 July 2006 at http://www.wcpfc.int/

[6] *United Nations Convention on the Law of the Sea*, opened for signature 10 December 1982, 1833 UNTS 3 (entered into force 16 November 1994).

[7] UNFSA. (1995). Full title is Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Stocks and Highly Migratory Fish Stocks. Signed December 1995. New York, USA. Entered into force 2001. Accessed online January 2011 at http://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm

Almost all of the key coastal States in the WCPO fisheries are developing States. These States are ultimately responsible for managing the majority of the WCPO tuna fisheries and implementing conservation and management measures. In addition to their rights and responsibilities over the fisheries within their EEZs, they have significant interests in various fishing activities and aspire to further develop their interests and benefits. However, as studied in the first paper in this series,[8] many of the developing States within the region suffer from substantial shortcomings in national governance and institutional capacity which impacts upon almost every aspect of fisheries management and development.[9]

The special requirements of developing States were a core issue in the negotiation of the WCPF Convention. Article 30 of the WCPF Convention prescribes the key principles and standards relating to the requirements of developing States. The Pacific Islands Forum Fisheries Agency referred to this Article as the 'foundation on which the Commission will be built.'[10] The Article establishes the principle that the WCPFC must take into account the special requirements of developing States (and territories and colonies), particularly small island States. In this context, the Commission must consider: the vulnerability of these States and territories that are dependent on the fisheries, including food security concerns; the need to avoid adverse impacts on, and ensure access to fisheries by, subsistence, small-scale and artisanal fishers and fishworkers, as well as indigenous people in these States and territories; and the need to ensure that measures do not result in transferring, directly or indirectly, a disproportionate burden of conservation action onto these States and territories.[11] These special requirements, and the importance of marine resources to the sustainable development of these States, have also been recognised in other globally significant agreements, such as the Barbados Programme of Action for the Sustainable Development of Small Island Developing States[12] and the World Summit for Sustainable Development's (WSSD) Johannesburg Plan of Implementation.[13]

Conservation and Management Challenges

In 2005 the Scientific Committee to the WCPFC advised that overfishing was occurring for bigeye, and probably occurring for yellowfin, and recommended a reduction in mortality for bigeye, and no increase for yellowfin.[14] Since then, the Scientific Committee has repeatedly

---

[8] In January 2009, the author presented a paper to the International Symposium on Islands and Oceans that discussed many of these institutional limitations: Quentin Hanich, "Implementing Oceans Governance in the Pacific Islands Region: Regional Solutions to National Challenges," International Symposium on Islands and Oceans, ed. Hiroshi Terashima (Tokyo, Japan: Ocean Policy Research Foundation, 2009).

[9] For further readings on fisheries governance capacity limitations throughout the Pacific islands region, Indonesia, Vietnam and the Philippines, see: Les. Clarke, Pacific 2020 Background Paper: Fisheries (Canberra: Australian Agency for International Development (AusAID), 2006). -- Ian. Cartwright and Gary. Preston, A Capacity Building Strategy for the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean (Honiara: Pacific Islands Forum Fisheries Agency, 2006). -- Quentin Hanich, Feleti Teo, et al., Closing the Gaps: Building Capacity in Pacific Fisheries Governance and Institutions (Honiara: Pacific Islands Forum Fisheries Agency, 2008). -- AusAID, Valuing Pacific Fish: A Framework for Fisheries Related Development Assistance in the Pacific (Canberra, Australia: Australian Government: AusAID, 2007).

[10] Quote attributed to FFA as reported in: Sandra Tarte, Report on the Third Session of the Preparatory Conference for the Establishment of the Commission on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (Suva: USP, 2002). P5.

[11] Article 30.2. WCPF Convention.

[12] United Nations, "Barbados Programme of Action for the Sustainable Development of Small Island Developing States," (Bridgetown, Barbados: 1994), vol.

[13] WSSD, "Johannesburg Plan of Implementation on Sustainable Development," (Johannesburg, South Africa: WSSD, 2002), vol. Amongst other things, the WSSD Plan of Implementation specifically called for support for the WCPF Convention. P34.

[14] WCPFC Secretariat, "Report of the First Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission," Scientific Committee of the Western and Central Pacific

expressed concerns regarding fishing levels for bigeye and yellowfin, and has progressively recommended increasingly tougher reductions in fishing mortality for bigeye as the years have passed.[15] In response, the WCPFC adopted progressively stronger conservation and management measures in 2005, 2006 and 2008 to address these overfishing concerns and ensure the sustainability of the fisheries in question.[16] These conservation measures have largely focused on two fishing activities that most heavily impact on bigeye and yellowfin: purse seine and longline.

Purse seine vessels are the largest of the fishing vessels targeting WCPO tuna and have increased in size significantly since their first widespread use in the 1970s. 'Super superseiners' exceed 100 metres in length and can carry approximately 2,500 to 3,000 metric tonnes (mt) of frozen tuna in multiple holds.[17] Purse seiners are often equipped with helicopters and various sophisticated technologies to assist with finding schools and minimise fuel-expensive transits.

Purse seiners are primarily used to target skipjack, which comprises approximately 70-85% of all purse seine catches (79% in 2008), and yellowfin which comprises approximately 15-30% of all purse seine catches (18% in 2008). Bycatch of bigeye accounts for a very small percentage (1-3%) but nevertheless has a significant impact due to the sheer size of the catch. All tuna caught by purse seine vessels are primarily sold as frozen raw material for canning, much of which is processed in Bangkok, Thailand. As a consequence, the purse seine fishery is valuable more in terms of its quantity, than its quality.

A globally significant development has been the increasing use of floating fish aggregating devices (FADs) and radio/satellite/sonar equipped buoys by purse seine fleets. Yellowfin, bigeye and skipjack (and many other species) are attracted to drifting objects at sea.[18] Purse seine fleets have exploited this behaviour by setting their nets around, or near, naturally

---

Fisheries Commission (Noumea, New Caledonia: Western and Central Pacific Fisheries Commission, 2005).

[15] WCPFC Secretariat, "Report of the Second Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission," Second Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission (Manila, Philippines: WCPFC, 2006). -- WCPFC Secretariat, "Report of the Third Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission," Third Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission (Honolulu, USA: WCPFC, 2007). -- WCPFC Secretariat, "Report of the Fourth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission," Fourth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission (Port Moresby, Papua New Guinea: WCPFC, 2008). -- WCPFC Secretariat, "Report of the Fifth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission," Fifth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission (Port Vila, Vanuatu: WCPFC, 2009). – WCPFC Secretariat, "Summary Report of the Sixth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission," Sixth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission (Nuku'alofa, Tonga: WCPFC, 2010).

[16] WCPFC, "CMM 2005-01 Conservation and Management Measures for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean " Western and Central Pacific Commission (Pohnpei, Federated States of Micronesia: 2005). -- WCPFC, "CMM 2006-01 Conservation and Management Measures for Bigeye and Yellowfin in the Western and Central Pacific Ocean," CMM 2006-01 (Apia, Samoa: WCPFC, 2006) -- WCPFC, "CMM 2008-01 Conservation and Management Measure for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean," CMM 2008-01 (Guam, USA: WCPFC, 2008)

[17] David Itano, "Super Superseiner," 15th Meeting of the Standing Committee on Tuna and Billfish (Honolulu, USA: 2002).

[18] Alain Fonteneau, Pilar Pallares, et al., "The Effect of Tuna Fisheries on Tuna Resources and Offshore Pelagic Ecosystems," Ocean Yearbook, vol. 16 (Chicago, USA: University of Chicago, 2002).

floating objects (i.e. floating logs and other storm detritus), and more increasingly 'seeding' fishing grounds with their own artificial FADs.[19] These FADs often now have sophisticated buoys attached that can monitor the growth of an aggregation underneath the FAD and inform the purse seine vessel about its size and location.[20]

The use of FADs rapidly increased in the late 1990s and has now become a significant, and increasingly controversial, feature of the purse seine fishery. Total sets on FADs now account for approximately 36% of all WCPO sets in 2008 (plus 11% sets on free floating logs).[21]

The use of FADs has become increasingly a matter of concern due to the significantly different nature of their catches. Purse seine sets on schools associated with FADs and logs will catch smaller fish, particularly juvenile yellowfin and bigeye, whereas sets on unassociated free swimming schools will catch larger skipjack and/or adult yellowfin.[22] Purse seine sets on FADs and logs are a significant factor in overfishing of bigeye, as bigeye are only caught by purse seiners in significant amounts when they set on FADs and logs. [23] Purse seiners that only set on unassociated free schools (i.e. non-FAD sets) do not have a significant impact on stocks of bigeye.[24]

Longline vessels, as the name suggests, utilise a very long mainline (sometimes over 100km in length) from which thousands of baited branch lines are suspended. The mainline is kept on or near the surface by regularly attached floating buoys, while branch lines are suspended below at specific depths according to conditions and targets.[25] Longline vessels are smaller than purse seiners and range in size from small domestically based vessels under 100 gross registered tonnage (GRT) with ice or chill capacity that undertake voyages of less than a month, to large scale freezer vessels over 250 GRT which operate over large areas and undertake long voyages over many months (sometimes over a year).[26]

Longliners target bigeye, which comprised approximately 38% of all longline catches in 2008, yellowfin (30%) and albacore (30%). Skipjack accounts for approximately 2% in bycatch.

---

[19] Jean-Pierre Hallier and Daniel Gaertner, "Drifting Fish Aggregation Devices Could Act as an Ecological Trap for Tropical Tuna Species," Marine Ecology Progress Series 353 (2008).

[20] WCPFC Secretariat, "Para. 24 of CMM 2008-01 FAD Management and Monitoring," Report of the Fifth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission (Port Vila, Vanuatu: Western and Central Pacific Fisheries Commission, 2009). -- David Itano, "Documentation and Classification of Fishing Gear and Technology on board Tuna Purse Seine Vessels," 16th Meeting of the Standing Committee on Tuna and Billfish (Mooloolaba, Australia: 2003).

[21] It is important to note that these two estimates are based on separate but related measurements. 25% of sets might return a significantly higher percentage of catches given the higher chance that a tuna school will be successfully netted. Due to limited availability of data, it was not possible to use the same measurement in both estimates. It is also important to note that the WCPFC definition of a FAD (see CMM2008-01) does not differentiate between artificial and natural, hence all figures are for sets on boat floating logs and artificial FADs. Peter Williams and Peter Terawasi, "WCPFC-SC5-2009/GN WP-1 Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions - 2008," Fifth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (Port Vila, Vanuatu: Western and Central Pacific Fisheries Commission, 2009).

[22] Adam. Langley, Andrew. Wright, et al., "Slow steps towards management of the world's largest tuna fishery," Marine Policy 33.2 (2008).

[23] Ibid.

[24] Adam Langley and John Hampton, "Tuna Resource Management: Management Options for Yellowfin and Bigeye tuna in the WCPO Fishery," Pacific Economic Bulletin 21.3 (2006).

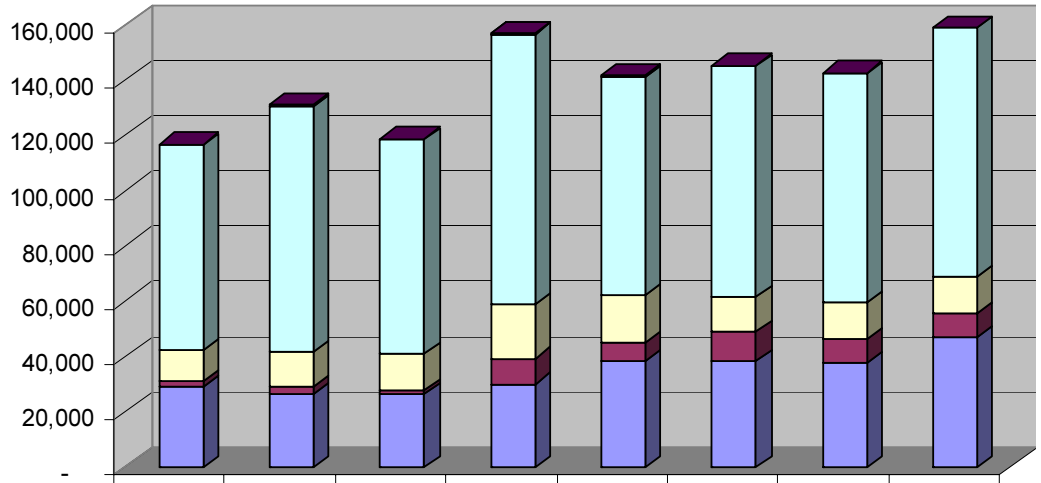
[25] James Joseph, Managing Fishing Capacity of the World Tuna Fleet (Rome: Food and Agriculture Organisation, 2003). P23.

[26] A Greenpeace joint enforcement patrol with FSM and Kiribati reported a longliner that had been at sea for 13 months. Greenpeace, Plundering the Pacific: Summary of Findings of Joint Enforcement Exercises with FSM and Kiribati, September 4th - October 23rd 2006 (Suva, Fiji: Greenpeace, 2006).

Due to the high value of sashimi products, the longline fisheries comprise a higher percentage of the value of the WCPO tuna fishery than would otherwise be indicated by their tonnage. Longline fisheries were 25% of the total value of bigeye, yellowfin and skipjack fisheries in 2008.

Despite the conservation measures, and numerous commitments by WCPFC members to restrain any increase in effort, purse seine catches have set six consecutive new records, with significant conservation concerns for yellowfin and bigeye.[27] Bigeye catches have increased by 36% since the Convention was agreed in 2000, averaging 139,000 mt per year (2000-2008). The fishery is almost entirely exploited by longline vessels. However, the use of FADs by purse seine has resulted in an increasingly significant bycatch of juvenile bigeye. Catches have steadily increased since 2000, with peak record years in 2004 and 2008 (see Figure 1).

Figure 1 - Bigeye Catches 2001-2008 (mt)



	2001	2002	2003	2004	2005	2006	2007	2008
Troll	408	712	318	464	430	404	510	346
Longline	73,877	88,605	77,670	97,626	78,774	83,559	82,701	89,930
Other Gears	11,312	12,508	12,931	19,756	17,224	12,503	13,048	13,141
Pole and Line	2,349	2,803	1,778	9,313	6,757	10,810	8,967	8,930
Purse Seine	28,771	26,344	26,072	29,944	38,254	38,066	37,434	46,781

The increase in overall catches is largely attributed to a significant increase in purse seine bycatch of bigeye, significant increases in longline catches and a large increase in Indonesian reports of pole and line catches of bigeye. During this time, the purse seine share has increased from 25% of total catches of bigeye in 2000, to 29% in 2008. Meanwhile, longline has declined from 63% of total catches of bigeye in 2000, to 57% in 2008. Pole and line has increased from 2% of total catches of bigeye in 2000, to 6% in 2008.

[27]All subsequent analysis and figures were developed by the author based on data from the following sources: Williams and Terawasi, "WCPFC-SC5-2009/GN WP-1 Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions - 2008." -- Peter Williams and Peter Terawasi, "WCPFC-SC4-2008/GN WP-1 Overview of Tuna Fisheries in the Western and Central Pacific Ocean Including Economic Conditions - 2007," Fourth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (Port Moresby, Papua New Guinea: Western and Central Pacific Fisheries Commission, 2008). -- Peter Terawasi and Len Rodwell, Value of WCPO Tuna Fisheries (Excel Database) (Honiara, Solomon Islands: Pacific Islands Forum Fisheries Agency (FFA), 2010).

In 2009, the Scientific Committee concluded that overfishing for bigeye was occurring, and that the stock may have now moved slightly into an overfished state.[28] The Committee advised that longline fishing continued to have the greatest impact on bigeye across the WCPO and that purse seine fishing and the Philippines and Indonesian domestic fisheries have a substantial impact in the western equatorial, and to a lesser extent, the eastern equatorial regions. It also noted that Japanese coastal pole and line and purse seine fisheries have a significant impact on biomass levels in their home region.

The Scientific Committee recommended a 34% to 50% reduction in fishing mortality from 2004-2007 levels would be required.[29] At the request of the Scientific Committee, the WCPFC science provider presented an evaluation of the most recent conservation and management measure which indicated that the following reductions were required to reduce fishing mortality to sustainable levels:[30]

- 80% reduction in purse seine FAD effort;
- 50% reduction in longline catch;
- 50% reduction in Indonesian and Phillipine effort.

In 2010, the Scientific Committee once again concluded that overfishing was occurring, but now suggested that the purse seine and other surface fisheries were likely to have an equal or greater impact on bigeye biomass than longline fisheries.[31]

Meanwhile, the overall value of the WCPO tuna fisheries showed a long term increase in value that peaked in 2008 and at US$5.393 billion, an increase of 117% since 2000. However, during that time, overall catches only increased by 28%. The key increase was in value, not in the size of the catch. While catches of the three tropical tunas increased moderately (skipjack by 31%, yellowfin by 26% and bigeye by 28%) – the three tropical tunas each experienced far more dramatic increases in value. The value of the WCPO skipjack fishery increased in value by 238%, while the value of yellowfin and bigeye increased by 80% and 40% respectively. Consequently, the price increase for skipjack and yellowfin resulted in the purse seine fishery substantially increasing in value by 315% from $US765 million in 2000 to $US3.173 billion in 2008, despite catches only increasing by 50% in that time.

Meanwhile, longline fleets increased in value by 20% to US$1.458 billion, while pole and line increased in value by 9% to USUS371 million, despite recording a 35% reduction in catch. Other gears, primarily Indonesian and Philippine artisanal fleets, increased by 163% to $US369 million despite catches only increasing by 13%.

Prices declined by approximately 30% in 2009 following the global financial crisis. The value of the 2009 purse seine catch declined by 28% while the value of the longline fishery increased marginally despite a marginal decline in catch. However, in 2010 the price of

---

[28] Shelton Harley, Simon Hoyle, et al., "WCPFC-SC5-2009/SA-WP-4 Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean," Fifth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (Port Vila, Vanuatu: Western and Central Pacific Fisheries Commission, 2009).

[29] WCPFC Secretariat, "Report of the Fifth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission."

[30] John Hampton and Sheldon Harley, "Assessment of the Potential Implications of Application of CMM-2008-01 for Bigeye and Yellowfin Tuna," Fifth Regular Session of the Scientific Committee to the Western and Central Pacific Fisheries Commission (Port Vila, Vanuatu: Western and Central Pacific Fisheries Commission, 2009).

[31] WCPFC Secretariat, "Summary Report of the Sixth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission."

skipjack rose strongly again which furthers strengthen the primacy of the purse seine fishery and its overall value.

Interests and Influences

The WCPFC faces an increasingly complex and urgent conservation and management challenge as it struggles to address overfishing. The WCPO tropical tuna fisheries are comprised of numerous gears and species that migrate across a vast area and multiple boundaries. Each species of tropical tuna is caught by each gear in a tightly inter-meshed manner that is difficult, if not impossible, to separate. Consequently, this makes the fishery inherently challenging to manage. This complexity is exacerbated by the substantially different biological characteristics of skipjack, yellowfin and bigeye (i.e. the highly resilient and productive skipjack appears to be under little pressure from existing fishing operations, while the longer-lived and less productive bigeye is suffering significantly from overfishing).

The inter-meshed characteristics make it difficult for the WCPFC to sufficiently reduce fishing mortality of bigeye, and restrain fishing mortality for yellowfin, without significantly impacting on fishing activities for skipjack. Consequently, it is likely that the WCPFC will need to implement a broad mix of reductions and controls across a range of gears and locations to ensure the long term conservation and sustainable use of bigeye and yellowfin. Furthermore, it appears increasingly likely that some form of total, or almost total, FAD prohibition will ultimately be required to address the increasingly significant concerns regarding juvenile bycatch and the potentially significant ecological trap concerns.

In order to resolve this challenge, it is necessary to understand the interests of those involved and how they weigh the debate. This is particularly important in regard to the WCPO tuna fisheries given their complex and inter-meshed nature. These fisheries are inherently challenging to manage due to their migratory, multi-species, multi-gear and multi-national nature. These complex and inter-meshed characteristics make it impossible to address a specific conservation challenge with a narrowly focused management response. Consequently, the members of the WCPFC are required to develop, negotiate and implement conservation and management measures that often affect a broad range of fleets and stakeholders and impact upon a diverse range of national interests. Due to overfishing concerns, these measures necessarily involve reductions in catch and/or effort for some fleets and widespread changes in current practice in order to effectively address overfishing of bigeye and implement adequate monitoring, control and surveillance.

In this context, conservation and management measures allocate a conservation burden on participants in the WCPO fisheries. Each participating State must apply costs to its fleets through limiting fishing opportunities and regulating their activities. In order to implement these measures, governments must fund national institutions to implement national regulations and govern their implementation, while potentially increasing the management costs on its fleets through more complex and costly licensing arrangements.

Depending upon its structure, the conservation and management measure will impact directly and indirectly on various participants: reducing benefits for some; limiting opportunities for others; and protecting or even increasing benefits for some participants. To further complicate matters, conservation and management measures may impact on developing States that depend significantly on these fisheries and have strong aspirations to further develop their benefits. Some of these States will have few other development and resource options and will be more heavily impacted by the conservation burden than other States with diverse resources, large institutions and substantial revenue streams from multiple economic activities. Consequently, the question of how the conservation burden is distributed is fundamental to conservation and management negotiations.

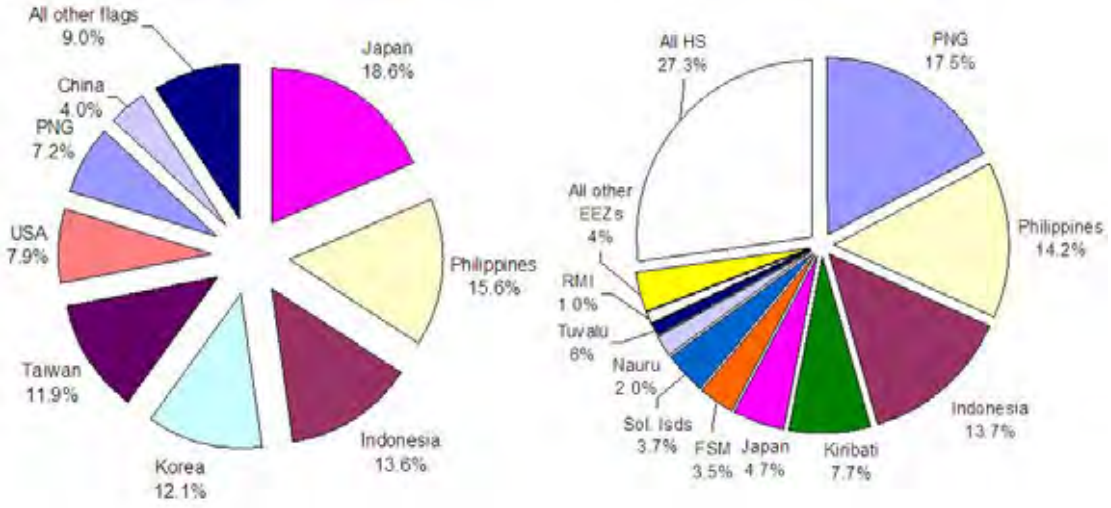
This paper argues that determining the distribution of the conservation burden (and the implicit allocation of fishing opportunities) is the key challenge facing the WCPFC. The complex nature of the WCPO tuna fisheries and the diversity of interests and influence held by its members make it highly likely that the distribution of these costs and impacts (the conservation burden) will be complicated and difficult.

Analysis of catch data for the WCPO tuna fisheries reveals that there are 14 States that collectively control almost all WCPO tropical tuna fisheries that impact on bigeye and yellowfin.[32] They are: Papua New Guinea, Indonesia, Philippines, Japan, Kiribati, Solomon Islands, Nauru, Federated States of Micronesia, Tuvalu, Marshall Islands, Korea, Chinese Taipei, United States of America (USA), and China (see Figure 2). These States effectively control the fishery and are ultimately responsible for implementing conservation and management measures.

Vessels registered to eight of these States caught 91% of the total value of the 2008 WCPO tropical tuna fisheries (i.e skipjack, bigeye and yellowfin). Meanwhile, 68% of the value of the fishery was caught within the waters of a different group of ten of these States (equal to 96% from waters within national jurisdiction).[33]

Figure 2 - Core States in the WCPO Tropical Tuna Fisheries

Flag State percentage of total value **Coastal State percentage**



Further data analysis reveals that all of these core 14 States have significant interests in the purse seine fishery for skipjack and yellowfin. Not surprisingly, the most influential interest is the purse seine fishery for skipjack: the most valuable fishery. While skipjack may be the least valuable in price per tonne, the sheer size of its stock and the strong market demand for canning has made this species the most widely held interest within the core group of States.

For most of these core 14 States, skipjack is their dominant or strongest interest. Seven of these core States have interests that are dominated by purse seine fleets (where greater than 80% of the value of the fishery derives from purse seine fleets). This includes: Papua New

[32] Analysis and figures by author, based on data from the following sources: Oceanic Fisheries Programme of the Secretariat to the Pacific Community, (Raw Excel Database for) Tuna Fishery Yearbook: Western and Central Pacific Fisheries Commission (Pohnpei, Federated States of Micronesia: Western and Central Pacific Fisheries Commission, 2010). -- Terawasi and Rodwell, Value of WCPO Tuna Fisheries (Excel Database).

[33] Estimates vary slightly for percentage of catch (as opposed to value) as the value of high seas catch is higher due to the higher price paid for longline caught bigeye and yellowfin over purse seine.

Guinea, Kiribati, USA, Federated States of Micronesia, Solomon Islands, Nauru and Tuvalu have dominant purse seine interests. These States gain little or no benefit from bigeye. The remainder of the core States all have a strong or moderate interest in purse seine fishing, but do gain some benefit from bigeye fisheries by longline vessels.

Significantly, six of the ten developing coastal States that control the most productive fishing grounds, are dominated by interests in purse seine fisheries (Papua New Guinea, Kiribati, Federated States of Micronesia, Solomon Islands, Nauru and Tuvalu). Indonesia, Philippines and the Marshall Islands also have strong interests in purse seine fisheries, but must balance this with interests in other fleets and species. Only Palau has a clear strong interest in longline fisheries for bigeye.

The dominance by purse seine interests fisheries in the core 14 States presents a fundamental challenge to the conservation of bigeye. 'Purse seine' States are likely to receive little benefit from conservation measures that improve the stock status of bigeye and therefore increase the catch per unit of effort (CPUE) and profitability of longline fleets. However, they do have an interest in ensuring the long term sustainability of yellowfin given that this provides significant value to the purse seine fleets. While there may be other interests to consider (i.e markets, conservation, etc), from the point of view of fishing fleet interests, they have an immediate interest in minimising the application of bigeye and yellowfin conservation measures to purse seine fleets and maximising the application to other gears – or to seek exemptions on their own purse seine activities. Furthermore, those States with interests dominated by purse seine fleets would likely receive little benefit from measures to boost the economic yield of the overall WCPO tuna fisheries through blanket reductions in capacity and effort. While bioeconomic modelling has suggested that reductions in fishing effort would maximise the benefits available from the WCPO tuna fisheries, these benefits would primarily go to longline fleets with only a very small increase to those States with primary interests in purse seine fleets.[34]

This is particularly challenging for the developing coastal States who receive very little commercial or revenue benefit from bigeye. Consequently these States have little incentive to support bigeye conservation measures that focus the conservation burden on purse seine fisheries and require them to bear a high level of the conservation burden through limiting their purse seine fisheries. This is potentially highly inequitable and inconsistent with the WCPF Convention, particularly if the benefits of these sacrifices flow to wealthy distant water fishing nations that hold interests in longline fleets targeting bigeye.

Conclusion

In order for the WCPFC to successfully agree on a conservation measure for bigeye that is sufficient to resolve overfishing of bigeye, the WCPFC must address the bycatch of bigeye by purse seine fisheries. However, in order for the WCPFC to do this, it must negotiate a measure that equitably distributes the conservation burden in a manner that addresses the special requirements of developing coastal States.

Given the failure of the WCPFC to reduce overfishing of bigeye after six years and three attempts, it is arguable that overfishing will continue until the WCPFC negotiates a measure that transparently recognises the benefits and costs, and equitably distributes the burden of conservation in a manner consistent with the WCPF Convention. Given the structure of the

[34] Christopher Reid, Michel Bertignac, et al., Further Development of, and analysis using, the Western and Central Pacific Ocean Bioeconomic Tuna Model (WCPOBTM) (Honiara, Solomon Islands: Pacific Islands Forum Fisheries Agency and the Secretariat of the Pacific Community, 2006). -- Christopher. Reid, "Economic Implications of an Implicit Allocation of Bigeye Harvest Rights Through an Across the Board Reduction in Effort Levels in the Western and Central Pacific Tuna Fishery," Sharing the Fish (Perth: 2006).

fishery, this will require some form of compensation or differential treatment for States that have significant purse seine interests and receive no benefit from longline catches of bigeye. Otherwise, there is no incentive for these States to support conservation measures that require them to undertake significant reductions that only benefit other States through improvements in stock levels, CPUE and profitability.

It is unlikely that the WCPFC will be able to develop and negotiate such a response across its plenary table without first agreeing on a conceptual framework that provides for differential application of measures to the degree necessary to recognise the divergent interests while allowing for sufficient reductions in fishing mortality. Consequently, this paper suggests that a new 'discussion' is required that allows for the development of such a conceptual framework. Given the politics and interests, it is recommended that this discussion occur outside the WCPFC so as to allow participants to focus on the problem, not the institution.

Recommendations

1. Support an experts workshop to develop a new conceptual framework for the equitable distribution of conservation in a manner consistent with the special requirements of developing States. Such a workshop should include experts and non-representative State officials from developed and developing States to discuss:
    - Key challenges (i.e. bigeye conservation);
    - Necessary management responses (i.e. 80% FAD removal, 50% longline reduction, etc);
    - Mechanisms for compensatory arrangements or differential application of conservation measures.

2. In 2009, the author presented the first paper in this series. That paper studied the national institutional and governance challenges to the management of these fisheries and recommended key areas for capacity building and institutional strengthening. In light of that earlier work, and discussion during the December 2010 Symposium, this paper recommends that consideration be given to the development of a research and capacity building project that builds the capacity of the Pacific islands region to extend and implement Ocean Policies. This paper suggests that the Pacific Islands Forum Oceanscape Initiative provides a strong framework for the development and implementation of Regional Oceans Policies that could address many of the concerns that have been raised throughout the OPRF 'International Symposiums on Islands and Oceans.' In order to support the development and implementation of Regional Ocean Policies, this paper recommends the following two research projects:
    - Study on existing whole-of-government ocean and maritime coordination in key Pacific island governments (i.e. Kiribati, Papua New Guinea, Federated States of Micronesia, etc). This project would engage with Pacific island governments and work with them to record their experiences and identify their institutional and governance frameworks and limitations in respect to coastal and lagoon management, climate mitigation, resource development and management, coastal infrastructure and development, aquaculture, tourism, etc.
    - Capacity building and support for the development and implementation of ocean policies at the national and regional level throughout the Pacific islands region.

References

AusAID. Valuing Pacific Fish: A Framework for Fisheries Related Development Assistance in the Pacific. Canberra, Australia: Australian Government: AusAID, 2007.

Cartwright, Ian., and Preston, Gary. A Capacity Building Strategy for the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Honiara: Pacific Islands Forum Fisheries Agency, 2006.

Clarke, Les. Pacific 2020 Background Paper: Fisheries. Canberra: Australian Agency for International Development (AusAID), 2006.

Evans, Karen, Langley, Adam, Clear, Naomi, Williams, Peter, Patterson, Toby, Sibert, John, Hampton, John, and Gunn, John. "Behaviour and Habitat Preferences of Bigeye Tuna (*Thunnus obesus*) and their Influence on Longline Fishery Catches in the Western Coral Sea." Canadian Journal of Fisheries and Aquatic Science 65 (2008): 2427-43.

Fonteneau, Alain, Pallares, Pilar, Sibert, John, and Suzuki, Ziro. "The Effect of Tuna Fisheries on Tuna Resources and Offshore Pelagic Ecosystems." Ocean Yearbook. Vol. 16. vols. Chicago, USA: University of Chicago, 2002. 142-70.

Gillett, Robert. Fisheries in the Economies of the Pacific Island Countries and Territories. Mandaluyong City, Philippines: Asian Development Bank, 2009.

Gillett, Robert. Marine Fishery Resources of the Pacific Islands. Rome, Italy: Food and Agriculture Organisation of the United Nations, 2010.

Greenpeace. Plundering the Pacific: Summary of Findings of Joint Enforcement Exercises with FSM and Kiribati, September 4th - October 23rd 2006. Suva, Fiji: Greenpeace, 2006.

Hallier, Jean-Pierre, and Gaertner, Daniel. "Drifting Fish Aggregation Devices Could Act as an Ecological Trap for Tropical Tuna Species." Marine Ecology Progress Series 353 (2008): 255-64.

Assessment of the Potential Implications of Application of CMM-2008-01 for Bigeye and Yellowfin Tuna. Fifth Regular Session of the Scientific Committee to the Western and Central Pacific Fisheries Commission. 2009. Western and Central Pacific Fisheries Commission.

Terashima, Hiroshi ed. Implementing Oceans Governance in the Pacific Islands Region: Regional Solutions to National Challenges. International Symposium on Islands and Oceans. January 2009 2009. Ocean Policy Research Foundation.

Hanich, Quentin, Teo, Feleti, and Tsamenyi, Martin. Closing the Gaps: Building Capacity in Pacific Fisheries Governance and Institutions. Honiara: Pacific Islands Forum Fisheries Agency, 2008.

WCPFC-SC5-2009/SA-WP-4 Stock Assessment of Bigeye Tuna in the Western and Central Pacific Ocean. Fifth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific. 10-21 August 2009 2009. Western and Central Pacific Fisheries Commission.

Indonesia. "Indonesia Annual Report to the Commission Part 1: Information on Fisheries, Research and Statistics - " Fifth Regular Session of the Western and Central Pacific Fisheries Commission. Ed.: WCPFC Secretariat,.

Super Superseiner. 15th Meeting of the Standing Committee on Tuna and Billfish. 2002.

Documentation and Classification of Fishing Gear and Technology on board Tuna Purse Seine Vessels. 16th Meeting of the Standing Committee on Tuna and Billfish. 2003.

Joseph, James. Managing Fishing Capacity of the World Tuna Fleet. Rome: Food and Agriculture Organisation, 2003.

Langley, Adam, and Hampton, John. "Tuna Resource Management: Management Options for Yellowfin and Bigeye tuna in the WCPO Fishery." Pacific Economic Bulletin 21.3 (2006): 24-30.

WCPFC-SC5-2009/SA-WP-03 Stock Assessment of Yellowfin Tuna in the Western and Central Pacific Ocean. Fifth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific. 10-21 August 2009 2009. Western and Central Pacific Fisheries Commission.

Langley, Adam., Wright, Andrew., Hurry, Glenn., Hampton, John., Aqoarau, Transform., and Rodwell, Len. "Slow steps towards management of the world's largest tuna fishery." Marine Policy 33.2 (2008): 271-79.

Oceanic Fisheries Programme of the Secretariat to the Pacific Community. (Raw Excel Database for) Tuna Fishery Yearbook: Western and Central Pacific Fisheries Commission. Pohnpei, Federated States of Micronesia: Western and Central Pacific Fisheries Commission, 2010.

Philippines Annual Report to the Commission Part 1: Information on Fisheries, Research and Statistics. Fifth Regular Session of the Scientific Committee to the Western and Central Pacific Fisheries Commission. 10-21 August 2009 2009. Western and Central Pacific Fisheries Commission.

Reid, Christopher, Bertignac, Michel, and Hampton, John. Further Development of, and analysis using, the Western and Central Pacific Ocean Bioeconomic Tuna Model (WCPOBTM). Honiara, Solomon Islands: Pacific Islands Forum Fisheries Agency and the Secretariat of the Pacific Community, 2006.

Economic Implications of an Implicit Allocation of Bigeye Harvest Rights Through an Across the Board Reduction in Effort Levels in the Western and Central Pacific Tuna Fishery. Sharing the Fish. 2006.

Sibert, John, Hampton, John, Fournier, David, and Bills, Peter. "An Advection-Diffusion-Reaction Model for the Estimation of Fish Movement Parameters from Tagging Data, with Application to Skipjack Tuna (*Katsuwonus pelamis*)." Canadian Journal of Fisheries and Aquatic Science 56.6 (1999): 925-38.

Tarte, Sandra. Report on the Third Session of the Preparatory Conference for the Establishment of the Commission on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific. Suva: USP, 2002.

Terawasi, Peter, and Rodwell, Len. Value of WCPO Tuna Fisheries (Excel Database). Honiara, Solomon Islands: Pacific Islands Forum Fisheries Agency (FFA), 2010.

United Nations. "Barbados Programme of Action for the Sustainable Development of Small Island Developing States." Bridgetown, Barbados, 1994.

CMM 2005-01 Conservation and Management Measures for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean Western and Central Pacific Commission. 2005 2005.

WCPFC. "CMM 2006-01 Conservation and Management Measures for Bigeye and Yellowfin in the Western and Central Pacific Ocean." CMM 2006-01. Apia, Samoa: WCPFC, 2006.

WCPFC. "CMM 2008-01 Conservation and Management Measure for Bigeye and Yellowfin Tuna in the Western and Central Pacific Ocean." CMM 2008-01. Guam, USA: WCPFC, 2008.

Report of the First Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. Scientific Committee of the Western and Central Pacific Fisheries Commission. 8-19 August. 2005 2005. Western and Central Pacific Fisheries Commission, 2005.

Report of the Second Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. Second Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. 7-18 August 2006 2006. WCPFC.

Report of the Third Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. Third Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. 13-24 August 2007. WCPFC.

Report of the Fourth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. Fourth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission 11-22 August 2008. WCPFC.

Para. 24 of CMM 2008-01 FAD Management and Monitoring. Report of the Fifth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. 2009. Western and Central Pacific Fisheries Commission.

Report of the Fifth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. Fifth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. 10-21 August 2009. WCPFC.

Summary Report of the Sixth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. Sixth Regular Session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. 10 - 19 August 2010 2010. WCPFC.

WCPFC-SC4-2008/GN WP-1 Overview of Tuna Fisheries in the Western and Central Pacific Ocean Including Economic Conditions - 2007. Fourth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific. 11-22 August 2008 2008. Western and Central Pacific Fisheries Commission.

WCPFC-SC5-2009/GN WP-1 Overview of Tuna Fisheries in the Western and Central Pacific Ocean, Including Economic Conditions - 2008. Fifth Regular Session of the Scientific Committee of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific. 10-21 August 2009 2009. Western and Central Pacific Fisheries Commission.

WSSD. "Johannesburg Plan of Implementation on Sustainable Development." Johannesburg, South Africa: WSSD, 2002.

Changing Access Rights to Marine Resources and Local Adaptation in Coral Reef Management

Tomoya AKIMICHI
Research Institute for Humanity and Nature (RIHN)

ABSTRACT

Conservation of marine biodiversity is one of the urgent issues that the present world should tackle with. In tropical and sub-tropical coastal regions where coral reef ecosystems have severely been deteriorated due to precarious anthropogenic impacts such as over-fishing, destructive fishing practices, land reclaim, and pollutant inflow from agricultural and industrial sectors [Akimichi 2004b]. Although programs and management schemes to restore appropriate ecosystem services as well as to meet with human socio-economic needs, such endeavors turned to fail due to some reasons.

In this paper, I deal with cases of tropical coastal resource use in Asia and the Pacific to evaluate the changing roles of access rights in local marine resource management. First, access rights to zones of MPA (Marine Protected Areas), limited entry, and open access are discussed, using examples of Fiji [Sano 2008] and Yaeyama Islands (Japan) [Akimichi 2003], in line with the design principles of local commons [Ostrom 1990]. Second, I examine changing aspects of access rights due to the infiltration of market economy, using an example of north Malaita, Solomon Islands [Akimichi 1991]. Second, I will argue how coastal marine resources are equally or unequally allocated among community members, from analysis of *sasi* practices in Maluku and Sulawesi in eastern Indonesia [Akimichi 2004a]. Thirdly, I discuss about the positive and negative roles of MPA, using an example of Bajau's decision-making in exploiting marine resources in north Sulawesi. Lastly, I will argue about a need for glocal consideration as to the appropriate and adaptive marine resource management measures, taking local and global contexts into account.

INTRODUCTION

As strongly appealed in the Convention of Biological Diversity (CBD) COP10 conference held in Nagoya City, Japan in 2010, conservation of marine biodiversity is one of the important issues in the present-day biodiversity debates. This issue is particularly crucial in tropical and sub-tropical coastal regions where marine ecosystem has severely been deteriorated due to precarious anthropogenic impacts such as over-fishing, destructive fishing practices, land reclaim, and pollutant inflow from agricultural and industrial sectors. Also, global warming under climate change is another driving force to the degradation of marine ecosystem.

Under the circumstances, it is fundamentally important to evaluate legislative and customary practices with respect to the access rights to marine resources. As the access rights are not uniform, but diverse in ecological, economic and cultural conditions. In the ocean regimes of the world, international laws define territorial seas and the Exclusive Economic Zone (EEZ) of the country [Buchholtz 1987] while territorial use rights are defined widely in fisheries sectors of the world [Christy 1982]. Furthermore, formal and informal/customary regulations and institutions in the marine fishery are reported [Johannes 1978; Carrier 1981; Ruddle and Akimichi 1984; Akimichi 1984].

There is a diversity in these sea tenure system, depending on local and ecological condition. Although the access rights can be basically divided into three; open access, limited entry and sanctuary (Figure 1), it is not exclusively defined, but possibly change over time, and depending on the marine resource potentials. What kind of driving forces are involved should then identified and made use of the better management program to avoid the tragedy of the commons [Hardin 1968; Berkes 1998].

In this paper, I deal with cases of tropical coastal resource use in Asia and the Pacific to evaluate the changing roles of access rights in local marine resource management. First, access rights to zones of MPA (Marine Protected Areas), limited entry, and open access are discussed, using examples of Fiji [Sano 2008] and Yaeyama Islands (Japan) [Akimichi 2003], in line with the design principles of local commons [Ostrom 1990]. Second, I examine changing aspects of access rights due to the infiltration of market economy, using an example of north Malaita, Solomon Islands [Akimichi 1991]. Second, I will argue how coastal marine resources are equally or unequally allocated among community members, from analysis of *sasi* practices in Maluku and Sulawesi in eastern Indonesia [Akimichi 2004a]. Thirdly, I discuss about the positive and negative roles of MPA, using an example of Bajau's decision-making in exploiting marine resources in north Sulawesi. Lastly, I will argue about a need for glocal consideration as to the appropriate and adaptive marine resource management measures, taking local and global contexts into account.

Changing Marine Resource Use and Access Rights

In coastal waters in Asia and the Pacific, rapidly growing economic development and increasing demand for marine resources used either for local foodstuffs or export commodity has apparently given serious impacts upon the marine ecosystem. As suggested by Gordon, ocean regime is fundamentally a common property, but vulnerable to resource depletion, if not managed appropriately [Gordon 1954]. On the contrary, in coastal waters a diverse spectrum of access rights has been claimed where access rights to marine space can be generally classified into three; open access, limited entry and sanctuary [Akimichi 2010]. This triangular

scheme is widely applied to coastal waters in any local, regional and national contexts. For instance, Japanese government has claimed the territorial waters of 12 nautical miles off the base line of the coast. This zone is open access for the Japanese nationality vessel, but limited entry for foreign vessels. In the local context, the demarcated area for communal fishery rights is exclusively claimed and used by members of the Fisheries Cooperative Association (FCA) [Ruddle and Akimichi 1984] and it is designated as limited entry while off-shore area is generally open-access where any Japanese fishermen from other FCAs can enter. Marine protected area (MPA) is often claimed either by local and national authorities where any fishing activities are prohibited, and the logic for open access and limited entry is rejected. Unlike limited entry and sanctuary which is the extreme pattern of the limited entry, open access is regarded as the cause of the tragedy of the commons [Cole 2002].

Triangular relations are not static, but change due to various reasons. For instance, in Sekisei coral lagoon in Yaeyama Islands, Okinawa prefecture, southwestern Japan, lagoon waters are generally admitted as open access. However, a few sites in the lagoon became to be assigned as the protected area as MPA for two months. After a long discussion among stakeholders, this regulation was enforced in line with decreasing trend of grouper and lethrinid fish resources especially during the spawning aggregation period in April and May [Akimichi 2003].

In Fiji, *qoliqoli* (traditional fishing area) used to be regarded as community-based resource area by respective village, and controlled by village and/or extended family. Once someone from another village wants to fish in *qoliqoli* area, they should bring kava and ask permission to fish. Also in Fiji, *tabu* (sanctuary) sea space also used to be managed by one or more villages, and *tabu* area is sometimes decided to open for all relevant community members. It is likely that both *qoliqoli* and *tabu* areas are common-pool resource [Ostrom 1990] and that *qoliqoli* area is limited entry, while *tabu* area is sanctuary, rather than limited entry. Since the agreement of *Qoli-Qoli* Bill in Fiji, *qoliqoli* was returned to the original owners from the Fijian Government that had been originally possessed by the Britain sovereignty in 1874 [Sano 2008].

Yet, even where enforced or voluntary governance is achieved over the access to coastal marine resources, abrupt changes brought by rapidly increasing external forces and impacts of China-based trade of live reef fish and sea-cucumber, marine tourism industry, ornamental fish trade for aquaria, and even growing trend in climate change may perturb the present situations. Changing aspect of access rights is also found in freshwater regimes in Southeast Asia [Akimichi 2008]

Changing Aspects in the Access Rights to Marine Resources; A case of Lau (Solomon Islands)

In the northeast of Malaita Island, Solomon Islands, extensive Lau lagoon is found in which Lau-speaking people live on small artificial and natural islets. As the Lau has no land for cultivation, their subsistence is based on fishing and gathering at sea. Marine product is used not only as daily food but also items for exchange with vegetable food at the markets located along coast of Malaita Island.

According to the Lau customary practice, the sea is divided into open-access, limited entry and taboo area. Sanctuary is located at the coastal mangrove where the Lau ancestors settled since the unknown past. The place is called Baleo, and no one can enter the place nor harvest mangroves and any marine resources. Most of the extensive lagoon is owned by particular clan and ordinarily closed as tabooed (*abu*) . Rivers are also assigned as limited entry for fishing, but trespassing is free. On the other hand, deep sea, shallow sea-grass beds and mud flat are free to harvest. Sea is generally termed as *asi,* and sea of limited entry is *asi abu* while sea of open access is called *asi mola*. *Asi abu* is often opened for a limited purpose to obtain a large amount of fish for the consumption in important occasions such as funeral, wedding and celebration of a new canoe. Fish are required in order to exchange them with taro and tubers brought by agriculturalists on mainland Malaita [Akimichi 1978].

After independence of the British Protectorate Government in 1978, the new Solomon Islands government launched programs to promote coastal fishery industry in which sales of reef fish were recommended. In line with economic development, local fishermen became to realize the market value of reef fish. Due to the economic incentive, Lau fishermen became to use open access sea space more frequently than before. For instance, shallow sea-grass beds are good fishing ground for rabbitfish (*Siganus* spp.). Catch is packed in the FRP box with flaked ice and transported to Honiara, the capital city. Over-fishing might reduce resource potentials, but according to local sea tenure, shallow sea is assigned as open access. On the other hand, reef system is basically closed, but due to the demand to sell reef fish, people became to exert pressure on the owner of the particular fishing grounds in order to sell fish for obtaining cash income. In the past, closed sea used to be open, following the traditional rules and as customary practice. However, economic demand became to urge people to use fishing grounds more frequently than before [Akimichi 1991]. This may also become a threat for the sustainable resource use in coral reef ecosystem. Over-all, traditional sea tenure is challenged to construct a new phase for resource management.

Allocation of Marine Resource: Cases of *Sasi* Practice in Indonesia

How resource can be managed, avoiding the tragedy of the depletion can be explored from various approaches. In this section, I will show the allocation of marine resource plays an important role in small-scale coastal harvesting activity, using an example of *sasi* practice in

eastern Indonesia.

Sasi is well-known traditional resource management practices found widely in eastern Indonesia; Maluku, Kai, Aru, and Irian Jaya [Bailey and Zerner 1992; Akimichi 2004a; Sasaoka 2008; McLeod *et al.* 2009]. Coastal and terrestrial living resources are managed as community-based practices in which resources are usually banned to exploit and the closure is enforced (*sasi tutup*: *sasi* is closed). During the closure, the notice is displayed by a sign of coconut leaf fronds as shown in Figure 3 (Figure 2). Upon the decision by the village council, *sasi* is lifted only a limited period of time (*sasi buka*: *sasi* is open). Marine resources targeted for *sasi* practice are mostly sources for cash income that include trochus shell, sea cucumber, green snail, and tridacna shell, but in one community on Kai Besar Island, such migratory fish as fusilier and mackerel scad become the object of *sasi*. During the opening period, community members are allowed to harvest marine resources.

Yet, allocation of cash income by sales of the resources is not constant, but varied, depending on the contexts [Pannell 1997; Lore 1998]. For instance, allocation of profit allocation by sales of trochus shell ranges between exclusively community's property to exclusively individual's property. As shown in Figure 3, Waturar village case shows that all the profit was used for community's public investment while in Ohoiel case, all the profit was distributed to individuals. Between the extreme, each community decided the proportion of the income between the community and individuals. In case of Ohoitel village, 65% were given to the community while 35% were distributed, depending on the individual's harvest. Profit for the community is usually assigned for public purposes; repair of school, church (in case of Christian community), and mosque (in case of Muslim community), otherwise road and bridge improvement (Akimichi 2004a). Variation is found not only inter-community level, but also intra-community level, depending on the amount of harvest, market price of trochus shell [Monk *et al.* 1997]. This suggests that even in a community-based practice such as *sasi*, economic consideration and the governance over the allocation of resources at post-harvest stage is crucial in sustaining the bottom-up approach.

Marine Park and Resource Use: Export of Marine Commodity

How the establishment of marine sanctuary gives various impacts upon activities of local fishermen who were accustomed to use the space is an interesting question. This question is also applicable to forest sanctuary as is found in Thailand where conflicts between the government and local people have occurred over the use rights in forest area. Logics for legitimacy in indigenous use rights and conservation ethics are not agreed between the two. Unlike terrestrial land holding where farmers can hardly adapt themselves to a new land, fishermen can move to other marine space to exploit marine resources. If fishermen are

excluded from neighboring fishing grounds, it is quite probable for them to search alternative fishing grounds. Yet, there remains another issue left for their entry rights there. Indeed, conflicts between local fishermen and foreign fishermen have been witnessed in many coastal regions in Indonesia [Zerner 2003] and elsewhere. Particularly the Bajau fishermen have succeeded the sea-faring nature to extend their fishing activity in a wide geographical space [Sopher 1977], and often make a fishing expedition beyond the national border [Fox 1992].

From northernmost of Sulawesi, Indonesia, there scattered an island chain as north as Mindanao, the Philippines under tropical equatorial environment. Bunaken, Manado Tua, Mantehage, Siladen and Nain Islands are southern group where marine environment rich in coral reefs are found. In this area, certain marine spaces are designated as National Marine Park, i.e., Taman Laut National, where fishing and collecting activities are banned. Due to this enforcement, local Bajau fishermen in north Sulawesi were obliged to search alternative fishing grounds outside of the area. Unlike pole line fishing for skipjack and purse-seine for mackerel scad (*Decapterus* spp.) in off-shore areas, coral reefs are major fishing grounds for the Bajau. This is the main reason why the Bajau became to conduct fishing expedition to Banggai Islands in central Sulawesi. They bring back live reef fish and ornamental fish from Banggai islands to north Sulawesi. Live fish are air-freighted for Bali for export.

On the other hand, coral reefs outside of the marine reserves came to be used for mari-culture of agar-agar (*Eucheuma* sp.). Using long-line strings for culture, agar-agar production turned to be a boom on Nain Island, one of the southern group islands. Expanding business has caused serious environmental problem. First, mangroves on neighboring Mantehage Island were cut for constructing platforms for sun-drying of agar-agar (Figure 4).

As mangroves in Marine Reserve were strictly conserved, development of mari-culture industry caused the deterioration of mangrove ecosystem. Second, due to the agar-agar beds in the middle layer in the sea, the growth of coral reefs was inhibited as the sunlight reached the bottom of the sea where coral reefs grow. Therefore, agar-agar has also become a threat for the growth of corals. Harvested agar-agar is exclusively traded for Denmark, and used as a source of shampoo, gel for cosmetics and ice-cream, etc. In this way, for the Bajau in north Sulawesi, proclamation of marine reserve has eventually brought about serious marine environmental degradation. As these marine products are transported to developed countries, it may not be fair to criticize only local sectors for environmental destruction. National government as well as international agencies should also aware of the process in which economic demands initially triggered the illegal and unsustainable use of marine resources.

Glocal Regulations for Marine Resources and Commodity Trade

Through the description of three case studies on the changing role of access rights, it became apparent that access rights in each site have been faced a difficulty in environmental and socio-economic terms. External impacts, particularly of global and regional market economy are conspicuous. Even in remote coral reef islets in north Malaita, infiltration of fish trade to urban sectors apparently reduced resource potential, and due to this reason, traditional sea tenure has reached a position to be re-considered if it still remains the past way, or transformed to adapt a new phase of economy. Similar problems have occurred in eastern Indonesia. Despite of traditional resource management practice of *sasi*, a rise of trochus shell has urged local community how to allocate the profit between individuals and the community. North Sulawesi case has also given us implication how the marine resources can be managed between local and global contexts.

Implementation for the appropriate allocation of coastal marine resources among stakeholders should therefore be adaptive to changing and glocalized (*i.e*., local linked with global) conditions, between the extreme approaches of environmental conservation and economic development. At the same time, relevant international regulations and laws provided in such as UNCLOS, CBD and CITES should carefully be considered so as to match with changing local settings. Glocalization is relative a new term to combine localization and globalization. In terms of access rights, it is evident that entry rights are changing in contemporary world, and therefore for the better implementation of resource management, it is absolutely important to see both local and global phases (Figure 5).

Keywords: marine resource, access rights, community-based marine resource management, cash economy, coral reef ecosystem, governance, international trade,

REFERENCES

AKIMICHI, Tomoya 1978. The ecological aspect of Lau (Solomon Islands) ethnoichthyology. *Journal of Polynesian Society* 87(4): 301-326.

AKIMICHI Tomoya 1984. Territorial regulation in the small—scale fisheries of Itoman, Okinawa. In K. Ruddle and T. Akimichi eds. *Maritime Institutions in the Western Pacific,* Senri Ethnological Studies No.17, Osaka: National Museum of Ethnology: 89-120.

AKIMICHI Tomoya 1991. Sea tenure and its transformation in the Lau of north Malaita, Solomon Islands. *South Pacific Study* 12(1): 7-22.

AKIMICHI Tomoya 1995b. *Maritime Ethnology.* University of Tokyo Press. In Japanese

AKIMICHI Tomoya 2003. Species-oriented resource management and dialogue on reef fish conservation: a case study from small-scale fisheries in Yaeyama Islands, Southwestern Japan.

J. R. MacGoodwin ed. *Understanding the Cultures of Fishing Communities: A Key to Fisheries Management and Food Security*, FAO Fisheries Technical Paper 401: 109-31.

AKIMICHI Tomoya 2004a. *Anthropology of the Commons- Culture, History and Ecology.* Jinbun-Shoin. In Japanese.

AKIMICHI Tomoya 2004b. Disturbance and sustainable use of coral reefs. In Ministry of Environment and Japanese Society of Coral Reefs eds., *Corals in Japan*., pp. 71-77.

AKIMICHI Tomoya. 2008. Changing property regimes in the aquatic environments of the lower Mekong Basin in Southern Laos and Northern Thailand," *TROPICS* 17 (4): 285-294.

AKIMICHI Tomoya 2010. *Global History of the Commons.* Iwanami Shoten.

BAILEY, C. and C. ZERNER 1992. Community-based fisheries management institutions in Indonesia. *Maritime Anthropological Studies* 5(1): 1-44.

BERKES, F. ed. 1998. *Common property resources: ecology and community-based sustainable development.* Belhaven Press.

BUCHHOLTZ, H. J. 1987. *Law of the Sea Zones in the Pacific Ocean.* Institute of Asian Affairs and Institute of Southeast Asian Studies.

CARRIER, J. G. 1981. Ownership of productive resources on Ponam Island, Manus Province. *Journal de la Societe des Oceanistes* 72-73: 205-217.

CHRISTY, F. T. Jr. 1982. Territorial use rights in marine fisheries: definitions and conditions. *FAO Technical Papers* No.227, Rome: Food and Agriculture Organization.

COLE, D. H. 2002. P*ollution and Property Comparing Ownership Institutions for Environmental Protection*. Cambridge University Press.

FOX, J. J. 1992. A report on eastern Indonesian fishermen in Darwin, In: J. J. Fox and A. Reid eds. Illegal Entry. Centre for Southeast Asian Studies, Northern Territory University, Occasional Paper Series 1: 13-24.

GORDON, H. S. 1954. The economic theory of a common-property resource: the fishery. *Journal of Political Economy* 62: 124-142.

HARDIN, G. 1968. The Tragedy of the Commons. *Science* 162: 1243-1248.

JOHANNES, R. E. 1978. Traditional marine conservation methods in Oceania and their demise. *Annual Review of Ecological Systematics* 9: 349-364.

LORE, M. R. 1998. Closing the Commons: Cooperation or Gain or Restraint? *Human Ecology* 26(1): 43-66.

McLEOD, E., B. SZUSTER and R. SALM 2009. Sasi and Marine Conservation in Raja Ampat, Indonesia. *Coastal Management* 37(6): 656-676.

MONK, A., de RETES, and REKSODIHARJO-LILLEY 1997. *Ecology of Nusa Tenggara and Maluku.* (The Ecology of Indonesia Series Volume V) Periplus Editions.

OSTROM, E. 1990. *Governing the Commons*. Cambridge University Press.

PANNELL, S. 1997. Managing the discourse of resource management: the case of sasi from Southeast Maluku, Indonesia. *Oceania* 67: 289-307.

RUDDLE, K. and T. AKIMICHI 1984. Maritime Institutions in the Western Pacific. *Senri Ethnological Studies* 17, National Museum of Ethnology.

SANO, Yae 2008. Social and institutional arrangements in coastal common pool resource systems: preliminary results of a study of community-based coastal management in Fiji. *TROPICS* 17(4): 295-314.

SASAOKA, M. 2008. Customary forest resource management in Seram Island, central Maluku: the "seli kaitahu" system. *TROPICS* 12(4): 247-260.

SOPHER, D. 1977. *The Sea Nomads: A Study of the Maritime Boat People of the Southeast Asia.* The Museum.

ZERNER, C. 2003. Sounding the Makassar Strait: the poetics and politics of an Indonesian marine environment. In C. Zerner ed. *Culture and the Question of Rights to Southeast Asian Environments: Forests, Sounds, and Law*. Duke University Press.

Figure 1. Triangular Schema on the Accessibility to Marine Resources .
A, B, and C show the changing processes in which such drivers as fluctuation in resource basis, legal and economic changes are involved, for instance.

Figure 2. Coconut frond suggests that certain resources are prohibited to harvest for some period of time. Left: Aru Islands, Right: Nusa Laut Island, eastern Indonesia

Figure 3. Profit allocation by sales of trochus in sasi practice in eastern Indonesia（Akimichi 2004a）

Figure 4. Mangroves in Mantehage Is. are illegally exploited in making shelves for sun-drying agar-agar.

Figure 5. Glocal Approach to marine Resource Management

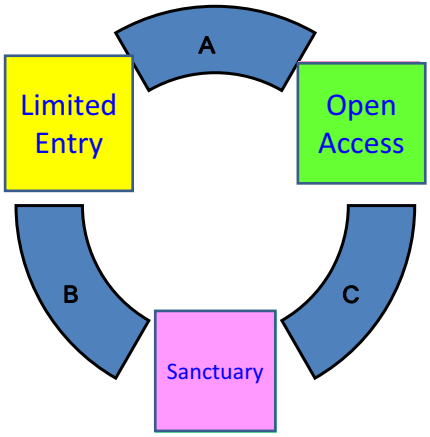


Figure 1. Triangular Schema on the Accessibility to Marine Resources .
A, B, and C show the changing processes in which such drivers as fluctuation in resource basis, legal and economic changes are involved, for instance.

Figure 2. Coconut frond suggests that certain resources are prohibited to harvest for some period of time. Left: Aru Islands, Right: Nusa Laut Island, eastern Indonesia

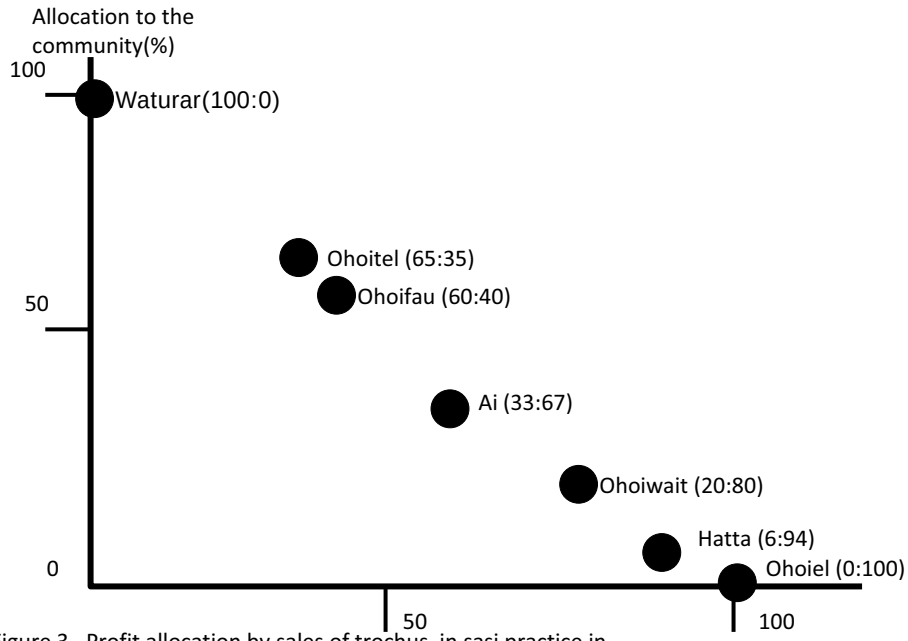


Figure 3. Profit allocation by sales of trochus in sasi practice in eastern Indonesia（Akimichi 2004a）

Figure 4. Mangroves in Mantehage Is. are illegally exploited in making shelves for sun-drying agar-agar.

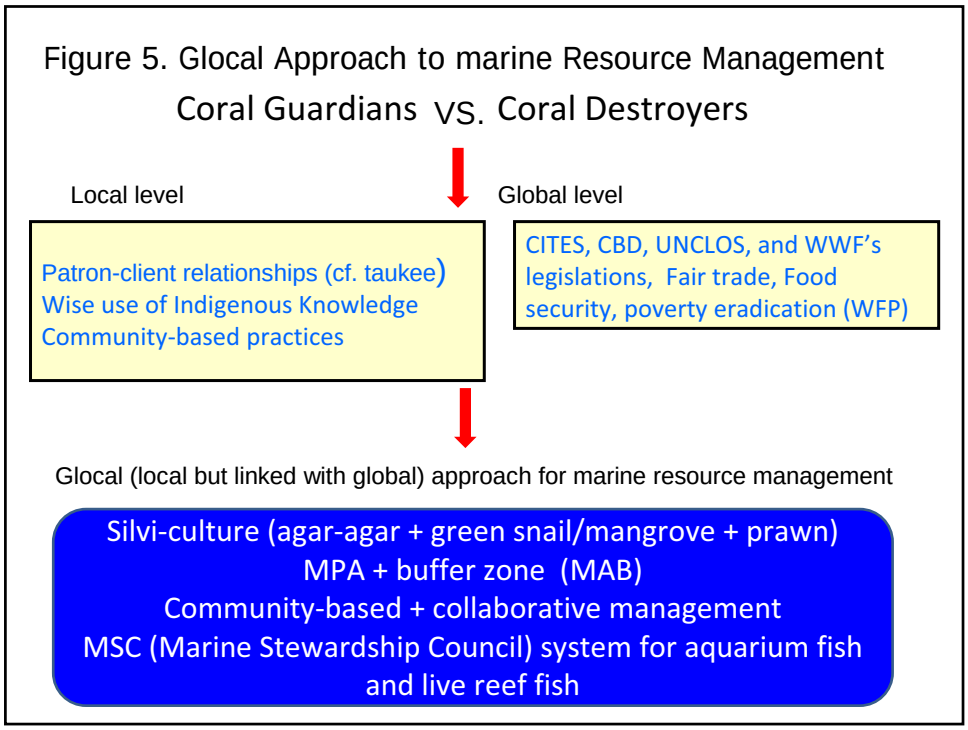


Figure 5. Glocal Approach to marine Resource Management
Coral Guardians VS. Coral Destroyers
Local level
Global level
Patron-client relationships (cf. taukee)
Wise use of Indigenous Knowledge
Community-based practices
CITES, CBD, UNCLOS, and WWF's legislations, Fair trade, Food security, poverty eradication (WFP)
Glocal (local but linked with global) approach for marine resource management
Silvi-culture (agar-agar + green snail/mangrove + prawn)
MPA + buffer zone (MAB)
Community-based + collaborative management
MSC (Marine Stewardship Council) system for aquarium fish and live reef fish

Distribution and its evaluation of deepsea mineral resources in the continental shelf and EEZs of the southwestern Pacific island states'

Kensaku Tamaki
Frontier Research Center for Energy and Resources
Graduate School of Engineering
The University of Tokyo

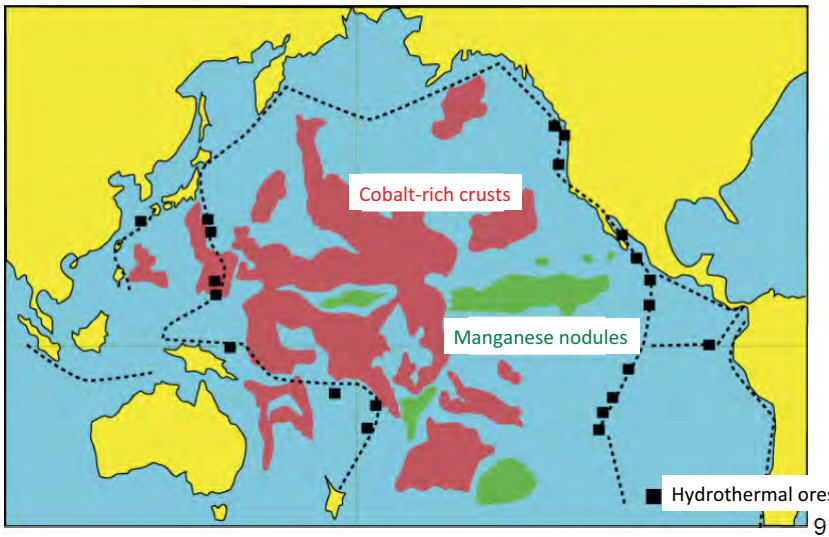
OPRF - **Islands and Oceans 2011**
Nov 29 – Dec 1, 2010 at Tokyo

Some basics

1. Three types of deepsea mineral resources: manganese nodules, cobalt-rich crusts, and hydrothermal ore deposits.
2. None of them have not been commercially produced.
3. ISB (International Seabed Authority) mining codes will be completed by May 2011.

JOGMEC

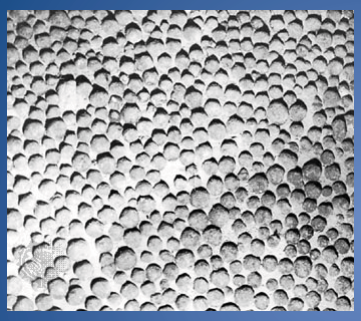
Distribution of deepsea mineral resources



9

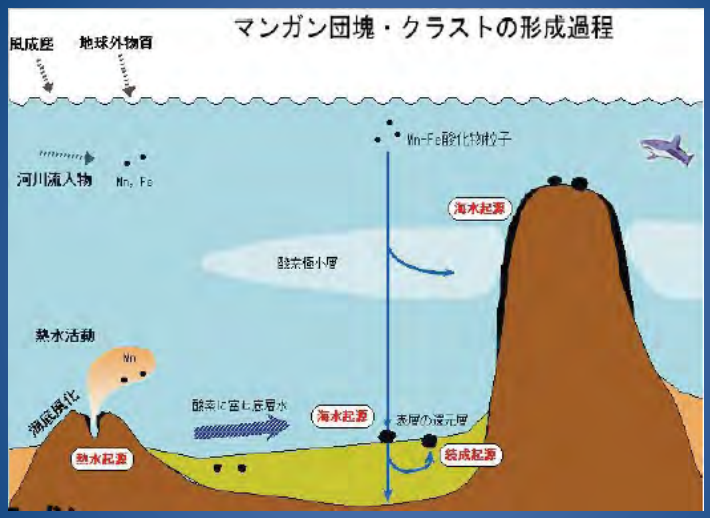
From JOGMEC publication

Manganese nodules



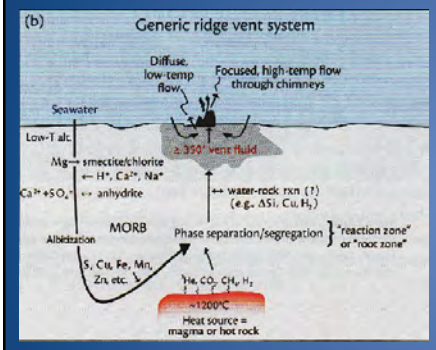
Pacific Ocean Floor 5500m

Coblt-rich crusts

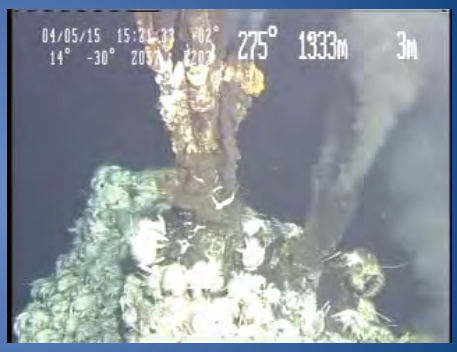


A. Usui

Hydrothermal ores



(Tivey, 2007)



YouTube: Black Smoker Vents

Metal Contents

	Manganese nodule	Cobalt-rich crusts	Hydrothermal ores
	Mn 28.8% Cu 1.0% Ni 1.3% Co 0.3%	Mn 24.7% Cu 0.1% Ni 0.5% Co 0.9% Pt 0.5ppm	Cu 1～3% Pb 0.1～5% Zn 30～55% Au, Ag

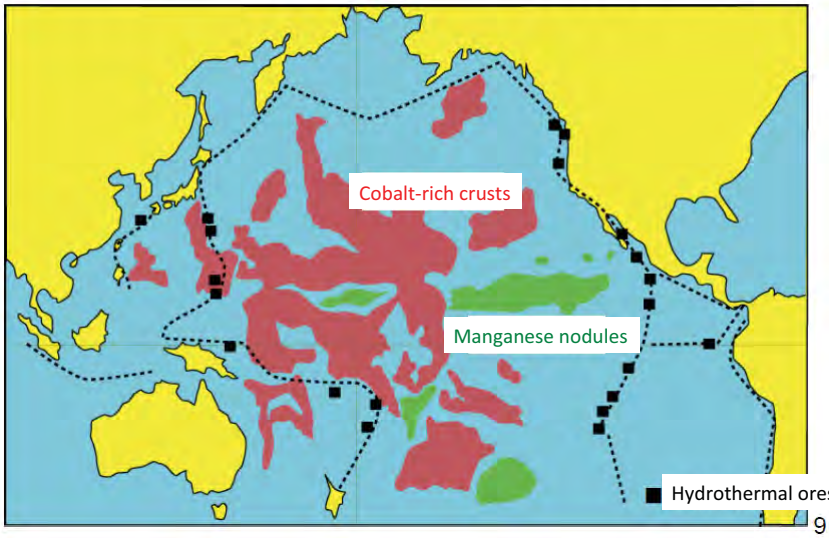
JOGMEC作成

Water depth

5000-6000m	2000-3000m	500-1500m

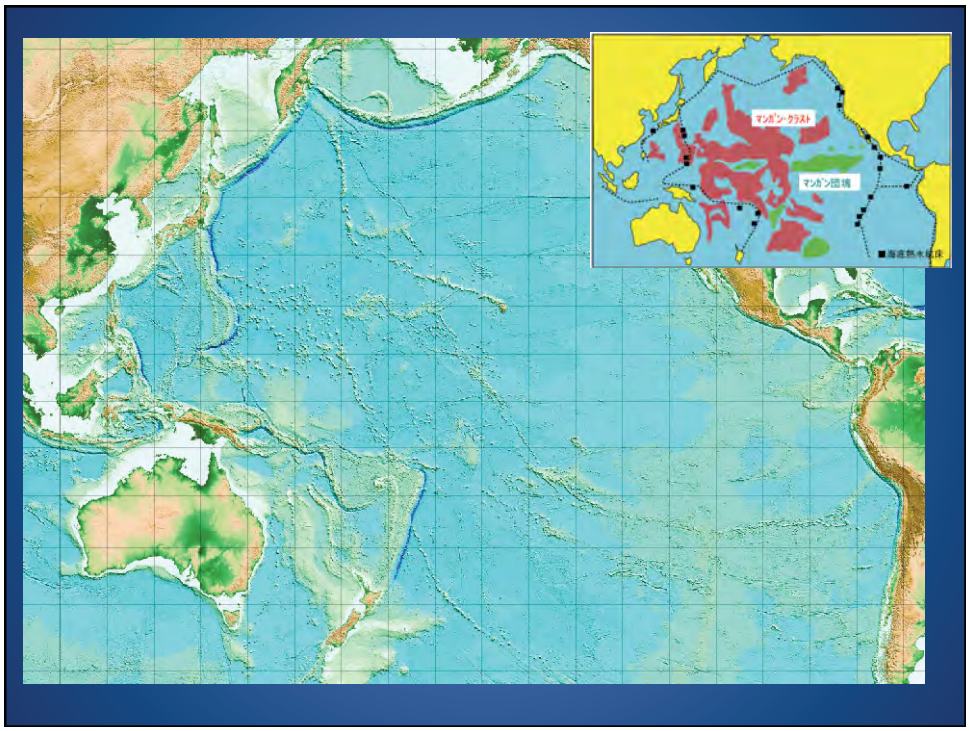
JOGMEC

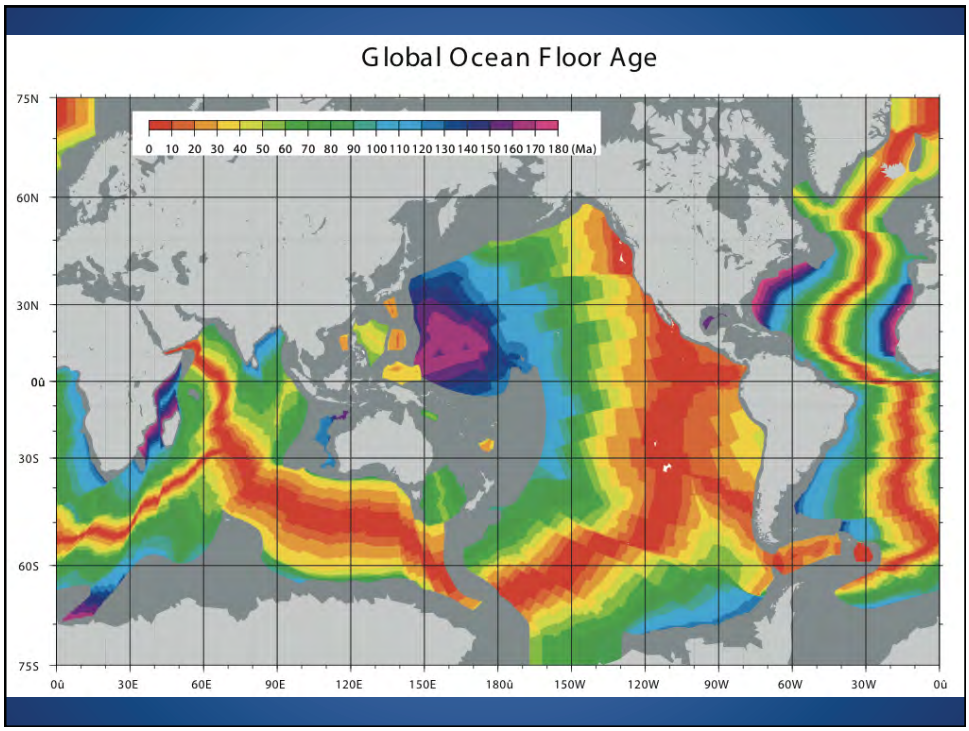
Distribution of deepsea mineral resources



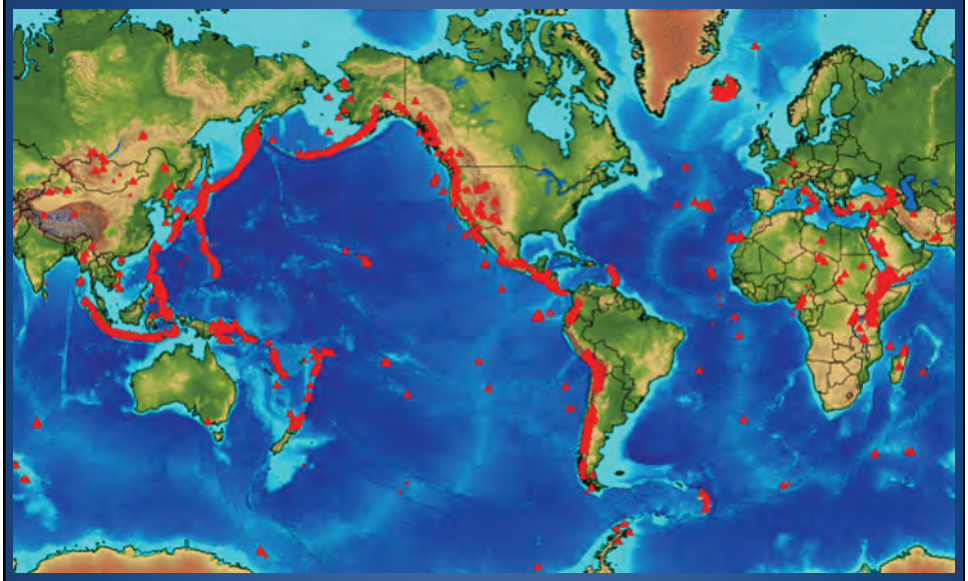
9

From JOGMEC publication


マンガン・クラスト
マンガン団塊


Global Ocean Floor Age
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 (Ma)
75N
60N
30N
0û
30S
60S
75S
0û
30E
60E
90E
120E
150E
180û
150W
120W
90W
60W
30W
0û

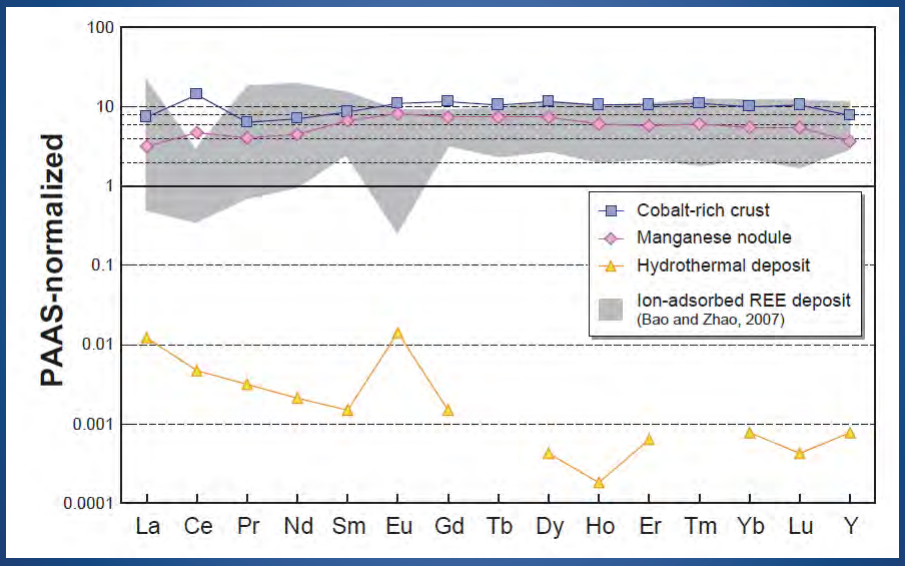
Volcanos of the World



Boundaries of the ocean floor

Economist May 16th 2009

Rare earth elements contents



(Awaji 2009)

Metal price: Copper

Conclusions

1. Pacific islands have geologically high potentials of deepsea mineral resources.
2. First commercial production will be done by hydrothermal ores.
3. Deepsea mineral resources will provide opportunity of sustainable production of key minerals for future society.

Deep Sea Minerals Development in the Pacific Islands Region: Status, Challenges and Opportunities

Author:

Akuila K. Tawake

Applied Geoscience and Technology Division (SOPAC)
Secretariat of the Pacific Community
Suva Sub-Regional Office
Fiji.

Abstract

The recent upsurge in activity related to exploration for mineral resources on the seabed within the Exclusive Economic Zones (EEZs) of Pacific Island Countries (PICs) is viewed with growing interest among key stakeholders. Whilst scientific research and exploration into these deposits have been underway for several decades, the current work is being conducted for commercial purposes, with numerous mining entities raising public funds for resource quantification, feasibility studies and eventual mining. The recent discovery of 'high grade' Seafloor Massive Sulphide (SMS) deposits in PNG's territorial waters has led to a rush for applications within the EEZ of other PICs that were previously identified as having deep sea mineral potential.

While offshore mining is a totally new venture, it appears that deep ocean mining for polymetallic mineral deposits may be less harmful to the environment than equivalent land mining. Adverse impacts that are normally associated with land mining such as acid mine drainage, scarred landscape caused by deep excavations and massive infrastructure development would be either significantly reduced or totally eliminated during marine mining. Additionally, technologies that have been successfully used in shallower marine mining, and deep-water oil and gas exploration and production are directly transferable to deep seabed mining.

Recent suggestions in the mining and scientific research industries that seabed mining poses fewer environmental risks than terrestrial mining are largely based on assumptions. Relative to terrestrial and aquatic systems, deep-sea ecosystems are much less understood and more difficult to monitor. Until and unless a better understanding of these ecosystems has been reached, the threats posed by deep-sea mining will be uncertain but potentially serious.

Despite this surge in interest and activity around the Pacific, specific policy, legislation and regulations necessary for the governance of deep sea mineral resources are lacking. Also lacking is the specific technical and human resources capacity essential to ensure that PICs are able to effectively manage these new found ocean resources that offer an economic potential. The European Union funded Deep Sea Minerals (DSM) Project will work with Pacific ACP States to develop a regional policy and regulatory framework from which they can develop their national frameworks for the sustainable management of their marine mineral resources. The work is of critical importance if Pacific ACP States are to have effective environmental, fiscal and social management instruments in place for the exploration and exploitation of deep sea minerals that could support economic growth.

1. Introduction

Interests in deep sea mineral deposits have been rejuvenated in recent years in the Pacific Islands region that could be attributed to the rise in metal prices triggered by sustained

increase in global demand. The discovery of 'high grade' Seafloor Massive Sulphide (SMS) deposits and the recent grant of commercial mining lease in Papua New Guinea (PNG) territorial waters has triggered renewed interest in marine polymetallic deposits including manganese nodules and cobalt-rich crust throughout the Pacific region. This has resulted within a space of four-years in either applications for or grant of exploration licenses in Fiji, Vanuatu, Solomon Islands, New Zealand, Papua New Guinea, Palau, and Federated States of Micronesia, with additional interest being expressed for exploration around the Cook Islands and Kiribati.

In recognition of the enormous potential of deep sea mineral resources within the Pacific region, the then SOPAC the Commission in collaboration with other donors convened a regional workshop in Madang PNG in early 1999 to discuss an enabling platform for the sustainable management of these resources. Countries with interests in deep sea minerals in the region were represented in the workshop and collectively developed "The Madang Guidelines" as a basis to formulate effective and enabling policy and legislation to govern offshore mineral exploration and development. The Madang Guidelines is a collective regional initiative with the primary objective to assist and guide individual nations in the region in developing their offshore mineral resources policy (SOPAC, 1999).

If seabed mining can be shown to be both profitable it will certainly become a new and maybe rapidly emerging economic activity for many PICs. There is therefore a need for effective regulatory regimes to ensure sustainable management that brings tangible benefits to PICs and their people.

2. History of Marine Minerals Scientific Research and Exploration

Marine mineral and hydrocarbon exploration intensified in the Pacific Islands region between the early 1970s and mid 1980s. Exploration efforts were initially focused on Manganese Nodules in the early to mid 1970s. This was followed by interests in other commodities namely, metalliferous sediments, phosphate and precious coral in the late 1970s in addition to ongoing manganese nodules survey. High projected costs associated with mining manganese nodules inhibited nodule mining efforts. Cobalt-rich Crust was not investigated until 1979 commencing with a survey in the Gilbert Islands Kiribati (McDougall and Fuata, 1979).

The search for metalliferous sediments in the mid 1970s in the marginal basins associated with the island arc-trench subduction zones of the' southwest Pacific was a relatively new venture. Indications of hydrothermal vents were first discovered in the Lau Basin in 1982 and new ones were found in the same area in 1984 (Herzer and Scholl, 1984). However, the first Seafloor Massive Sulphide (SMS) deposit in the region was confirmed in the Manus Basin PNG in 1985. During the 1991 marine scientific expedition that was conducted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in the Manus Basin, high grade base and precious metals were confirmed (Binns and Wheller, 1991) that led to commercial exploration interests for SMS deposits in the region.

In response to requests by the Committee for Co-ordination of Joint Prospecting for Mineral Resources in the South Pacific Offshore Areas (CCOP/SOPAC)[1], the Government of Japan had developed and undertaken a 21-year mineral prospecting program to assess the deep-seafloor mineral resource potential in selected areas of the EEZ of twelve PICs. Much of the results of the early minerals prospecting in the region had been rendered redundant by this

[1] CCOP/SOPAC later became the Pacific Islands Applied Geoscience Commission (SOPAC), and now as the Applied Geoscience and Technology Division (SOPAC) of the Secretariat of the Pacific Community (SPC).

systematic and reasonably detailed works that were carried out during this 1985-2005 Japan-SOPAC Cooperative Study programme.

This deep sea mineral resources investigation programme has greatly enhanced the geological knowledge of deep sea mineral resources within the EEZ of the twelve participating countries, namely: Cook Islands, Kiribati, Tuvalu, Samoa, Papua New Guinea, Solomon Islands, Vanuatu, Tonga, Marshall Islands, Federated States of Micronesia, Fiji and Niue. The then SOPAC the Commission was instrumental in facilitating and coordinating all survey activities in the region for the duration of this 21-year program.

3. Known Deep Sea Mineral Resources

The potential for seabed mining in the Pacific Island region is significant. The Cook Islands EEZ, for example, is believed to contain some 7.5 million metric tons of manganese nodules, a potential source of 32 million metric tons of cobalt, or about 500 years of supply at current world demand.

Cobalt-rich manganese crusts deposits have been found in the Federal States of Micronesia and the Marshall Islands. On the other hand, polymetallic SMS deposits have been discovered in the Lau Basin in Fiji and Tonga's EEZ, and in the Manus and Woodlark Basins in Papua New Guinea and Solomon Islands. Indications that the Pacific SMS deposits may have a high gold content, with the extracted value potentially as high as US$1,800 per tonne. With the exception of the Nautilus Minerals Inc' (hereafter "Nautilus") advanced Solwara 1 exploration project, the volume of known SMS deposits in the region has yet to be quantified.

Occurrences of deep sea polymetallic mineral resources within the EEZ of various PICs are tabulated below. However, further exploratory work is required to increase geological knowledge and confidence hence inferred resource category can be upgraded and ultimately the feasibility of exploiting these seabed resources can be determined.

Table 1. *Known seabed mineral occurrences within the EEZs of Pacific Island Countries.*

Country	MN	SMS	CRC
Kiribati	√		√
Cook Islands	√		
Tuvalu	√		√
PNG		√	
Vanuatu		√	
Solomon		√	
Fiji		√	
Tonga		√	
Samoa			√
RMI			√
FSM			√
Palau		√	
Niue	√		√

Abbreviations: MN – Manganese Nodules; SMS – Seafloor Massive Sulphide; CRC – Cobalt-rich Crust; PNG – Papua New Guinea; RMI – Republic of the Marshall Islands; FSM – Federated State of Micronesia.

4. Recent Development

A number of offshore mineral exploration / mining companies have either been granted exploration licenses or awaiting a decision on their respective applications principally for SMS deposits in the Pacific Islands region. Nautilus advanced exploration project in the Manus Basin in PNG has recently been granted a mining lease and is poised to become the world's first undersea mining operations.

Secondly, Neptune Minerals, a United Kingdom company was conducting mineral prospecting in the Kermadec Ridge within New Zealand's EEZ more than two years ago. Both companies have substantial offshore exploration licence holdings in a number of countries in the region. Additionally, Bluewater Metals and the Korean Ocean Research and Development Institute (KORDI) were reported to have been active in the region in recent years. Further, an offshore exploration consortium, known as "The Bond Group", has shown significant interest in exploring for Manganese Nodules within the EEZs of the Cook Islands and Kiribati.

5. Advantage of Offshore Mining over Onshore Mining

While offshore mining is a totally new venture, there are a number of similar issues that can be compared with onshore mining. It appears that ocean mining for polymetallic deposits may be less harmful to the environment than equivalent land mining. Two of the biggest problems with land mining are acid mine drainage caused by ground or rain water reacting with iron sulphides to produce sulphuric acid, and a permanent scarred landscape caused by deep excavations and rock piles, would be eliminated during offshore mining. Abundant sulphuric acid cannot form in the oceans because seawater, being alkaline, would instantly neutralise any acid. In addition, the recovery of most deposits would not leave big holes and rock piles on the seabed (International Seabed Authority, 2000).

Due to the large surface exposed to seawater, some of the liberated sulphide debris will oxidise in a way which is not different from the oxidation of inactive massive sulphides in many of the seafloor deposits (International Seabed Authority, 2000). In addition, apart from consideration of maritime rights such as fishing and navigation, seabed mines will not be accompanied by the potential land-use conflicts faced onshore. Rainforest and other terrestrial ecosystems, rivers, lakes, and transportation corridors will not be at risk. Moreover, unrecoverable infrastructure costs, such as community facilities, roads and bridges will not be necessary. Once a deposit is mined, the mining system will be able to move on to the next target area with minimal reclamation and abandonment of assets.

6. Exploration and Mining Technology

Early efforts of offshore mining technology innovation were undertaken in the 1970s and 1980s by multinational consortia composed of developed countries private companies and public agencies. Since the early 1990s, a number of developed countries including Germany, Japan, China, Korea, India and the United States, were reported to have been working on developing new offshore mining technology (International Seabed Authority and Government of India, 2008).

Over the last two decades, there has been incredible expansion in marine technology and biotechnology that are largely driven by military and marine research, as well as oil production. Since 1990, China Ocean Mineral Resources Research and Development Association (COMRA) of the People's Republic of China has been working on a special mining system for collecting and lifting nodules in its exploration area. KORDI has been

engaged in resource and development activities for nodule mining since 1993. Deep Ocean Resources Development Co. Ltd. (DORD), a Japanese company, tested a collector system around a seamount at 2200 m depth in 1997 and achieved around 87% efficiency (International Seabed Authority and Government of India, 2008).

A consortium including Halliburton SubSea was working on developing the necessary exploration and mining systems from proven commercial components. Halliburton SubSea is the designer and fabricator of the NamSSOL device which is very successful in producing marine diamonds off the coast of Namibia in southern Africa, and has extensive operations in deep-water oil and gas exploration and production. It has been confirmed that these technologies are directly transferable to deep seabed mining.

Nautilus is developing a production system using existing technologies adapted from the offshore oil and gas industry to enable the extraction of high grade SMS systems on a commercial scale. In late 2007 the company was reported to have awarded the contract for the Seafloor Mining Tool (SMT) for its Solwara 1 Project to Soil Machine Dynamics of Newcastle United Kingdom. The system is designed to operate at production rate of 6,000 tonnes / day. The schedule provides for the completion of assembly, testing and integration work on the Mining Support Vessel (MSV) to meet the scheduled production timeline (Nautilus Minerals, 2007). A second contract was awarded in early 2008 to Technip USA Inc to provide engineering procurement and construction management services for the Riser and Lifting System (RALS) components of the deepwater SMS extraction system (Nautilus Minerals, 2008). However, significant delay to the construction of these systems is largely driven by the 2008 global economic downturn.

7. Environmental Considerations

While there have not been adequate studies to determine the potential impacts of deep sea mining on the ocean floor and ecosystem, scientists have begun describing what the impacts might be to help regulators and the public better understand the potential price of this new industrial activity on the oceans. It is well known that terrestrial and aquatic ecosystems can be disrupted, damaged, or destroyed by terrestrial mining operations. Recent suggestions in the mining and scientific research industries that seabed mining poses fewer environmental risks than terrestrial mining are largely based on assumptions. Relative to terrestrial and aquatic systems, deep-sea ecosystems are much less understood and more difficult to monitor. Until and unless a better understanding of these ecosystems has been reached, the threats posed by deep-sea mining will be uncertain but potentially serious (Halfar and Fujita, 2002).

While it is clear that mining would not take place at the active hydrothermal vent system due to hazardous conditions, direct impact on biological communities peripheral to vents and indirect impacts on vent communities are most likely to be adversely significant. It is anticipated that the potential for serious environmental impact will be greatest at the seafloor and at the depth zones of discharge of mine tailings and effluent.

Other major potential impacts include: dispersal of fine sediments on and near surface water due to pumping and transfer of ore materials, feeding of fish on heavy metal rich suspended sediments causing bio-accumulation in the food chain, oil leaks from the mining support vessel, extent of impacts are expected to be more widespread since there are no physical borders in the ocean, and waste produced from onshore processing facility may impact the nearshore environment and coastal communities.

8. Potential Impacts on Communities

While mining companies are quick to argue that there will be widespread economic benefits of offshore mining in the region, the same claim was made for land-based mining and other extractive industries and has not been borne out by experience. Wealth would almost certainly be generated, but it is unclear how that wealth would be distributed. One of the significant adverse impacts of mining in the region is the inequitable sharing of the wealth coupled with ongoing transparency and governance issues associated with the extractive industry.

Moreover, many coastal communities have lived for generations under a resource-rich, rather than cash-rich, economy. In many ways, rich natural resources are a social safety net, supplying food, livelihoods, and security. Industrial activities in the ocean, such as deep sea mining, could potentially erode this long term economic base, diminish food supply, and poison the environment with pollution.

9. Lack of National Frameworks for the Management of Marine Minerals

Existing legislative instruments that govern the Territorial Seas, EEZ and continental shelf of individual nations in the Pacific Islands region are more or less a declaration of sovereign rights and ownership of the non-living resources of the seabed and subsoils without the necessary legal frameworks governing these resources. Additionally, legislation that deals with offshore resources are silent on the management of seabed minerals and often designed to administer the ocean's living resources, particularly fishery resources, within their respective jurisdictions. Further, most of the active mineral and mining legislation is applicable only to onshore exploration and exploitation with little or no mention of the offshore mineral resources (Tawake and Rao, 2009).

Apart from the lack of policies, legislation and regulations that govern mineral exploration in the offshore areas of PICs, specific technical capability and human resources capacity that enable countries to effectively participate in the development and management of these new ocean resources and benefit streams are lacking. Linked to this capacity vacuum is the inability to regulate and monitor offshore exploration and mining, and associated environmental impacts. Additionally, there is a general lack of information and understanding in countries of the nature and economic potential of these deposits as well as factors that are going to affect the viability of any mining operation.

Offshore mining in the jurisdiction of any country will potentially generate significant wealth and a fair share must be returned to the government and the people in terms of tax revenues, employment and indirect economic activities. It is therefore crucial for countries to put in place enabling mechanisms that safeguard the interests of the country and its people while at the same time encourage investment in offshore minerals exploration and mining in the region.

10. SPC-EU EDF10 Deep Sea Minerals Project

The regional Deep Sea Minerals (DSM) Project is funded by the European Union under the 10th European Development Fund (EDF10) and will be implemented by the new Applied Geoscience and Technology Division (SOPAC) of the Secretariat of the Pacific Community (SPC). The overall objective of the project is to expand the economic resource base of Pacific ACP States by developing a viable and sustainable marine minerals industry. The specific objective is to strengthen the system of governance and capacity of Pacific ACP States in the sustainable management of their deep sea mineral resources through the

development and implementation of sound and regionally integrated legal, fiscal and environmental frameworks, improved human and technical capacity and effective monitoring systems (Tawake and Rao, 2009). This has flow on effects with respect to better governance of the oceanic areas under national jurisdictions and the resources contained therein.

The Project will be delivered against the following four major components: (1) Development of Regional Legislative and Regulatory Framework(s) (RLRF) for offshore minerals exploration and mining; (2) Formulation of National policy, legislation and regulations; (3) Building national capacities - supporting active participation of PICs nationals in the offshore mining industry; and (4) Effective management and monitoring of offshore exploration and mining operations.

With the Project support and guidance, the RLRF will be used by individual PICs to develop their national legislative instruments for the sustainable management of their marine mineral resources. The work is of critical importance if PICs are to have effective environmental, fiscal and social management instruments in place for the exploration and exploitation of deep sea minerals that could support immediate and long-term economic growth.

Additionally, capacity building initiatives in areas associated with marine minerals development and management will be supported including technical professions, policy development, assessing fiscal and taxation regimes and environmental monitoring. Further, the project will also develop environmental management guidelines for deep sea exploration and mining and support the participation of selected candidates in offshore environmental monitoring (Tawake and Rao, 2009). However, effective implementation of capacity building and environment monitoring activities hinges on the commencement of mining operation within the EEZ of any country in the region, notably in PNG.

11. Conclusion

With significantly improved efficiency in mining technology, increasing consumption rate of mineral commodities and the general upward trend of commodity prices, the mining of deep sea mineral deposits will soon be realized. There is a greater degree of optimism that the Nautilus' Solwara 1 Project in the Manus Basin in PNG will become the first ever deep sea mining project in the world. If offshore mining occurs in PNG, it will provide the benchmark for the improvement of future offshore mineral exploitation in the region and beyond.

With the financial assistance of the EU, the SPC under the DSM Project will provide technical and policy guidance to individual nations in the region to enable and facilitate the development of national legislative and regulatory frameworks that are necessary for the governance of offshore mineral exploration and exploitation. Equally important that these frameworks must safeguard national interests while at the same time encourage investment in exploration and eventually offshore mining.

The SPC recognises the tremendous potential of offshore mineral resources in the region that requires the reconciliation of key policy issues. Any initiative under the DSM Project must be consistent with relevant provisions of the United Nations Convention on the Law of the Sea (UNCLOS) and other international, regional and national laws and convention. Once national legislative instruments are in place under which these resources can be explored and exploited, the next obvious challenge for countries in the region is to ensure these policies, legislation and regulations are effectively administered and enforced.

Keywords

ACP – Africa Caribbean Pacific

CCOP/SOPAC – Committee for Co-ordination of Joint Prospecting for Mineral Resources in the South Pacific Offshore Areas

EEZ – Exclusive Economic Zone

EU – European Union

DSM – Deep Sea Minerals

PICs – Pacific Island Countries

SMS – Seafloor Massive Sulphides

SOPAC – Applied Geoscience and Technology Division

SPC – Secretariat of the Pacific Community

UNCLOS – United Nations Convention on the Law of the Sea

12. References

Binns R. A and Wheller G. E .1991. Report on the PACLARK-V/PACMANUS-I RV Franklin Woodlark and Manus Basins PNG. *CSIRO Division of Exploration Geoscience. Restricted Report 263R.*

Halfar J and Fujita R. M. 2002. Precautionary Management of Deep Sea Mining. *Marine Policy Vol 26 103 – 106.*

Herzer R. H and Scholl D. W. 1984. Initial Report on RV S. P. Lee Cruise L3-84-SP: Tonga Ridge and Lau Basin. *CCOP/SOPAC Cruise Report No. 93.*

International Seabed Authority and Government of India. 2008. Workshop on Polymetallic Nodule Mining Technology – Current Status and Challenges Ahead. *National Institute of Ocean Technology, Chennai India 18 to 22 February 2008.*

International Seabed Authority. 2000. Polymetallic Massive Sulphides and Cobalt-Rich Ferromanganese Crust: Status and Prospect. *ISA Technical Study No.2.*

McDougall J. C and Fuata P. K. 1979. Cruise Report: Kiribati Offshore Survey. Cruise GL 79-1. *CCOP/SOPAC Technical Secretariat Project Report No. 26.*

Nautilus Minerals Inc. 2008. US$116 Million Contract Awarded for Nautilus's Solwara 1 Development. *News Release Number 2008-06.*

Nautilus Minerals Inc. 2007**.** Seafloor Mining Tool Contract Award and Project Development Update. *News Release Number 2007-50.*

SOPAC. 1999. The Madang Guidelines: Principles for the Development of National Offshore Mineral Policies. *SOPAC Miscellaneous Report 323.*

Tawake A. K and Rao B. 2009. Deep Sea Minerals in the Pacific Islands Region: A Legal and Fiscal Framework for Sustainable Resource Management. *Action Fiche FED / 2009 / 21368.*

The United Nations Convention on the Law of the Sea.

Approaches for environmental impact assessment of seafloor massive sulfide mining

Tetsuo YAMAZAKI
Osaka Prefecture University, Sakai, Japan
tetsuo-yamazaki@aist.go.jp

ABSTRACT

Seafloor Massive Sulfides (SMS) including Au, Ag, Cu, Zn, and Pb exist in exclusive economic zones (EEZ) of some Pacific island countries. Some of SMS are interested in as immediate targets for commercial mining ventures. Little information, however, is available for the mining impacts on marine ecosystem, because no actual deep-sea mining operation is there in the world. In case of SMS, in addition, some of them accompany active hydrothermal vents beside the possible mining sites. High primary biomass production and dense ecosystem population on seafloor are found around the vent system.

On the basis of physical, chemical, and biological baseline survey data, Nautilus Minerals submitted an environmental impact statement for the Solwara 1 Project to Papua New Guinea (PNG) Government. The final environmental permit for the Solwara 1 Project was received on December 29th 2009 from PNG Government for a term of 25 years, expiring in 2035.

The other approach is the environmental impact assessment program for SMS mining driven by Japan. In contrast with PNG, the feature of Japan's program is the step-by-step process for the assessment. The first will be an assessment for a small scale machine test, and then the scale-up is scheduled. The step-by-step process of Japan's program is introduced in detail.

INTRODUCTION

Deep-sea mining has been a subject of interest for several groups and countries for over four decades, due to its potential for the economical recovery of large reserves of minerals that would provide an alternative resource of strategic metals for industrial development. The first target through 1960s to 1980s was manganese nodules lying on ocean floors at 4,000-6,000 m deep (Mero, 1965; Cronan, 1980; Welling, 1981; Kaufman et al., 1985; Bath, 1989; Herrouin et al., 1989). Then, secondary one in 1980s was cobalt-rich manganese crusts covering ocean seamounts at 1,000-2,500 m deep (Cronan, 1980; Halbach, 1982; Clark et al., 1984; Halkyard, 1985; Latimer and Kaufman, 1985; Manheim, 1986; Pichocki and Hoffert, 1987; Hawaii DPED, 1987). Because the economic condition in 1990s was not good for the commercial mining, no actual deep-sea mining was realized. The third and current target in the last two decades has been SMS depositing along seafloor spreading axes at 600-2,000 m deep (Halbach et al, 1989; Fouquet et al., 1991; Bendel et al, 1993; Iizasa et al. 1999; Kia and Lasark, 1999; Lenoble, 2000; Malnic, 2001; Yamazaki and Park, 2003; Yamazaki et al., 2003; Yamazaki, 2007). Some of them have received much attention as immediate commercial mining targets. However, because of the economic crisis in 2008, the commercial mining activities have been postponed.

In the High Sea Areas defined by ANCLOS, all the mining activities are controlled and regulated by the International Seabed Authority. In the EEZs, the continental selves, and the terrestrial sea areas, each state has the responsibility to control and regulate the mining activities. Less information is available, however, for the environmental impacts of deep-sea mining and no effective method for the environmental assessment in these areas. Owing to growing concern for the global and local environments, the quantitative understanding of the environmental impacts, the systematic environmental assessment, and the effective control and regulation methods of deep-sea mining must be clarified for the sustainable developments.

Japan has learned many from the multi-disciplinary environmental studies (oceanography, geology, geochemistry, ecology and geotechnical engineering) in an ocean floor at 5,300 m deep around manganese nodule distribution area (Fukushima, 1995; Shirayama and Fukushima, 1997a; Shirayama and Fukushima, 1997b; Yamazaki and Kajitani, 1999; Shirayama, 1999) and on a seamount at 2,200 m deep around cobalt-rich manganese crust distribution area (Yamazaki, et al, 2001; Ohkubo and Yamazaki, 2003). The collaboration with USA around manganese nodule distribution area was helpful for understanding the deep-sea baseline and for conducting a benthic impact experiment in the ocean floor. Then, Japan has

continued the original approach for developing environmental assessment techniques of deep-sea mining on the seamount around cobalt-rich manganese crust distribution area. The important points in summary are as follows:

1. Careful and sufficient benthic baseline data accumulation is required to evaluate their variations of fluctuation;
2. Benthic ecosystem model is an effective tool to evaluate the quantitative ecosystem reaction against environmental impacts cause by the artificial deep-sea disturbance;
3. Benthic impact experiment and the monitoring are necessary to improve the ecosystem model; and
4. Scale and rate viewpoints of the benthic impact experiment against the actual exploitation are necessary for applying the ecosystem model to the quantitative environmental assessment.

Quite less information around SMS areas, in contrast with the ocean floor and the seamount, is available not only for the baseline benthic ecosystem but also the mining impacts on the ecosystem. That is the reason why Japan has started a new environmental program in SMS distribution areas from 2008.

SEAFLOOR MASSIVE SULFIDES AND THE MINING

SMS, which include metals such as Au, Ag, Cu, Zn, and Pb, received much attention as one of deep-sea mineral resources (Lenoble, 2000). SMS are formed by hydrothermal processes associated with spreading centers of plate-tectonic activity (Rona, 1985). The geological characteristics of the ocean ridge type SMS found in the Atlantic, Indian, East Pacific, and Red Sea areas were studied by several researchers (Haymon and Kastner, 1981; Malahof, 1981; Hekinian et al., 1983; Rona et al., 1984; Hekinian and Bideau, 1985; Rona, 1985).

Since the first discovery in the Okinawa Trough near Japan (Halbach et al, 1989), in the western Pacific, the back-arc basin and oceanic island-arc types of SMS have been found. The typical examples are the Izu-Ogasawara Arc near Japan (Iizasa et al. 1999), in the Lau Basin and the North Fiji Basin near Fiji (Fouquet et al., 1991; Bendel et al, 1993), and in the East Manus Basin near Papua New Guinea (Kia and Lasark, 1999). Because of the higher Au, Ag, and Cu contents, they have received much attention as immediate commercial mining targets by private companies (Malnic, 2001; http://www.nautilusminerals.com; http://www.neptuneminerals.com).

Because of the economic crisis in 2008, the commercial mining activities have been postponed. The recovery rate of metal market, however, has been very quick and the copper price in the London Metal Exchange has leached the historical record breaking level from the end of 2010 (http://www.lme.co.uk). The environmental permit for the development of the Solwara 1 Project was received in December, 2009. The mining lease for the development of the Solwara 1 Project was granted in January, 2011. The activities are expected to re-start soon.

ECOSYSTEM AROUND HYFROTHERMAL PROCESS

Quite unique and large biomass ecosystem communities have been found around active hydrothermal processes (http://www.whoi.edu/oceanus/viewArticle.do?id=2420). They are *Beggiatoa*, *Calyptogena*, *Bathymodiolus*, tubeworms (*Riftia pachyptila*), amphipods, copepods, snails, shrimps, crabs, sea urchins, sponges, and fishes. They are called chemosynthetic communities. All SMS in the western Pacific mentioned above accompany with the active hydrothermal processes and the ecosystem communities. The primary productions in the ecosystem are sulfur oxidation using hydrogen sulfide supplied from the venting water and immobilization (Fenchel and Bernard 1995; Hessler and Kaharl, 1995; Karl, 1995; Van Dover, 2000; Micheli et al., 2002). Some of them are expected to be an important biological resources (Little and Vrijenhoek, 2003). The additional primary production from the chemosynthesis causes the higher biomass around active hydrothermal process than the one in normal deep-sea benthos population.

Depending on targets selection of the SMS mining, the ecosystem communities around active hydrothermal processes may be affected with the mining operations (Yamazaki, 2010).

EXPECTED MINING IMPACTS

In case of Nautilus Minerals in the Solwara 1 Project in PNG, the mining target includes active hydrothermal

processes. The schematic image of environmental impacts caused by the mining is introduced in Figure 1. Direct destruction by the excavation both in active and non-active areas is expected in the image. In avoiding loss of biodiversity in the active area, a mitigation process is introduced in the environmental impact statement (EIS) for the Solwara 1 Project (Source: http://www.cares.nautilusminerals.com/).

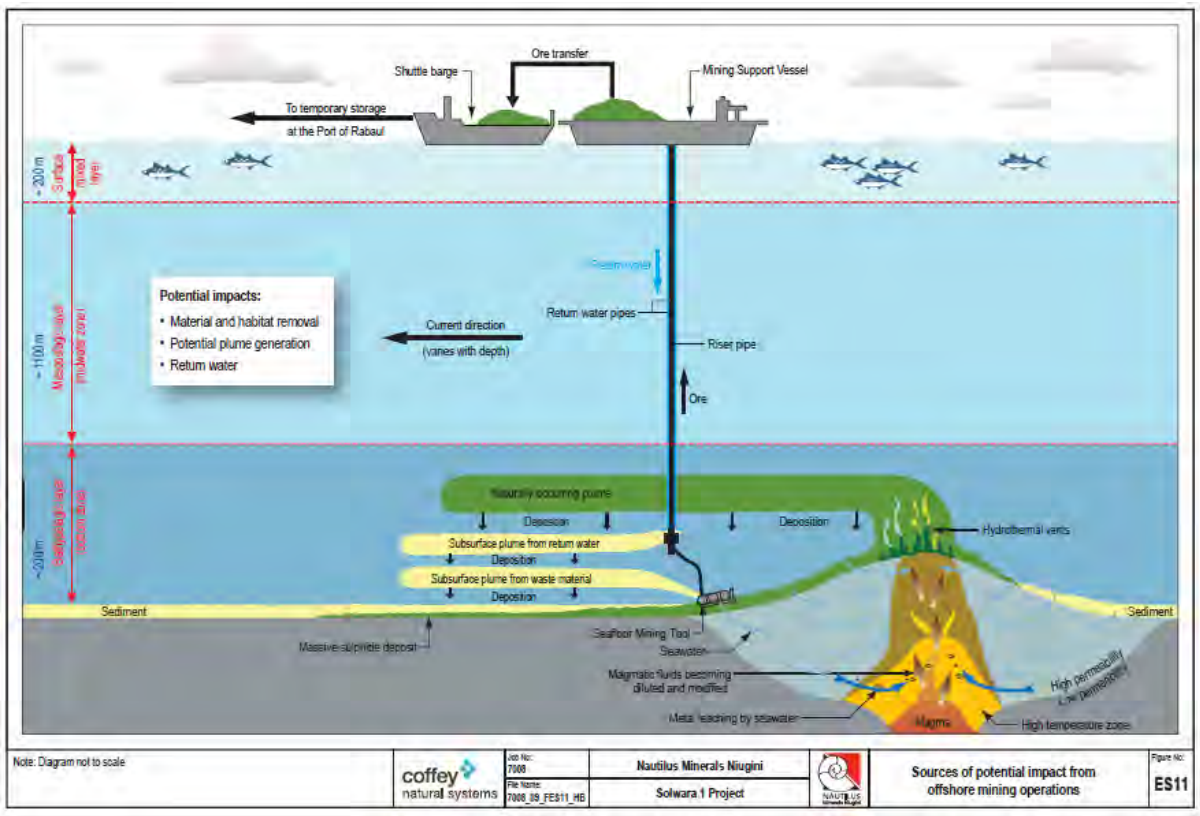


Figure 1 Schematic image of environmental impacts expected by Nautilus Minerals in the Solwara 1 Project in PNG (Source: http://www.cares.nautilusminerals.com/)

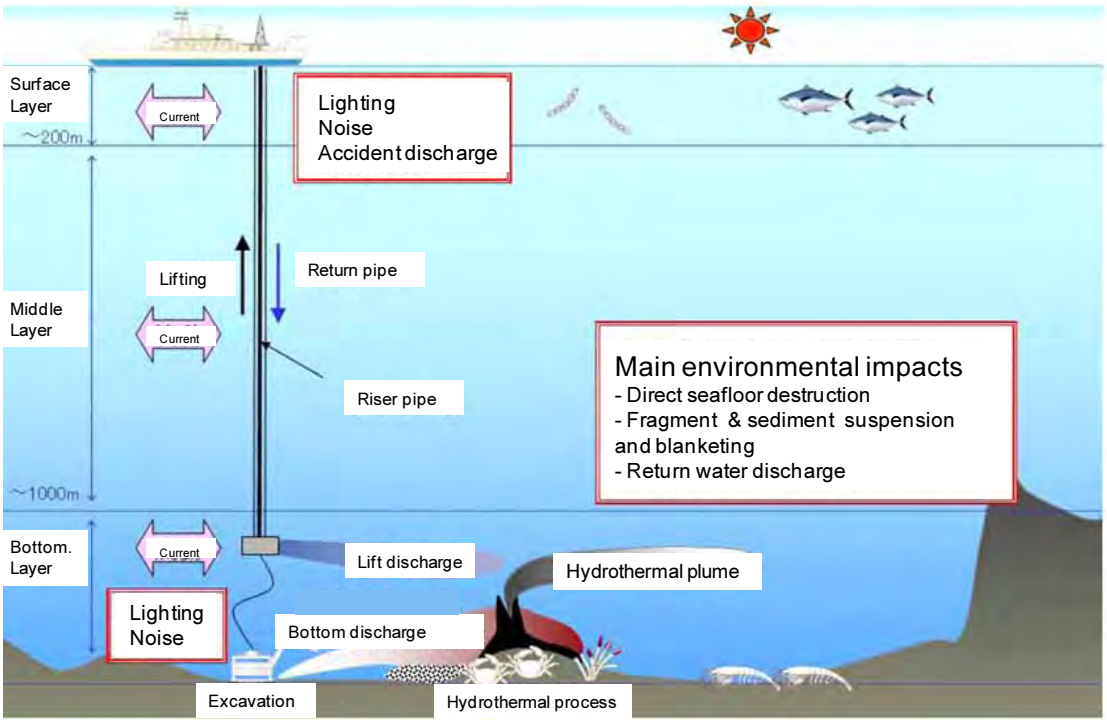


Figure 2 Schematic image of environmental impacts expected by JOGMEC (Modified original figure in Japanese.) (Source: http://www.jogmec.go.jp/mric_web/koenkai/100527/briefing_100527_4.pdf)

In the environmental program started in 2008 managed by Japan Oil, Gas and Metals National Corporation (JOGMEC), the mining target is expected to be non-active SMS adjacent to active hydrothermal processes (http://www.jogmec.go.jp/mric_web/koenkai/100527/briefing_100527_4.pdf). The schematic image of environmental impacts caused by the mining is introduced in Figure 2. Direct destruction only in non-active area is expected in the image.

In the both cases in Figures 1 and 2, blanketing and other impacts on seafloor with the mining plumes created by the seafloor miners and the returned lift discharges in active and non-active areas are expected.

ENVIRONMENTAL IMPACT ASSESMENT FOR SOLWARA 1 PROJECT

The environmental impact assessment (EIA) for the Solwara 1 Project was conducted by Nautilus Minerals from 2006 to 2008. It is the first systematic environmental studies for SMS mining. The important specific features of the EIA are as follows:

- General
- Social acceptance
- Baseline survey
- International collaboration
- Open information
- Environmental impact statement (EIS).

The EIA included all the general direct and indirect aspects of offshore, onshore, and social relations (http://www.cares.nautilusminerals.com/). In addition to the offshore mining and transportation activities, onshore ore dressing in the nearest location is planned, and through the SMS mining venture, many social impacts on local communities are the reasons. Therefore, the social understanding and acceptance are important.

The main part of offshore work was physical, chemical and biological baseline studies in and around the Solwara 1 Project area. The studies were conducted under international collaboration with many organizations and the results were opened to public through the Nautilus CARES website (http://www.cares.nautilusminerals.com/).

The studies and organizations are as follows:

- Macrofauna of hard seafloor areas (College of William and Mary, Duke University)
- Macrofauna and meiofauna of sediments (Scripps Institution of Oceanography)
- Abyssal meiofauna (Dr John Moverley and Coffey Natural Systems)
- Sediment geology (University of Toronto)
- Sediment geochemistry – elutriate and toxicity testing (CSIRO and Charles Darwin University)
- Biomass, biodiversity, and bioaccumulation (Hydrobiology)
- Water quality (CSIRO and Coffey Natural Systems)
- Natural hazards (Rabaul Volcano Observatory)
- Oceanography (Coffey Natural Systems)
- Underwater acoustic modeling (Curtin University of Technology)
- Discharged water and sediment dispersion modeling (Asia-Pacific Applied Science Associates).

From the results of the studies, an environmental impact statement (EIS) for the Solwara 1 Project was prepared and presented to PNG government in Sep. 2008 and accepted in Nov. 2008. The EIS emphasized some limited impacts in small area and the mitigation.

The mitigation strategies described measures taken in the mining operations to minimize the impacts on the environment. Ensuring the re-colonization after the mining operation on seafloor, the following approaches were presented:

- Provide an un-mined reference area close to the Solwara 1 to provide parent stock for re-colonization and a control site for environmental monitoring;
- Create a temporary refuge area within the Solwara 1 to allow progressive rehabilitation;
- Some animals will be moved from non-excavated areas to excavated ones to enhance re-colonization; and
- May establish artificial substrates to provide re-colonization base, if necessary.

Because the lifted water for ore transportation from seafloor to the surface mining vessel will be returned to 20-50 m above seafloor after filtration of most of particles and be discharged into bottom layer, no large impact in middle and surface layers were expected. No chemical processing on board the vessel was planned and the ores recovered by the filtration will be transported to onshore facilities.

The monitoring program of environmental impacts caused by the mining operation was mentioned as follows: the details, including descriptions of the methods, locations and frequency of monitoring, will be included in the detailed environmental management plans (EMPs) to be submitted to the PNG government after approval of the EIS.

The environmental permit for the development of the Solwara 1 Project was received on December 29, 2009 from the Department of Environment and Conservation of PNG government for a term of 25 years, expiring in 2035. The mining lease for the development of the Solwara 1 Project was granted on January 17, 2011 from PNG government for a term of 20 years.

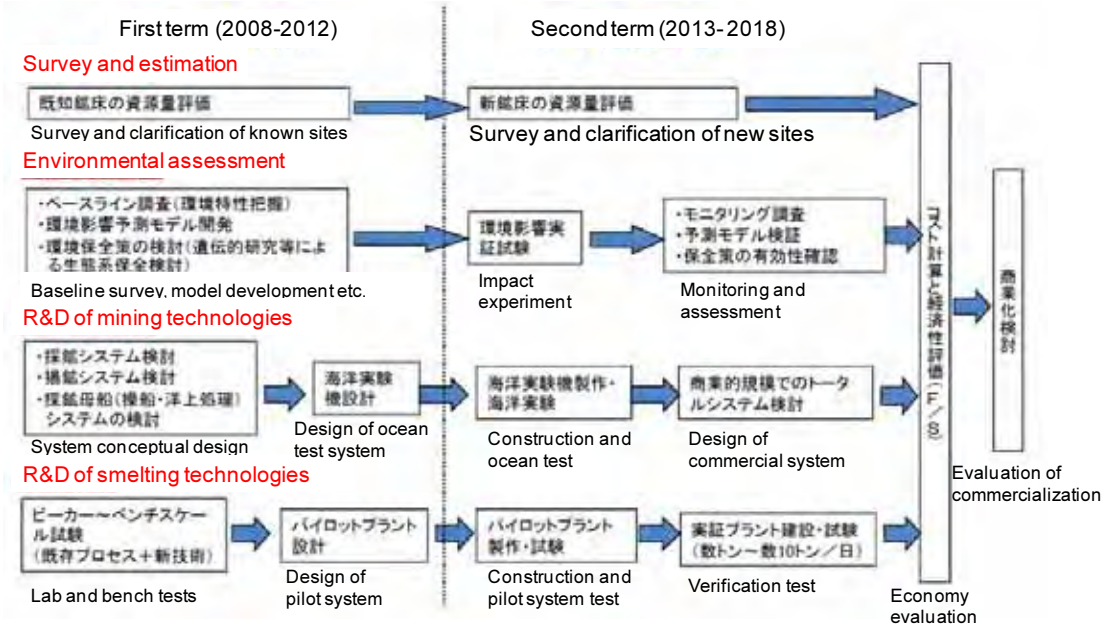


Figure 3 Outline and schedule of Japan's R&D project for SMS (Modified original figure in Japanese.) (Source: http://www.meti.go.jp/committee/materials2/downloadfiles/g81031a05j.pdf)

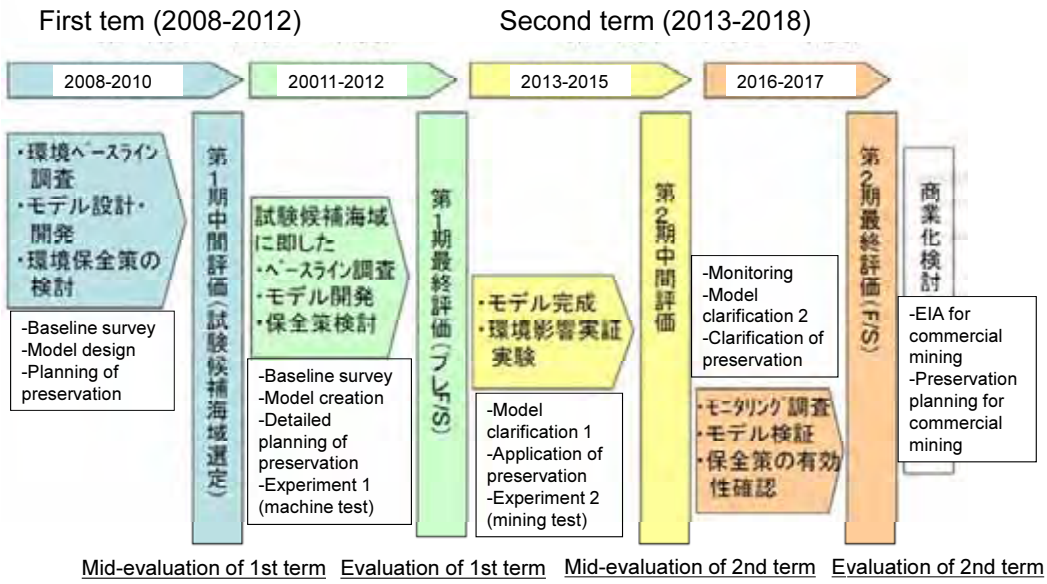


Figure 4 Outline and schedule of Japan's EIA program for SMS (Modified original figure in Japanese.) (Source: http://www.jogmec.go.jp/mric_web/koenkai/100527/briefing_100527_4.pdf)

ENVIRONMENTAL IMPACT ASSESMENT BY JOGMEC

In Japan, the Ministry of Economy, Trade and Industry (METI) commenced a R&D project for SMS in Japan's exclusive economic zone (EEZ) in 2008. The project defines the plan for the commercial development of SMS (http://www.meti.go.jp/committee/materials2/downloadfiles/g81031a05j.pdf). The outline and schedule of the project is introduced in Figure 3. Japan Oil, Gas and Metals National Corporation (JOGMEC) has conducted the research under contract with METI. An environmental impact assessment (EIA) program is included in the project. The outline and schedule of the program is introduced in Figure 4 (http://www.jogmec.go.jp/mric_web/koenkai/100527/briefing_100527_4.pdf).

Through baseline surveys, environmental impact modeling, and conceptual design of conservation and mitigation plans, methodologies of impact experiments and the monitoring will be examined and created. EIA procedures and techniques will be one of the final goals. Some environmental regulations and guidelines will also be the other goals.

The target sites for the EIA program are Izena Calderon in Okinawa Trough area and Beyonnaise Knoll in Izu-Ogasawara Island Arc area as shown in Figure 5. Some of the preliminary results are briefly introduced in the website (http://www.jogmec.go.jp/mric_web/koenkai/100527/briefing_100527_4.pdf) and presented in detail in the publications (Toyohara et al., 2011; Ishida et al., 2011; Miwa et al., 2011; Arai et al., 2011). Genetic approaches to determine biological relationship between mining and preserved area in the program is introduced in Figure 6.

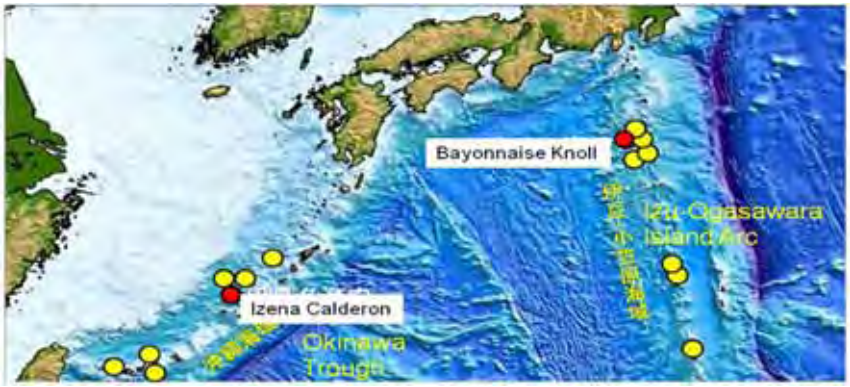


Figure 5 Target sites for Japan's EIA program (Modified original figure in Japanese.)
(Source: http://www.jogmec.go.jp/mric_web/koenkai/100527/briefing_100527_4.pdf)

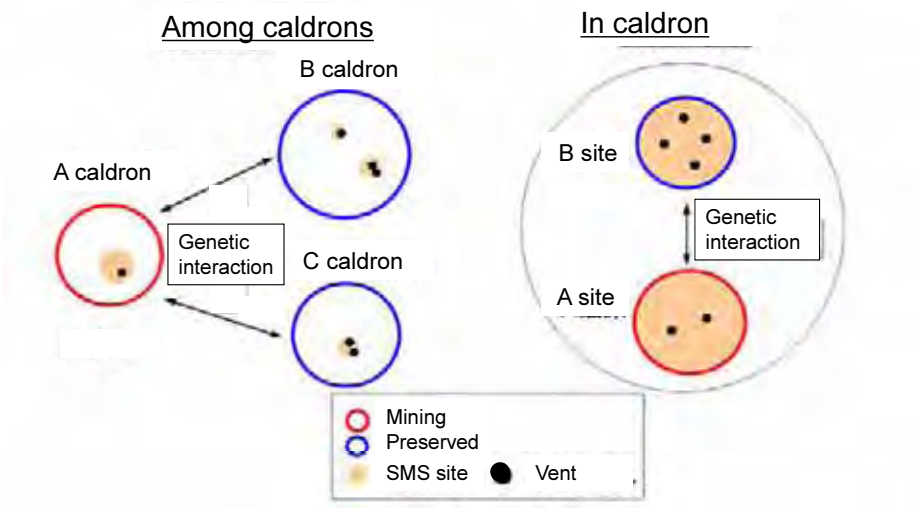


Figure 6 Genetic approaches to determine biological relationship (Modified original figure in Japanese.)
(Source: http://www.jogmec.go.jp/mric_web/koenkai/100527/briefing_100527_4.pdf)

The important specific feature of the Japan's program is the step-by-step EIA process. Although the program

is under progress, the difference with Nautilus Minerals, direct EIA for commercial mining on the basis of physical, chemical, and biological baseline survey data, is remarkable.

The detailed step-by-step EIA process and an image of impact experiment at partially active site are presented in Figures 7 and 8. Because some disturbance such as blanketing and other impacts is expected both active and non-active sites as shown in Figure 2, during the impact experiments, the mining plumes artificially created must leach to active site.

In the first cycle, a preliminary environmental impact assessment (PEIA) for a small scale seafloor miner excavation test in-situ is conduced. Following the machine test, the impact monitoring will be. Then, the first-step evaluation and ecosystem model clarification is scheduled. The same procedure will be in the second cycle for a pilot-scale whole system test including lift subsystem. After the second-step evaluation and ecosystem model clarification, an effective EIA method will be established for a commercial scale SMS mining.

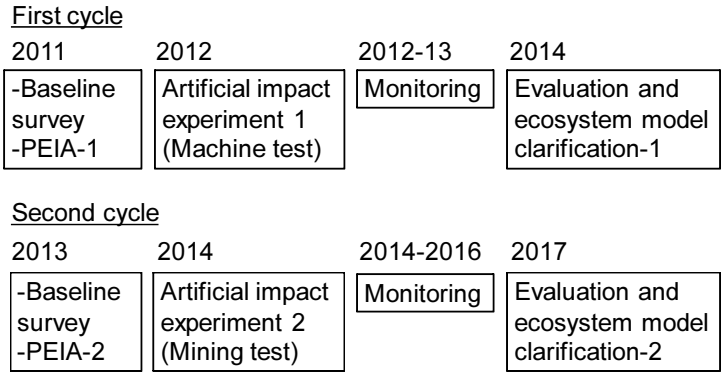


Figure 7 Detailed step-by-step EIA process in Japan's EIA program

Figure 8 Image of impact experiment at partially active site

The step-by-step process is important for the EIA for the commercial scale mining, because almost nothing about the seafloor ecosystem itself and the reaction against the mining impacts is recognized. The methodologies of longer and larger scaled-up EIA from the PEIAs must be clarified, too. Monitoring methodologies and procedures of artificial impact experiments are designed in the program and applied in both the cycles.

PROPOSAL OF INTERNATIONAL COLLABORATION

Fortunately, we have time to prepare the environmental guidelines and the EIA methodologies and techniques for SMS mining, because the economic crisis in 2008 has postponed the coming commercial mining (http://www.nautilusminerals.com). It is the timing to start an international collaboration that creates effective control and regulation methods of SMS mining for the environmental protection and preservation.
The author presents the following two proposals:
- To join and collaborate with the Japan's environmental program; and
- To initiate a collaboration program in the PNG commercial mining project.

If the system construction is re-started early in 2011, the mining operation will come at the end of 2013. An example time schedule is introduced in Figure 9.

Figure 9 Example international collaboration schedule for PNG commercial mining

CONCLUDING REMARKS

Japan learned many from the multi-disciplinary environmental studies in an ocean floor at 5,300 m deep (Yamazaki and Kajitani, 1999) and on a seamount at 2,200 m deep (Ohkubo and Yamazaki, 2003). Three important points are as follows:

- Careful and sufficient baseline data accumulation is necessary;
- Ecosystem model is effective; and
- Impact experiment and the monitoring are necessary.

Japan needs to chase the possibilities of SMS mining because of lack of on-land mineral resources for the industrial demands. Therefore, on the basis of collaboration with the Pacific countries and others, Japan should take a leadership for creating the effective EIA methodologies and procedures.

The production scale consideration for maximizing the economy and for minimizing the environmental impacts must be conducted. The acceptable zone of mining development is becoming smaller and smaller recently because of the increasing world environmental concern.

REFERENCES

Arai, R. et al., (2011). Fluctuation of High-turbidity Water Measured by Acoustic Doppler Current Profiler at the Izena Hole in the Okinawa Trough, Proc. 30th Int. Conf. Ocean, Offshore and Arctic Eng., Paper No. OMAE2011-49984.

Bath, A.R. (1989). Deep Sea Mining Technology: Recent Developments and Future Projects, Proc. 21st Offshore Tech. Conf., Paper No. 5998.

Bendel, V. et al. (1993). The White Lady Hydrothermal Field, North Fiji Back-arc Basin, Southwest Pacific, Economic Geology, Vol. 88, pp. 2237-2249.

Clark, A. et al. (1984). Assessment of Cobalt-rich Manganese Crusts in the Hawaiian, Johnston and Palmyra Islands' Exclusive Economic Zones, Natural Resources Forum, New York, UN, Vol. 8, No. 2, pp. 163-174.

Fenchel, T., and Bernard, C. (1995). Mats of colourless sulphur bacteria. I. Major microbial processes, Marine Ecology Progress Series, Vol. 128, pp. 161-170.

Fouquet, Y. et al. (1991). Hydrothermal activity and metallogenesis in the Lau Back-ark Basin, Nature, Vol. 349, pp. 778-781.

Fukushima, T. (1995). Overview "Japan Deep-sea Impact Experiment = JET", Proc. 1st ISOPE Ocean Mining Symp., Tsukuba, Japan, Int. Soc. Offshore and Polar Eng., pp. 47-53.

Halbach, P. (1982). Co-rich Ferromanganese Seamount Deposits of the Central Pacific Basin, in Halbach, P., and Winter, P., eds, Marine Mineral Deposits--New Research Results and Economic Prospects, Marine Rohstoffe und Meerestechnik, Bd. 6, Verlag Gluckkauf, Essen, pp. 60-85.

Halkyard, J.E. (1985). "Technology for Mining Cobalt Rich Manganese Crusts from Seamounts," Proc OCEANS'85, Vol 1, pp 352-374.

Hawaii Department of Planning and Economic Development (1987). Mining Development Scenario for Cobalt-Rich Manganese Crusts in the EEZ of the Hawaiian Archipelago and Johnston Island, State of Hawaii, 326p.

Latimer, J.P., and Kaufman, R. (1985). Preliminary Considerations for the Design of Cobalt Crusts Mining System in the U.S. EEZ, Proc. OCEANS'85, Vol. 1, pp. 378-399.

Halbach, P., et al. (1989). Probable modern analogue of Kuroko-type massive sulfide deposit in the Okinawa Trough back-arc basin, Nature, Vol. 338, pp. 496-499.

Haymon R.M., and Kastner, M. (1981). Hot spring deposits on the East Pacific Rise at 21°N: Preliminary description of mineralogy and genesis, Earth and Planet. Sci. Lett., Vol. 53, pp. 363-381.

Hekinian, R. et al. (1983). East Pacific Rise near 13°N: Geology of new hydrothermal field, Science, Vol. 219, pp. 1321-1324.

Hekinian, R., and Bideau, D. (1985). Volcanism and mineralization of the oceanic crust on the East Pacific Rise, Metallogeny of Basic and Ultrabasic Rocks, Inst. Min. Metall. London. Publ., pp. 1-20.
Herrouin, G. et al. (1989). A Manganese Nodule Industrial Venture Would Be Profitable - Summary of a 4-Year Study in France," Proc 21st Offshore Tech Conf, Paper No 5997.
Hessler, R.R., and Kaharl, V.A. (1995). The Deep-sea Hydrothermal Vent Communities: An Overview, in Seafloor Hydrothermal Systems: Physical, Chemical, Biological and Geological Interactions, Geophysical Monograph, Vol. 91 (ed. Humphris, S.E. et al.), pp. 72-84. Washington DC, American Geophysical Union.
Iizasa, K. et al. (1999). A Kuroko-type polymetallic sulfide deposit in a submarine silicic caldera, Science, Vol. 283, pp. 975-977.
Ishida, H. et al. (2011). Characteristics of the Environment around a Massive Sea-floor Sulfide Area in the Okinawa Trough, Proc. 30th Int. Conf. Ocean, Offshore and Arctic Eng., Paper No. OMAE2011-49987.
Kaufman, R. et al. (1985). The Design and Operation of a Pacific Ocean Deep-Ocean Mining Test Ship: R/V Deepsea Miner II, Proc. 17th Offshore Tech. Conf., Paper No. 4901.
Karl, D.M. (1995). Ecology of Free-Living, Hydrothermal Vent Microbial Communities, The Microbiology of Deep-Sea Hydrothermal Vents (ed. Karl, D.M.), CRC Press, Boca Raton, pp. 35-124.
Kia, P., and Lasark, J. (1999). Overview of Papua New Guinea offshore resources, Workshop Rep. Offshore Mineral Policy Workshop, Madang, PNG, SOPAC Miscellaneous Rep. 323, pp. 39-46.
Lenoble, J.-P. (2000). A comparison of possible economic returns from mining deep-sea polymetallic nodules, polymetallic massive sulphides and cobalt-rich ferromanganese crusts, Proc. Workshop on Mineral Resources of the International Seabed Area, Kingston, Jamaica, Int. Seabed Authority, Lenoble 1-22.
Little, C.T.S., and Vrijenhoek, R.C. (2003). Are Hydrothermal vent animals living fossils?, TRENDS in Ecology and Evolution, Vol. 18, pp. 582-588.
Malahoff, A. (1981). Comparison between Galapagos and Gorda Spreading Centers, Proc. 13th Offshore Tech. Conf., Paper No. 4129.
Malnic, J. (2001). Terrestrial Mines in the Sea; Industry, Research and Government, Proc. Proposed Technologies for Mining Deep-Seabed Polymetallic Nodules, Kingston, Jamaica, Int. Seabed Authority, pp. 315-331.
Manheim, F.T. (1986). Marine Cobalt Resources, Science, Vol. 232, pp. 600-608.
Mero, J.L. (1965). The Mineral Resources of the Sea, Elsevier Oceanography Series, 312p.
Micheli, F. et al. (2002). Predation structures communities at deep-sea hydrothermal vents," Ecological Monographs, Vol. 72, pp. 365-382.
Miwa et al. (2011). Conservation Strategy of Biodiversity for Hydrothermal Vent in relation to the Seafloor Massive Sulfide (SMS) Mining, Proc. 30th Int. Conf. Ocean, Offshore and Arctic Eng., Paper No. OMAE2011-49984.
Ohkubo, S., and Yamazaki, T. (2003). Summary of "Environmental Impact Research on Marine Ecosystem for Deep-sea Mining" Conducted by Metal Mining Agency of Japan, Proc. 5th ISOPE Ocean Mining Symp., Tsukuba, pp. 200-207.
Pichocki, C., and Hoffert, M. (1987). Characteristics of Co-Rich Ferromanganese Nodules and Crusts Sampled in French Polynesia, Marine Geol., Vol. 77, pp. 109-119.
Rona, P.A. et al. (1984). Hydrothermal activity at the TAG Hydrothermal Field, Mid-Atlantic Ridge crest at 26°N, J. Geophys. Res., Vol. 89, pp. 365-377.
Rona, P.A. (1985). Hydrothermal mineralization at slow-spreading centers: Red Sea, Atlantic Ocean, and Indian Ocean, Marine Mining, Vol. 5, pp.117-145.
Shirayama, Y., and Fukushima, T. (1997a). Benthic Organism Distribution in the Japanese Deep Sea Mining Claim Area, Proc. Int. Symp. Environmental Studies for Deep-sea Mining, Tokyo, Metal Mining Agency of Japan, pp. 311-316.
Shirayama, Y., and Fukushima, T. (1997b). Responses of a Meiobenthos Community to Rapid Resedimentation, Proc. Int. Symp. Environmental Studies for Deep-sea Mining, Tokyo, Metal Mining Agency of Japan, pp. 187-196.
Shirayama, Y. (1999). Biological Results of JET Project: An Overview, Proc. 3rd ISOPE Ocean Mining Symp., Goa, pp. 185-190.
Toyohara, T. et al., (2011). Environmental Researches within Japan's approach for Seafloor Massive Sulfide (SMS) Mining, Proc. 30th Int. Conf. Ocean, Offshore and Arctic Eng., Paper No. OMAE2011-49906.
Van Dover, C.L. (2000). The Ecology of Deep-Sea Hydrothermal Vents, Princeton Univ. Press, Princeton, 424p.
Welling, C.G. (1981). An Advanced Design Deep Sea Mining System," Proc. 13th Offshore Tech. Conf., Paper No. 4094.

Yamazaki, T. (2007). Economic Validation Analyses of Japan's Proposed Nodule, Crust, and Kuroko-type SMS Mining in 2006, Proc. Oceans 2007, Vancouver.
Yamazaki, T., and Kajitani, Y. (1999). Deep-sea Environment and Impact Experiment to It, Proc. 9th Int. Offshore and Polar Eng. Conf., Brest, pp. 374-381.
Yamazaki, T., and Park, S.H. (2003). Relationship between Geotechnical Engineering Properties and Assay of Seafloor Massive Sulfides, Proc. 13th Int. Offshore and Polar Eng. Conf., Honolulu, pp. 310-316.
Yamazaki, T. et al. (2001). DIETS: A New Benthic Impact Experiments on a Seamount, Proc. 4th ISOPE Ocean Mining Symp., Szczecin, pp. 69-76.
Yamazaki, T. et al., (2003). A Case Study of Mining Seafloor Massive Sulfides in Japanese EEZ, Proc. 5th ISOPE Ocean Mining Symp., Tsukuba, pp. 63-70.
Yamazaki, T. et al. (2010). A Systematic Approach for Quantitative Environmental Assessment of Seafloor Massive Sulfide Mining, Proc. 29th Int. Conf. Offshore Mechanics and Arctic Eng., Paper No. OMAE2010-20248.

SUSTAINABLE MANAGEMENT OF DEEP SEA MINING IN THE PACIFIC REGION: IS THIS AN OXYMORON?- A LAWYERS VIEWPOINT

Dr David Leary*

Abstract

In 2008 Nauru sponsored an application to the International Seabed Authority by Nauru Ocean Resources Inc (NORI) for a plan of work to explore for polymetallic nodules under the 'parallel system' in the ocean floor beyond national jurisdiction known under the 1982 United Nations Convention on the Law of the Sea ('UNCLOS') as the 'Area'. This application lead in turn to a request from the ISA to the International Tribunal for the Law of the Sea (ITLOS) for an advisory opinion under Article 191 of UNCLOS to clarify the legal responsibilities and obligations of states sponsoring mining in the Area, the extent of their liability, and the nature of measures they must take to fulfil their obligations as a sponsoring state under the 'parallel system'. The international law issues which ITLOS has been asked to advise on are complex and may have potentially wide reaching implications for the future implementation of Part XI of UNCLOS. It is too early to speculate what position ITLOS will take on these issues. However, through an analysis of submissions in the ITLOS proceedings this paper argues that there are clearly significant differences of opinion between States, industry and civil society as to what constitutes sustainable mining practices in the deep sea as well as the nature and extent of obligations of states involved in such activities. Do these differences of opinion mean that ultimately pacific island states will not be able to participate in mining in the Area in the "parallel system" under Part XI? What implications does this case hold for domestic regulation of mining within areas of national jurisdiction in the pacific region?

Introduction

There is growing commercial interest in mining for minerals in the deep sea both within and beyond areas of national jurisdiction in the Pacific region. More than 158,000 km^2 of deep sea mining tenements have been granted and a further 366,000 km^2 of tenements are under application in the territorial sea and Exclusive Economic Zones (EEZs) of Papua New Guinea (PNG), Tonga, Solomon Islands, Fiji and New Zealand.[1] While mining for deep sea minerals within areas of national jurisdiction (especially within the territorial waters of PNG) appears to be imminent, there is also growing interest in mining operations in areas beyond national jurisdiction. These sites fall within the mandate of the International Seabed Authority ('ISA') over the so called 'Area' to which Part XI of the 1982 United Nations Convention on the Law of the Sea ('UNCLOS') applies. Under Article 136 of UNCLOS the seabed and subsoil of the ocean (the 'Area'), and its mineral resources are declared the common heritage of mankind [sic]. Under Article 137 of UNCLOS all claims or exercise of sovereignty or sovereign rights over any part of the Area or its resources are prohibited. All rights in the mineral resources of the Area are vested in mankind [sic] as a whole on whose behalf the ISA manages these mineral resources.[2] Article 157(1) provides that the ISA is the organization through which State Parties shall "organize and control activities in the Area, particularly with a view to administering the [mineral] resources of the Area".

The mineral 'resources' to which the ISA's mandate applies includes "all solid, liquid or gaseous mineral resources in situ in the Area at or beneath the seabed, including polymetallic nodules".[3] UNCLOS explicitly recognises the rights, inter alia of State Parties, state enterprises or natural or

* Senior Research Fellow, Faculty of Law, University of New South Wales, Sydney, Australia. Email: dleary@unsw.edu.au

1 Nautilus Minerals, 'Tenements' available at http://www.nautilusminerals.com/s/Tenements.asp

2 Article 138 provides that the general conduct of all States in relation to the Area must be in accordance with the provisions of Part XI, 'the principles embodied in the Charter of the United Nations and other rules of international law in the interests of maintaining peace and security and promoting international co-operation and mutual understanding'. Article 140 also requires that such activities be carried out for the 'benefit of mankind [sic]', and Article 141 requires the Area to be used exclusively for peaceful purposes.

3 UNCLOS, article 133 (a).

juridical persons which possess the nationality of State Parties to UNCLOS or which are effectively controlled by them or their nationals when sponsored by such states, to take part in exploration for and exploitation of the mineral resources of the Area.[4] Any of these entities may apply to the ISA for approval of plans of work for exploration in the Area.[5]

A central component of this mining regime is the so called 'parallel system' where entities that propose to explore and subsequently mine must set aside part of the site proposed (so called 'reserved areas') for future exploration by the Enterprise (the organ of the ISA that will carry out mining) or in association with developing states.[6]

Some pacific island countries, including Nauru and Tonga are keen to participate in mining in the Area under the 'parallel system' by sponsoring other juridical persons to carry out exploration and mining for minerals in the Area on their behalf. On 31st March 2008 two companies, Nauru Ocean Resources Incorporated (NORI) sponsored by Nauru, and Tonga Offshore Mining Ltd (TOM), sponsored by Tonga, formally notified the Secretary-General of their intention to submit applications for approval of plans of work for exploration.[7] Both applications related to plans for work for 'reserved areas' under the 'parallel system'. Both of these companies were subsidiaries of Nautilus Minerals Incorporated which is also involved in mining for deep sea minerals in PNG's territorial waters.

On 10 April 2008 the Enterprise declared it did not intend to carry out activities in the area the subject of these applications, and the two applications were subsequently referred by the Secretariat of the ISA to its Legal and Technical Commission for consideration.[8] In the course of consideration of these applications by the Legal and Technical Commission differences of opinion emerged regarding responsibility and liability of sponsoring States under UNCLOS. In a short paper such as this it is not possible to give a detailed account of these differences of opinion. But for present purposes it is worth noting that these differences of opinion lead Nauru to submit a proposal on 5 May 2010 that the Council of the ISA seek an advisory opinion from the International Tribunal on the Law of the Sea (ITLOS) on certain matters regarding sponsoring State responsibility and liability.[9] It should also be noted that it is no longer clear whether the application supported by Tonga will proceed and as such subsequent discussions at the ISA and before ITLOS were confined to consideration of the application sponsored by Nauru.

After extensive debate the ISA Council ultimately decided not to adopt the proposal as formulated by Nauru which contained many complexes, lengthy and specific questions. Instead the Council adopted a decision on 6 May 2010 requesting ITLOS to provide an advisory opinion on three abstract but concise questions.[10] This paper considers the questions that have been posed for ITLOS. Through an analysis of submissions in the ITLOS proceedings it will be argued that there are clearly significant differences of opinion between States, industry and civil society as to what constitutes sustainable mining practices in the deep sea as well as the nature and extent of obligations of states involved in such activities.

NORIs application and the request for an Advisory opinion from ITLOS

The NORI application sponsored by Nauru relates to some 74,830 square kilometres of the Clarion-Clipperton Fracture Zone in the Pacific Ocean. An area far larger than the State of Nauru. Nauru is one of the smallest independent sovereign nation states on earth. Its total land mass covers only 21

4 UNCLOS, article 153(2).

5 UNCLOS, annex III, Article 3.

6 UNCLOS, annex III, Article 8.

7 International Tribunal for the Law of the Sea, *Request for Advisory Opinion Submitted to the Disputes Chamber, Verbatim Record,* Submission by Counsel for the International Seabed Authority, M.Lodge, page 7, paras 31-34

8 Ibid, pages 8-9.

9 Ibid, page 10.

10 Ibid.

square kilometres and as at July 2010 its total population was estimated at 9,267 people.[11] It does not have the technical expertise or capacity nor the financial resources to carry out mining in the Area by itself. What little resources Nauru has have now all but been exploited, its future economic prospects look bleak and the government of Nauru teeters on the brink of economic collapse.[12] It clearly does not have the financial resources to manage the potential legal risks associated with mining in the Area and the only way it can possibly participate in such mining is by engaging private companies to assume risk and responsibilities of such ventures. The nature and extent of those risks and responsibilities will determine whether the plan of work proceeds. If the risks and responsibilities imposed on Nauru are to onerous it will not be in a position to proceed with its sponsorship and likewise NORI would not be willing to proceed the proposal if it views its potential obligations and liabilities as to onerous. The advisory opinion that ITLOS has been asked to provide lies at the centre of this balancing act between the rights and aspirations of a small island developing state and a subsidiary of a large multinational mining company.

UNCLOS established a specific specialised seabed disputes chamber of ITLOS to deal with cases relating to Part XI of UNCLOS and matters within the mandate of the ISA.[13] By virtue of article 191 of UNCLOS the Sea-Bed Disputes Chamber is required to give an advisory opinion at the request of the Assembly or the Council of the ISA on legal questions arising within the scope of their activities. These opinions shall be given as a matter of urgency.[14] Significantly the request from the ISA is the first time an advisory opinion has been requested from ITLOS and is also the first case to come before the Sea-Bed Disputes Chamber. It was also the first time ITLOS streamed its proceedings live over the internet

The request from the ISA asked ITLOS to render an advisory opinion on three questions:

> "1. What are the legal responsibilities and obligations of State Parties to the [UNCLOS] Convention with respect to the sponsorship of activities in the Area in accordance with the Convention, in particular Part XI, and the 1994 Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982?
>
> 2. What is the extent of liability of a State Party for any failure to comply with the provisions of the Convention, in particular Part XI, and the 1994 Agreement, by an entity whom it has sponsored under Article 153, paragraph 2(b), of the Convention?
>
> 3. What are the necessary and appropriate measures that a sponsoring State must take in order to fulfil its responsibility under the Convention, in particular Article 139 and Annex III, and the 1994 Agreement?"[15]

By order on 18 May 2010 ITLOS set 9 August 2010 as the date for submission of written statements by State parties to UNCLOS, the ISA and intergovernmental organisations that are accredited as observers to the ISA who wished to make submissions in the case. Written submissions were received from 12 states (United Kingdom, Nauru, the Republic of Korea, Romania, the Netherlands, Russia, Mexico, Germany, China, Australia, Chile and the Philippines) and 3 intergovernmental organisations (the ISA, Interoceanmetal Joint Organization, and UNEP). In addition a written submission was received from the International Union for Conservation of Nature (IUCN), and a joint submission was received from the Stichting Greenpeace Council (Greenpeace International) and the World Wide Fund for Nature (officially not part of the case file).[16] In addition to these written submission oral submissions were made before the tribunal when it heard the case on 14-16 September 2010.

---

11 Central Intelligence Agency, *The World Factbook-Nauru*, < https://www.cia.gov/library/publications/the-world-factbook/geos/nr.html#>

12 Ibid.

13 UNCLOS, Annex VI, article 14 and UNCLOS article 187.

14 UNCLOS, article 191.

15 International Seabed Authority, Request for Advisory Opinion to the International Seabed Authority, 11 May 2010 available at < http://www.itlos.org/start2_en.html>

16 All of the submissions can be accessed on the ITLOS web site at < http://www.itlos.org/start2_en.html>

Delegations making oral submissions were: the ISA; Germany; the Netherlands; Argentina; Chile; Fiji; Mexico; Nauru; United Kingdom; Russia; IOC/UNESCO and the IUCN. The following discussion outlines some of the key points made in these submissions.

Submissions by the International Seabed Authority

Submissions by the ISA, although general in nature, did touch upon some of the core issues of controversy in the case. Given the divergent views of members of the ISA it was somewhat surprising that the ISA did seek to address some of the more controversial issues in its submissions. It is hard to see how the ISA could have any view at all in this case given these differences of opinion. In theory the ISA can only express the consensus view of its members and given no consensus could be reached it is difficult to see the legal basis on which the ISA was entitled to make these submissions.

Nonetheless the ISA began its submissions by noting that the questions presented for the tribunals consideration in the case were "framed in an "abstract manner" without referring to any particular situation or application for plan of work".[17] As the ISA submissions highlighted the advisory opinion to be rendered by ITLOS will therefore be relevant to all future plans for exploration for deep sea minerals and in theory will guide the ISA in its work for many years to come. The ISA also submitted that in providing its advisory opinion ITLOS should focus purely on the obligations of "sponsoring states [i.e. those sponsoring a plan of work] rather than State parties to the Convention".[18]

The applicability of the principle of common and differentiated responsibility lies at the heart of all three questions ITLOS has been asked to provide an advisory opinion on. As Sands has noted:

> "The principle of common but differentiated responsibility has developed from the application of equity in general international law, and the recognition that the special needs of developing countries must be taken into account in the development, application and interpretation of rules of international environmental law...[As articulated in Principle 7 of the Rio Declaration]...[t]principle of common but differentiated responsibility includes two elements. The first concerns the common responsibility of states for the protection of the environment, or parts of it, at the national, regional and global levels. The second concerns the need to take account of differing circumstances, particularly in relation to each state's contribution to the creation of a particular environmental problem and its ability to prevent, reduce and control the threat. In practical terms, the application of the principle of common but differentiated responsibility has at least two consequences. First, it entitles, or may require, all concerned states to participate in international response measures aimed at addressing environmental problems. Secondly, it leads to environmental standards which impose differing obligations on states."[19]

In his oral submissions before the Tribunal counsel for the ISA Mr Michael Lodge argued that there was nothing to "suggest that obligations of sponsoring states vary in any way depending on their level of development".[20] The ISA therefore seems to have argued that the principle of common but differentiated responsibility has no application when considering the responsibilities and obligations of sponsoring states.

The ISA's submissions also addressed what 'necessary and appropriate' measures a sponsoring state must adopt to ensure compliance by the sponsored entity with Part XI, and relevant rules and regulations that might be adopted by the ISA in accordance with its mandate. It submitted that failure to take any measures would constitute a failure by States to fulfil their obligations under Part XI of UNCLOS.[21] But as the ISA observed there are divergent views on what constitutes 'necessary and appropriate measures'; some states have submitted that adopting legislation to give effect to such obligations is sufficient while others such as Nauru had argued that a mere contractual arrangement

---

17 Above, n7, page 12, line 11.

18 Above n7, page 12, line 19.

19 Philippe Sands, *Principles of International Environmental Law*, (2005), 286.

20 Above n 7, page 12, line 19.

21 Above n 7, page 16., line 3.

was all that was necessary. The ISA argued that a contractual obligation would not suffice instead arguing that "articles 139(2), article 153 and article 4(4) of Annex III [to UNCLOS] require States Parties to enact legislation and adopt measures within its public legal framework".[22] As counsel for the ISA observed

> "The objective of adopting legislation and enacting measures is to assist the Authority to secure the sponsored natural or legal persons carry out activities in the Area with compliance with Part XI of the Convention, with the [Part XI] Agreement, with the Regulations of the Authority and with the approved plan of work. Accordingly "necessary and appropriate" measures are those that transpose in domestic public legal systems the international duties and obligations of the sponsoring State...".[23]

However, the ISA also submitted the content of those measures is very much left to the discretion of each individual state.[24]

Submissions by Nauru

Nauru took a very different approach to the key issues in its submissions. The substance of those submissions will be addressed below. But it is worth noting that in its submissions Nauru used very emotive language suggesting that failure by ITLOS to accept its submissions would have disastrous consequences for its people and the peoples of developing countries around the world. The most notable of these comments was when counsel for Nauru stated

> "Depending upon whether the interpretation encourages commercial development of seafloor resources, or discourages it, will mean the difference between the life and death for 27 million people moving forward".[25]

This statement was nothing more than pure rhetoric and not supported by any evidence in the case. An outrageous unsubstantiated allegation. In a further provocative statement Counsel for Nauru also submitted

> "by not encouraging seafloor mining, you are effectively encouraging further terrestrial environmental degradation".[26]

Again this assertion was offered without any scientific evidence to back such and assertion.

Nauru argued for as narrow an interpretation of sponsoring states obligations as possible. Their submission were largely devoid of any reliance on principles or concepts of either international law or environmental law. Instead they argued that ITLOS should "interpret the rules and regulations in such a way as to encourage private sector investment"[27] In fact Nauru's submissions on one interpretation go as far as suggesting that neither the sponsoring state or the sponsored entity should have any liability in the event of environmental harm,; that there should be no residual liability. For example they suggested that the flag states of vessels involved in mining should not be liable for any environmental harm that may arise in the course of mining, and that the sponsoring state and the sponsored entity should not be liable for any environmental harm that should arise in the course of mining.

Nauru's willingness to argue for such an interpretation of course no doubt stems from the perceived benefits it as a small impoverished island nation might receive from its participation in such a venture. As Nauru noted in its oral submissions to ITLOS

---

22 International Tribunal for the Law of the Sea, *Request for Advisory Opinion Submitted to the Disputes Chamber, Verbatim Record,* Submission by Counsel for the International Seabed Authority, Le Gurun, page 24, line 3.

23 Above n 22, page 24, line 11.

24 Above n 22, page 25, line 1.

25 International Tribunal for the Law of the Sea, *Request for Advisory Opinion Submitted to the Disputes Chamber, Verbatim Record,* 16 September 2010, Submission by Counsel for Nauru Jacob, page 7, line 19.

26 Above, n 25, page 7, line 19.

27 Above, n 25, page 11, line 15.

> "Nauru relies on foreign aid and support as well as imported food. Importantly Nauru's land resources have been significantly depleted due to overharvesting of its phosphate deposits by other countries. This mining by foreign countries in the 1900s has since caused our island to be 80 per cent uninhabitable. Indeed, 80 per cent of our country is now virtually a moonscape, and this has in turn significantly impaired Nauru' opportunities to develop industries and grow its own food. Moreover, it has had significant ramifications for the habitation of indigenous Nauruans. This partnership to explore for minerals in the Area therefore allows us to benefit from resource development without our country being further raped of what few resources we have left. In effect, this provides us with a second chance and a chance for the mining industry to give back to a country ravaged by past excavation"[28]

It is not clear on the face of the transcript of the case though whether in fact Nauru will actually benefit on a significant scale from the plan of work it seeks to sponsor. The major benefits Nauru might receive will come from NORI's commitment to fund clean drinking water and sanitation projects. While these may bring benefits for a developing country like Nauru there is little evidence to suggest Nauru will receive any significant benefits beyond that. Likewise NORIs promise to contribute funds to help with the cleaning up of the Great Pacific Garbage Patch and donations to the ISA endowment fund appear little more than the usual 'greenwash' that has become all to familiar modus operandi of mining companies in the pacific region.

Submissions by Germany

Germany's submissions addressed a number of key points. Firstly their submissions addressed the paramount importance of the protection of the environment. On the question of the question of the liability of sponsoring states they argued for the absence of subsidiary or secondary liability for the sponsoring state noting in particular that

> "A State Party which has taken the necessary legislation and administrative measures to meet the obligations under the Convention cannot be held responsible for any breach of the provisions of Part XI by a contractor. The acts of a contractor are not as such attributable to the sponsoring state. Germany takes the view that Part XI gives primary responsibility to the contractor. The sponsoring state is liable for failure to secure compliance by the contractor whom it sponsors, and thus for supervisory fault and nothing else. The obligations of the sponsoring state are obligations of conduct, not of result. Accordingly, there is no subsidiary or secondary responsibility on the part of the sponsoring State".[29]

Germany also took issue with claims the principle of common but differentiated responsibility applied as had been suggested by Nauru. As Counsel for Germany submitted

> "Germany is of the opinion that the same standards must apply to all States as regards the adoption of laws and regulations and their implementation and enforcement. A differentiated regime with different standards of due diligence applicable to State Parties cannot be accepted. This is what the carefully balanced rules of the Convention that reflect the fundamental need to protect the Area as the common heritage of mankind provide for. If it were otherwise, we would encourage a system of "eco-tourism" or "sponsor shopping". In such a system, contractors-often subsidiaries of powerful mining companies from industrialised countries- could seek the sponsorship of States with lower due diligence standards in order to avoid stricter standards and control. In our view, such a development should definitely be prevented. It would be detrimental to the Area and in the end harmful to all States, whether industrialised or developing countries".[30]

Although not explicitly stated by Germany it is arguable that NORI in this case has in fact gone 'sponsor shopping' and sought a country willing to apply lower due diligence standards in exchange for a desperately needed source of income. Although no country (Germany included) would be so undiplomatic as to say so openly.

---

28 Above, n 25, page 14, line 11.

29 International Tribunal for the Law of the Sea, *Request for Advisory Opinion Submitted to the Disputes Chamber, Verbatim Record,* 15 September 2010, Submission by Counsel for Germany, Wasum-Rainer, page 3, line 31.

30 Above n 29, page 4, line 32.

Submissions by the Netherlands

The Netherlands argued along much similar lines but rather than referring to 'sponsor shopping' it referred instead to what it called 'jurisdictions of convenience' or sponsoring states "through which access could be obtained to the mineral resources of the Area without the acceptance of international obligations to secure that the relevant provisions of the Convention and the Area will be complied with".[31]

On the question of the nature of the legal responsibility and obligations of a sponsoring state the Netherlands agreed with Germany that the obligation was merely to implement necessary legislative and administrative measures. That obligation it characterised only as an obligation of due diligence. Thus as the Netherlands submitted

> "a sponsoring State is not liable for damage caused by a failure of an entity sponsored by it to comply with its obligations if that State has taken all necessary and appropriate measures to secure effective compliance...requires the sponsoring State to adopt laws and regulations and to take administrative measures within the framework of its legal system that are reasonably appropriate for securing compliance by persons under its jurisdiction. It appears from these provisions that the sponsoring State responsibility to ensure that an entity sponsored by it complies with its obligations is not absolute, but depends on the efforts that the sponsoring State has made to discharge itself of that responsibility. It is a due diligence obligation."[32]

However, the Netherlands argued that the obligation was not just one of ensuring implementation of necessary laws but rather a due diligence obligation also requires States to supervise and enforce compliance with such measures.[33] Having said this though the Netherlands did not argue that supervision and enforcement of such measures need to result in the desired environmental outcome. Thus

> "The ultimate objective of such an obligation may be to achieve a certain result, for example, the prevention of damage, but the obligation itself is oriented towards the action to be taken, that is the adoption of measures. It is an obligation of conduct".[34]

As a consequence the Netherlands, also argued the liability of a State only arises if environmental damage is caused by the failure of the State to adopt, implement, supervise and enforce measures to secure compliance with the convention and the Part XI Agreement by sponsored entities. But this does not automatically mean liability arises in the event of environmental harm being caused by the sponsored entity.[35]

Submissions by Argentina

Argentina is a developing country but it also disagreed with Nauru on the relevance of the principle of common but differentiated responsibility. In its submissions Argentina stated

> "Nowhere does the Convention differentiate between the 'obligations' of developing States and of other States regarding sponsorship. Argentina, being itself a developing country, does not decline its responsibility in the event of failing to ensure compliance regarding activities in the Area, having accepted in good faith its obligations under the Convention. Because the obligation of the sponsoring

---

31 International Tribunal for the Law of the Sea, *Request for Advisory Opinion Submitted to the Disputes Chamber, Verbatim Record,* 15 September 2010, Submission by Counsel for the Netherlands, Linzaad, page 7, line 8.

32 Above n 31, page 8, line 20.

33 Above n 31, page 8, line 32.

34 Above n 31, page 9, line 9.

35 Above n 31 page 9, line 19.

> State is one of 'due diligence', the burden appears to be equally onerous on developed and developing States".[36]

Like other states Argentina also characterised the obligation as one of due diligence. In addition though Argentina stressed the need for an 'effective link' between the sponsoring state and the sponsoring entity. As counsel for Argentina submitted

> "The ability of the sponsoring State to exert effective control over the sponsored entity is paramount is a lacuna in responsibility and liability for damage caused by operations in the Area is to be avoided. To this end, the existence of an 'effective link' between the sponsoring State and the sponsored entity must be taken into account by the Authority's organs, the Legal and Technical Commission and the Council for that matter when assessing the qualifications of applicants".[37]

In the course of fulfilling its obligations Argentina also stressed the role of environmental impact assessment by the sponsoring state noting

> "special regard must be shown to the obligations imposed by Article 206 and the new international law of the environment, in particular the need to conduct an environmental impact assessment (EIA), and to consult in the course of the EIA any coastal State across whose jurisdiction the resource deposit lies, as well as the affected population as appropriate, notably of the coastal State likely to be affected by activities in the Area".[38]

Finally, Argentina also submitted that in the event of environmental harm "financial compensation including interest should be paid to the Authority, given the legal status of the Area as common heritage of mankind [sic] on whose behalf the ISA acts.[39] But it was not clear from Argentina's submissions whether it was arguing that money should simply go into the revenue accounts of the ISA and be used for its own general purposes, or whether such compensation should be applied to remediating the environmental harm to which it relates.

Submissions by Fiji

Fiji's submission matched those of both Germany and the Netherlands on how a sponsoring state could fulfil its obligations in arguing that there was no residual liability; all that was required was that the sponsoring state enacts appropriate domestic legislation to give effect to those obligations and sees that those laws are enforced. Fiji suggested that perhaps the ISA could have a role to play in developing model legislation in accordance with international standards for states to adopt to give effect to their obligations in relation to sponsored entities.[40] In addition Fiji contended that the sponsoring state should also establish an adequate and compulsory insurance or compensation scheme in relation to potential damage caused by the failure of a sponsored entity to comply with its obligations.[41]

Like many other states, including developing states such as Argentina, Fiji (also a small island developing state) argued against any extension of the principle of common but differentiated responsibility to the sponsoring states regime under Part XI. Specifically Fiji submitted that "the requirements and standards established under Part XI of the Convention apply equally to all States without regard to economic status or financial or other resource capability".[42]

Submissions by Mexico

---

36 International Tribunal for the Law of the Sea, *Request for Advisory Opinion Submitted to the Disputes Chamber, Verbatim Record,* 15 September 2010, Submission by Counsel for Argentina, Cerutti, page 18, line 16.

37 Above n 36, page 21, line 33.

38 Above n 36, page 22, line 32.

39 Above n 36, page 22, line 16.

40 International Tribunal for the Law of the Sea, *Request for Advisory Opinion Submitted to the Disputes Chamber, Verbatim Record,* 15 September 2010, Submission by Counsel for Fiji Tikoisuva, page 39, line 9.

41 Above n 40, page 38, line 15.

42 Above n 40, page 39, line 1.

Mexico put forward by far the most progressive submissions in the case arguably stretching their case beyond the boundaries of existing international environmental law. In particular Mexico argued for a broad and expansive application of the precautionary approach when assessing the scope of the sponsoring states obligations. Thus Mexico submitted

> "the due diligence standard is not merely discharged with the adoption of laws, regulation and administrative measures. In order for the sponsoring State to fulfil its obligations under the Convention, it is necessary that such laws, regulations and administrative measures conform to a high due diligence threshold".[43]

More significantly Mexico argued for a strict liability regime including prompt and adequate compensation as part of necessary and appropriate measures the sponsoring state must enact. In that regard Mexico suggested the work of the International Law Commission in developing Principles on the allocation of loss in the case of transboundary harm arising out of hazardous activities developed under the rubric of the topic International Liability for Injurious Consequences arising out of acts not prohibited by international law, as an appropriate model. This would include a requirement for the sponsored entity to establish and maintain financial security such as insurance, bonds or other financial guarantees as well as the possible establishment of industry level compensation funds at the national level. If those measures are insufficient Mexico argued that States should also ensure additional financial resources are made available.[44]

Submissions by the United Kingdom

The United Kingdom tended to agree with most submissions made by countries such as Germany, Mexico and Australia. However, it did not agree with the strict liability regime suggested by Mexico saying this was a matter of policy for states to decide, not a question of law suitable for an advisory opinion.

In addition the United Kingdom took issue with the extreme hyperbole of some of Nauru's submissions. As the counsel appearing for the United Kingdom noted

> "it is important to recall...that the protection of the environment is at the heart of this case. The representatives of Nauru...painted a very broad, impressionistic picture if the economic, social and environmental considerations facing deep seabed mining in its overall perspective, but we are concerned today with the specific question of the obligations of sponsoring States.
>
> In this regard we must recall that the deep seabed contains many fragile and sensitive ecosystems which once damaged could take years, even decades, to regenerate. It is essential that sponsoring States, and the entities that they sponsor have the necessary measures in place for the purpose of preventing serious harm to the marine environment. To say that...is not to discourage seabed mining. I do not believe it is the intention of anyone taking part in the proceedings to do that. No one is seeking to discourage private-sector investment in deep seabed mining; but a proper balance has to be struck with environmental concerns. Striking that balance is a matter for the Authority and for the States Parties acting through the Authority".[45]

Other submissions

Finally it is worth noting in passing that submissions by the Philippines, China, South Korea and Russian Federation appeared to do no more than re-state (almost verbatim) the exact provisions of UNCLOS without making any meaningful submissions on how those provisions are to be interpreted.

---

43 International Tribunal for the Law of the Sea, *Request for Advisory Opinion Submitted to the Disputes Chamber, Verbatim Record,* 15 September 2010, Submission by Counsel for Mexico, Hernandez, page 51, line 25.

44

45 International Tribunal for the Law of the Sea, *Request for Advisory Opinion Submitted to the Disputes Chamber, Verbatim Record,* 16 September 2010, Submission by Counsel for the United Kingdom, Sir Michael Wood, page 37, line 24.

Submissions by UNESCO, UNEP and by civil society also tended not to go beyond the submissions made by key states noted above.

Concluding thoughts

As at the date of writing this paper the advisory opinion was still pending. So it is not possible to offer any analysis of the tribunal's opinion. Nonetheless given the wide divergence of views expressed by States on the key issues (especially the application of the principle of common but differentiated responsibility) outlined above it is clear there is great uncertainty surrounding what constitutes sustainable mining practices in the deep sea as well as the nature and extent of obligations of states involved in such activities. The advisory opinion to be provided by ITLOS is therefore of great significance in terms of helping to clarify these questions. It is still an open question as to whether these differences of opinion mean that ultimately pacific island states will not be able to participate in mining in the Area in the "parallel system" under Part XI as the risk and liabilities they might assume would be too great for them. Likewise it is also unclear what implications the advisory opinion holds for domestic regulation of mining within areas of national jurisdiction in the pacific region, especially if the ISA is ultimately going to play a role in developing model legislation for countries to adopt. If ITLOS does not provide clear answers to these questions, and instead leaves these questions for the ISA to resolve, then there is likely to be a very lively debate and little clear resolution of the issues at the ISA for many years to come.

References

Central Intelligence Agency, *The World Factbook-Nauru*, < https://www.cia.gov/library/publications/the-world-factbook/geos/nr.html#>

International Tribunal for the Law of the Sea, *Request for Advisory Opinion Submitted to the Disputes Chamber, Verbatim Record, 15 and* 16 September 2010Philippe Sands, *Principles of International Environmental Law*, (2005).

Philippe Sands, *Principles of International Environmental Law*, (2005).

Recent Developments in National Legislation on Islands in Japan

Professor *Emeritus*, Keio University
Special Adviser, OPRF
Tadao KURIBAYASHI

I The Basic Act of Ocean Policy

Japan's land territory is composed of 6,852 islands in total, among which 6,847 islands are called "ritou (remote islands)" except such big islands as Hokkaido, Honshu, Shikoku, Kyushu and Okinawa Main Island.

The subject of "remote islands" was not originally included in the draft Basic Act of Ocean Policy proposed by "the Study Group for the Basic Act of Ocean Policy" (Kaiyo-Kihon-Ho-Kenkyukai) which had a considerable influence upon the adoption of the legislation at the instance of the House members. It is said that the article concerning remote islands was finally inserted in the Act on the strong request of remote island group of Parliament members.

"The Law for Revitalization of Islands (Ritou-Shinko-Ho)" aiming at stabilization of life, improvement of welfare, revitalization of industry, etc. of island people has been the only national legislation on remote islands in Japan since July 22, 1953. The Basic Act on Ocean Policy (Kaiyo-Kihon-Ho) was adopted on April 27, 2007. Article 26 of the Act provides, under the title of "Conservation of the Remote Islands, etc.", that the State, with regard to the remote islands, shall take necessary measures including conserving the seacoasts and others, securing the safety of navigation as well as establishing the facilities for the development and use of ocean resources, conserving natural environment in adjacent sea areas, maintaining infrastructures for the life of inhabitant and executing others, in consideration of such fact that the remote islands bear an important role in conserving our territorial sea and the Exclusive Economic Zone and other areas, and in securing the safety of navigation in the development and use of ocean resources as well as in conservation of the marine environment.

The Basic Act on Ocean Policy thus marks a turning point by treating, for the first time, in its Article 26, problems on islands from the perspective of the basic measures of ocean policy in Japan, upon the recognition that islands play an important role in

the preservation of territorial seas and exclusive economic zones and other areas, in securing maritime transport safety, in the development and use of ocean resources and in the preservation of the maritime environment.

II The Basic Plan on Ocean Policy

"The Basic Plan on Ocean Policy（Kaiyo-Kihon- Keikaku）" of March,2008, explains in detail the relevant provisions on islands in the Basic Act of Ocean Policy. First of all, it states clearly that islands scattered widely within vast jurisdictional marine zones of Japan play a significant role as one of the grounds to establish that zones, as well as in securing maritime transport safety, developing and using maritime resources, and preserving the marine environment and that it is, therefore, important to clarify the position of islands in promoting the government's ocean policy and implement preservation and management thereof in an appropriate manner. At the same time, it states also that aging and population decrease have been advancing on many islands, and it is worried that communities with long histories are declining, and that efforts to be made for developing living environments as measures to revitalize islands (Chapter 2.10).

Then, the Basic Plan on Ocean Policy gives a more detailed account on (1) preservation and management of islands, and (2) revitalization of islands. With respect to (1) preservation and management of islands, it enumerates in particular the following important measures：

(a) Securing maritime transport safety

From the viewpoint of securing maritime transport safety and preventing disasters through ensuring weather forecasts across the nation, navigational aids such as lighthouses and meteorological / oceanographical observation facilities on islands should be improved and managed properly.

Support should be provided for residents' marine salvage activities and a system should be developed to appropriately respond to residents' reports of maritime accidents and crimes.

(b) Supporting development and use of marine resources

Bases for fuel transportation, refueling, and shelter in heavy weather should be developed on islands so that maritime activities concerning the development and use of marine resources and marine surveys and activities for managing various facilities supporting such activities can be carried out safely and seadily in marine zones far from the mainland.

Furthermore, prevention and restoration of the environment and development of fishing grounds should be promoted at marine zones surrounding islands where seaweed beds, tidal flats, and coral reefs still remain in abundance and which serve as precious fishing grounds.

(c) Preserving the natural environment in the surrounding marine zones

Islands which are isolated from other regions by the sea and where unique ecosystems have been nurtured are vulnerable to various human activities and introduction of alien species. From the viewpoint of ensuring biodiversity, monitoring of the natural environment and ecosystems should be continuously conducted so as to conserve and manage these precious ecosystems in a proper manner, and control of invasive alien species and preservation and improvement of habitat environments for seabirds and other organisms should be promoted.

In order to contribute to purifying water and ensuring biodiversity, efforts for managing seaweed beds, tidal flats, and coral reefs made by fishermen and local residents should be promoted so as to improve habitat environments of aquatic plants and animals and restore fishery resources. For preserving distinguished natural scenic sites, underwater beauty, and natural seashores, the natural park system should be utilized properly, and measures should also be promoted to reduce outflow of red clay and nutrient salts from terrestrial areas, remove and transport wastes drifting or washed ashore outside the islands, and improve waste disposal facilities.

(d) Establishing policies concerning preservation and management.

Islands play a significant role as mentioned above. It is necessary to clarify the position of islands including uninhabited islands in promoting the government's ocean policy and establish the "Basic Policy concerning Preservation and Management of Islands for Management of the Sea (provisional title)", which stipulates appropriate management systems, measures and schedules of implementation. In addition, basic information such as location data concerning islands should be prepared and preservation and management of islands should be promoted in accordance with respective regions' economic activities, ecosystems, resources in the surrounding marine zones, and eteorological / oceanographical features, such as through improving coast protection facilities to prevent coastal erosion and taking aerial photos periodically.

With respect to (2) revitalization of islands, the Basic Plan on Ocean Policy proposes various concrete plans. However, mention on them will be omitted here because we are mainly paying attention in this paper to problems in the surrounding marine zones. It is needless to say, of course, that this omission does not underestimate at all the close relationship between problems arising on land and those in the coastal zones and ocean.

III The Basic Guideline on the Preservation and Management of Islands for Ocean Management

The Headquarters for Ocean Policy of the Cabinet adopted "the Basic Guideline on the Preservation and Management of Islands for Ocean Management" (hereinafter referred to as the "Basic Guideline") in December, 2009. The Basic Guideline states definitely that, while government measures on revitalization of islands should naturally be continued and promoted, the reasons for making the Basic Guideline, based on the Basic Act on Ocean Policy and the Basic Plan on Ocean Policy, lie in the new viewpoint for observing islands from an ocean perspective or for managing the ocean. In other words, the Basic Guideline was adopted from the point of view as to what kind of role and importance the islands should have in promoting ocean management, and how national measures should be promoted in order to bring such roles and their importance into proper play.

To put it more concretely, the Basic Guideline sets up the following guidelines and measures:

1 The objectives and significance of the Basic Guideline.

2 The fundamental way of thinking on the role and measures of islands for the ocean management.

3 The measures for the preservation and management of islands

(1) Measures concerning stable preservation and management of remote islands as a basis for national jurisdiction on the ocean.

(2) Measures concerning preservation and management of islands as a foothold to support and promote various marine activities.

(3) Measures concerning preservation and management of islands and surrounding marine zones as a basis for promoting a rich natural ocean environment.

(4) Measures concerning succession of history and tradition of islands which have been formed by the relation of man and ocean

4 The organization, etc., to promote preservation and management of islands

5 The diffusion and enlightenment to nationals, etc.

IV The Law on the Preservation of Low-Water Line and the Development of Basic Infrastructure of Remote Islands for the Maintaining and Promoting Utilization of the Exclusive Economic Zone and the Continental Shelf

The Law on the Preservation of Low-Water Line and the Development of Basic Infrastructure of Remote Islands for the Maintaining and Promoting Utilization of the Exclusive Economic Zone and the Continental Shelf (2010, Law No.41) was put into force in July, 2010.

(1) As regards its objectives, the Law states that, recognizing the significance of the exclusive economic zone and the continental shelf which provide opportunities for activities, including exploration and exploitation of natural resources, conservation of marine environment, the Law aims to protect aforementioned maritime zones by regulating certain acts that may damage low-water lines from which those maritime zones are measured in "the Low-Water Line Protection Areas" to be designated in accordance with the Law, and to provide matters related to "the Specified Remote Island Port Facilities" that will be built on the remote islands designated by the Minister of Land, Infrastructure, Transport and Tourism (LITT) in order to facilitate conservation and the use of the maritime zones. As shown above, the preservation of low-water line and the development of basic infrastructure of remote islands seem to be the main aims of this Law.

(2)For the establishment of a Basic Plan, the Law requires the Government to develop a Basic Plan for implementing synthetically the measures for preservation of low-water lines and maintenance of islands facilities for promotion of conservation and use of the exclusive economic zone and the continental shelf. "The Basic Plan on the Preservation of Low-Water Line and the Development of Basic Infrastructure of Remote Islands for Maintaining and Promoting Utilization of the Exclusive Economic Zone and the Continental Shelf" was actually adopted by the Cabinet in July, 2010.

(3) For the designation of the low-water line protection areas, the Law provides that waters adjacent to low-waters lines providing basis for the outer limit of maritime zones stipulated in Art.1, para.2 of the Law on the Exclusive Economic Zone and the Continental Shelf may be designated as "the Low-Water Line Protection Areas" by the Cabinet Order, should such waters deemed to require protection. The so-called "Northern Islands" and the " Takeshima Islands" are not designated as the low-water line protected areas in view of the practical difficulty of maintaining their effective control.

(4) Under the title of "Regulation of certain acts in the Low-Water Line Protection Areas", the Law requires any person who intends to engage in the Low-Water Line Protection Areas, in certain acts which may hinder the conservation of low-water line, such as digging in the seabed, gathering of sands and gravels and building facilities and other structures, to obtain permission from the Minister of LITT.

(5) As for the establishment of the specified remote island port facilities, the Law provides that anchorage, quay and other port facilities to be used for national activities provided in "the Basic Plan", shall be constructed, refurbished and administered by the Minister of LITT.
(6) The Law provides for other measure necessary for the purpose of the legislation.

V The Basic Plan on the Preservation of Low-Water Line and the Development of Basic Infrastructure of Remote Islands for Maintaining and Promoting Utilization of the Exclusive Economic Zone and the Continental Shelf

The two islands, Minami-Torishima and Okino-Torishima, are designated as "Specified Remote Islands" in Art.1 of the Enforcement Order of the Law in 2010 (Government Ordinance No.157 of 2010). The Basic Plan of the Law (Section3(2)) enumerates the following 12 items of the matters concerning the goals of activities for the preservation and utilization of exclusive economic zone and continental shelf of these specified remote islands:

(1) Preservation of national land by means of development and establishment of technology for increasing coral.
(2) Promotion of development of mineral resources of ocean.
(3) Promotion of the sustainable fishing activities.
(4) Coping with practical use of technology for recycling energies in ocean.
(5) Development of new materials to make use of natural environment.
(6) Observation, etc. of earth environment to make use of environment not affected by artificial influence.
(7) Wide area observation of change in the earth's crust.
(8) Arrangement of the environment as a base for observation and research activities.
(9) Sustainable energy model.
(10) Proper preservation of ecosystem by means of setting up, etc. of marine protection areas.
(11) Practical use, etc. as a space for education and sight-seeing.
(12) Collection of marine data, securing of maritime safety, etc. to support the activities in the specified remote islands.

Many activities enumerated above involve characteristics in relation to the sea areas of the two specified remote islands, particularly in items (1), (4), (6), (7), (8) and (9). Article 19 of the Basic Act on Ocean Policy provides that the State shall take necessary measures in order to promote the development and others of the exclusive economic

zone and other areas “according to the characteristics of its sea areas”. The Basic Plan of the Law seems, therefore, to conform to this provision of the Basic Act on Ocean Policy.

V Concluding Remarks

The new legislation on islands aims at preservation and management of islands and their surrounding sea areas. However, as compared with the matters concerning low-water line protection areas and the specified remote island port facilities, the aspect of management of surrounding sea areas does not seem coming out to the front of the new Law. The Basic Plan made under the Law enumerates only the “goals” of activities, and those goals of activities are confined to the two “specified remote islands” which locate at the peripheral but important geographical position in the sea areas around Japan. Further study will be needed for their practical application to sea areas of the specified remote islands.

However, the new Law on islands seems to be moving in the direction of ocean management. The Basic Guideline on the Preservation and Management of Islands for Ocean Management of 2009 was adopted from the point of view as to what kind of role and importance the islands should have in promoting ocean management, and how national measures should be promoted in order to bring such roles and their importance into proper play. The idea of the goals of activities set up by the Basic Plan and embodied in the new Law on islands are in conformity with the concept of ocean management involved in the aforesaid objects of the Basic Guideline, even if it may be in the course of germination.

The present writer has proposed that the study of “the regime of islands”, which has been limited to the traditional way of legal thinking as to whether a coastal state is entitled to possess the surrounding maritime zones in the same way as other land territories, should be done hereafter in much broader context in the light of the developing international ocean order laying stress on the management and conservation of maritime zones. Legislation on islands is now enforced in Japan, and it is expected that Japan, together with other states having similar experiences, would contribute to the formation and development of a new regime of islands.

Management of Islands and their Surrounding Oceans

.

Hiroshi Terashima
Executive Director
Ocean Policy Research Foundation

Keywords
UNCLOS, Agenda21, management of the oceans, Article 121, Small Island Developing States' challenges, Basic Act on Ocean Policy, Basic Principles, Basic Plan, Basic Measures, Administrative Mechanism

Abstract

The UNCLOS regime parceled up vast and originally integrated ocean spaces of up to 200nm from shorelines and entrusted the management of these spaces to individual coastal states.

As Article 121 of UNCLOS recognized the right of islands to territorial waters, contiguous zones, exclusive economic zones, and continental shelves, many Small Island States assumed management over vast ocean areas and thus came to play an important role in global ocean governance. As life on the islands depends heavily on their surrounding ocean areas, and their relations with those areas are closer and more direct than are terrestrial States to their coasts, it is natural that Island States assume the management of their surrounding ocean areas.

At the same time, many islands that dot the ocean are vulnerable to global climate change and variation and face serious threats of saline damage to crops, extreme weather conditions, flood and inundation, as well as damage to their coral reefs, the foundation of island life. There is even the fear that the islands themselves might disappear under the waves due to sea level rise.

It is no easy task to address the threats facing islands while also managing the surrounding ocean areas, as prescribed by UNCLOS. Given the fact that climate change and variation are largely due to developed States' economic activities and recognizing the limitations to small island States' economic and technological capacities, UNCLOS and Agenda 21 therefore set out an international cooperative framework to assist Small Island Developing States in their initiatives.

However, at present, these initiatives are unfortunately not as effective as they might be in promoting comprehensive ocean management and sustainable development by Small Island States.

In order to obtain the necessary support from international society, there is a

need for Island States to formulate ocean policies in concrete terms sufficient to convince international society of their merit, and then make clear for what part of that policy they are requesting support and concrete consideration.

Japan has recently taken rapid, concrete steps to form its own comprehensive ocean policy, with a Basic Act on Ocean Policy proposal being adopted by the Diet after being submitted by MPs from a multi-partisan group.

I would introduce recent Japanese initiatives for promoting its ocean policy and the significance and contents of the Basic Act on Ocean Policy in the hopes that it will be of use to Small Island States in their deliberations on how best to undertake comprehensive management and sustainable development of their islands and surrounding oceans.

Background and Introduction

In the twentieth century, particularly the latter half, the world's population saw a dramatic increase, which is expected to continue in the present century. As the limits to land based resources and the environment have been made clearer in recent years, the ocean is expected to play an extremely large role in providing the water, food, natural resources, and energy for this expanding population, as well as facilitating transport and maintaining a stable and healthy global environment.

However, the ocean now faces a growing number of problems – for example, the indiscriminate exploitation of ocean resources, increasingly serious degradation of marine and coastal environments, increasing competition among users of coastal areas, and conflict between nations concerning the extent of jurisdictional waters. These have increased the call for more effective management of the oceans.

International society was forced to undergo a paradigm shift that resulted in the adoption of UNCLOS and Agenda 21.

In response to the demands of Coastal States for expansion of ocean areas over which they would have sovereign rights, UNCLOS, which came into effect in 1994, adopted the twelve-mile territorial waters regime, the archipelagic regime, the two hundred mile Exclusive Economic Zone regime, and reformed the continental shelf system. It also established the "common heritage of mankind" system regarding the deep sea bed and the mineral resources therein.

In this regard, it should be noted that the territorial sea, the contiguous zone, the exclusive economic zone and the continental shelf of an island are determined in accordance with the provisions of UNCLOS applicable to other land territory, except as provided for in paragraph 3 of article 121.

We should also note that, in recognition of the need to consider ocean problems as a whole, the Convention emphasized marine environmental protection and conservation and sought to strengthen international initiatives for prevention of marine pollution, promoted scientific ocean research for peaceful purposes, and urged cooperation in the transfer of ocean-related knowledge and technology to developing countries.

It was the Rio Earth Summit in 1992 that gave direction as to how mankind should address these pressing environmental and development problems when it adopted the principle of "sustainable development." Chapter 17 of Agenda 21 sets out detailed action plans for seven program areas that would comprise a common global policy framework on the Oceans, including "Integrated management and sustainable development of coastal and marine areas" and "marine environmental protection," among others.

Ten years after Rio, the World Summit on Sustainable Development was held in 2002, in Johannesburg, South Africa. In regard to oceans, WSSD reaffirmed the importance of implementing UNCLOS and Agenda 21 and included in its Plan of Implementation practical measures that need a cross-sectoral approach.

The UNCLOS regime parceled up vast and naturally unified ocean spaces of up to 200nm from shorelines and entrusted the management of these spaces to individual coastal states. While the preamble to UNCLOS states that "…the problems of ocean space are closely interrelated and need to be considered as a whole," it neither provides for how individual states are to implement concrete measures nor indicates a concrete framework for how states are to implement the securing of a legal order on the oceans, promote peaceful use, conserve natural resources, and protect the environment.

The difficulties we are facing include marine pollution over increasingly wider areas, depletion of marine biological resources and IUU fishing, rapid increase in transnational crimes at sea, and disputes over border delimitations.

Concerted efforts by the States concerned are necessary to cope with these problems and harmonize the UNCLOS/Agenda 21 regime and initiatives by individual States.

Challenges by Small Island Developing States in Ocean Governance

I would like to consider the Small Island States that dot the Pacific and the management of their surrounding ocean areas. As Article 121 of UNCLOS recognized the right of islands to territorial waters, contiguous zones, exclusive

economic zones, and continental shelves, many Small Island States assumed management over vast ocean areas and thus came to play an important role in global ocean governance. As life on the islands depends heavily on their surrounding ocean areas, and their relations with those areas are closer and more direct than are terrestrial States to their coasts, it is natural that Island States assume the management of their surrounding ocean areas.

At the same time, many islands that dot the ocean are vulnerable to global climate change and variation and face serious threats of saline damage to crops, extreme weather conditions, flood and inundation, as well as damage to their coral reefs, the foundation of island life. There is even the fear that the islands themselves might disappear under the waves due to sea level rise.

It is no easy task to address the threats facing islands while also managing the surrounding ocean areas, as prescribed by UNCLOS. Given the fact that climate change and variation are largely due to developed States' economic activities and recognizing the limitations to small island States' economic and technological capacities, UNCLOS and Agenda 21 therefore set out an international cooperative framework to assist Small Island Developing States in their initiatives.

Thus, PART 14 of UNCLOS was included to address the "Promotion of the development and transfer of marine technology," stating that "States shall promote the development of the marine scientific and technological capacity of States which may need and request technical assistance in this field, particularly developing States … with regard to the exploration, exploitation, conservation and management of marine resources, the protection and preservation of the marine environment, marine scientific research and other activities in the marine environment compatible with this Convention, with a view to accelerating the social and economic development of the developing States."

Also, the problems of Small Island Developing States were taken up by Chapter 17 of the Agenda 21 Programme of Action for Sustainable Development, adopted at the Rio Earth Summit, and the Plan of Implementation adopted 10 years later at the World Summit on Sustainable Development. They considered SIDS as a special case from both an environmental and development perspective, and called on international society to support their management of their coastal zones, EEZs, and continental shelves. The 1994 Barbados Programme of Action for the sustainable development of SIDS and the 2005 Mauritius Strategy were based on this.

However, at present, these initiatives are unfortunately not as effective as they might be in promoting comprehensive ocean management and sustainable

development by Small Island States. The reasons for this can be found in both international society and the Small Island States themselves.

First, support by international society has not been necessarily sufficient. Second, I believe we can say that Small Island States' ocean policies for comprehensive ocean management and sustainable development have not been sufficiently developed. Looking closer, moreover, there seems that the lack of concrete ocean policy by Island States as to what kind of initiatives they want to undertake to remedy their ocean management problems and the nature and mode of support they require could be a latent cause of international society's insufficient support.

If that is the case, in order to obtain the necessary support from international society, there is a need for Island States to formulate ocean policies in concrete terms sufficient to convince international society of their merit, and then make clear for what part of that policy they are requesting support and concrete consideration.

Collaborative Efforts for Ocean Policy by Lawmakers, Scholars and Experts, and a Think-Tank in JAPAN

I would introduce recent Japanese initiatives for promoting its ocean policy and the significance and contents of the Basic Act on Ocean Policy in the hopes that it will be of use to Small Island States in their deliberations on how best to undertake comprehensive management and sustainable development of their islands and surrounding oceans.

Although Japan is surrounded by the ocean, has strong fishing and maritime industries, a long tradition of ocean research and development, and is entrusted with the world's 6th largest EEZ/CS by UNCLOS, its contributions to ocean governance under UNCLOS and Agenda 21 were uninspiring until the enactment of the Basic Act on Ocean Policy in 2007.

Its government agencies were characterized by their vertically compartmentalized division of functions, making them particularly ill suited for addressing "the problems of ocean space [that] are closely interrelated and need to be considered as a whole." There was neither a Minister nor coordinating office for the oceans that could consider these problems in a comprehensive manner.

However Japan has recently taken rapid, concrete steps to form its own comprehensive ocean policy in regard to integrated ocean management and sustainable development, with a Basic Act on Ocean Policy proposal being adopted by the Diet after being submitted in April 2007 by MPs from a multi-partisan group.

The reason change is finally starting to take place is that responses are being demanded to questions about the need for the conservation and management of ocean resources, the need for more ocean anti-pollution measures, the coordination of the increasing and competing claims for ocean and coastal usage, and the need for guaranteeing safety and security in waters around Japan and for maritime transport.

The realization has finally come about, in both the public and private sectors, that a more comprehensive ocean policy is required.

The main impetus behind the movement was "the Proposal for a 21st Century Ocean Policy," prepared by the Ocean Policy Research Foundation and presented to the Chief Cabinet Secretary in November of 2005.

This proposal comprised thirty-five concrete measures over eight fields of activity and urged the drafting and adoption of a National Ocean Policy, the enactment of a Basic Ocean Law, establishment of a ministerial level council for the ocean, and appointment of an Ocean Minister.

OPRF, along with the Nippon Foundation, made a formal application to the ruling Liberal Democratic Party to consider the proposal. The LDP agreed to push for submission of the Basic Ocean Law bill at the next Diet session.

Building on this, at the initiative of the LDP, it was decided to form a multi-partisan Basic Ocean Law Study Group, which began meeting in April 2006. The Study Group consisted of many political leaders, scholars and experts in various ocean fields, and observers from relevant government ministries and agencies. OPRF served as Secretariat for the Group. The Group met ten times, from April to December 2006. Discussion at the meetings focused on the Guideline for Ocean Policy and a Basic Act on Ocean Policy, with presentations by scholars and experts, policy statements by ministry representatives, and hearings from ocean related business associations.

The Ocean Law Study Group, after exhaustive discussion of ocean policy, the systems necessary for its promotion, and the contents of a Basic Ocean Law, succeeded in establishing a common understanding and views on the Guideline for Ocean Policy, setting out the goals and enunciating a guiding philosophy and, based on these, presented the general form and substance the Law would eventually take.

The text of the Basic Bill on Ocean Policy was then drafted, based on the Ocean Policy Guideline by the Study Group. The bill was presented to the Diet by MPs from ruling and opposition parties in April 2007, passing in the Lower House on the third and the Upper House on the twentieth of the same month. The Basic Act on

Ocean Policy came into force in July 2007.

The process leading toward the law was a collaborative one, a first for Japan, among lawmakers and a group comprising ocean scholars and experts, representatives from government ministries and agencies, private stakeholders, and a think-tank.

The Significance and Contents of the Basic Act on Ocean Policy

In Japan, for some policy areas, a legal approach is taken, whereby establishment of a Basic Law is first carried out to integrate policies previously separated due to the vertically compartmentalized division of functions among the ministries and agencies.

Many Basic Laws have recently been adopted in Japan, bringing the total to thirty, including the Basic Environment Act, Science and Technology Basic Act, Basic Act for Fisheries, Basic Act for Energy Policy, etc.

The Basic Law system is especially useful for facilitating effective coordination in multi-faceted policy areas, such as ocean affairs, which will necessarily involve different ministries overseeing maritime transport, shipbuilding, fisheries, energy, the environment, science and technology and so on.

The Basic Act on Ocean Policy establishes a basic framework and mechanism to cope with comprehensive ocean management. Also, in order to promote effective implementation, a Minister for Ocean Policy is appointed to the cabinet.

There are three important points that must be addressed in undertaking comprehensive management of the oceans: the setting of comprehensive ocean policy, the institutional arrangements necessary to promote such policy, and the administrative arrangements for policy implementation. The Basic Act on Ocean Policy addresses these three points.

The Basic Act on Ocean policy consists of 4 chapters.

Chapter 1 stipulates General Provisions, which include provisions on objectives, 6 basic principles, responsibilities of national and local public bodies, industries, and the general public.

Chapter 2 sets out the Basic Plan on Ocean Policy

It stipulates that the Government shall formulate a basic plan on Ocean Policy in order to promote measures with regard to the oceans comprehensively and systematically.

Chapter 3 sets out 12 Basic Measures where a comprehensive and systematic

approach is required.

Chapter 4 mandates a Headquarters for Ocean Policy

It stipulates that in order to promote measures with regard to the oceans intensively and comprehensively, a Headquarters for Ocean Policy shall be established in the Cabinet.

Basic Principles of the Ocean Policy

The Study Group called for the Basic Act on Ocean Policy to state clearly the basic philosophy and principles underlying ocean policy and says as follows.

The new ocean policy, making the principle of the "coexistence of the oceans and mankind" an ultimate goal, would place emphasis on "protecting marine environments" for present and future generations and "securing the use and safety of the oceans" as a foundation for the continued existence of the human race. It would work toward "sustainable development and use" of the oceans to equitably meet the needs of present and future generations. To that end, it would endeavor to "enhance scientific knowledge" about the still little understood ocean through research and development, and to achieve a "healthy development of marine industries." Based on this, it would strive for "comprehensive management of the oceans," whereby the government and private sector could join forces to comprehensively address the closely interrelated problems of the oceans. In view of the physical unity and international nature of the oceans, it would also work to create an international ocean partnership aimed at playing a leading role in the formation and development of international order, making "international coordination" a basic tenet of national policy.

The Basic Act on Ocean Policy (hereinafter referred to as "the Act") has translated these philosophies and principles into 6 basic legal principles and stipulated in the Act[1]. Those are listed below.

a. Harmonization of the development and use of the ocean with conservation of the marine environment
b. Improving safety and security on the ocean
c. Enhancement of scientific knowledge of the ocean
d. Sound development of marine industries
e. Comprehensive ocean governance
f. International coordination on ocean issues

---

[1] Article 2 to 7 of the Act

Basic Plan on Ocean Policy

How to establish a national ocean policy in an integrated manner is a vitally important question. The Act addresses this by establishing the Basic Plan on Ocean Policy (herein after in this section referred to "Basic Ocean Plan[2]". It stipulates that the Government shall formulate a basic plan on the oceans in order to promote measures with regard to the oceans in a comprehensive and systematic manner.

The Government shall endeavor to take necessary measures for the smooth implementation of the Basic Ocean Plan by, for example, appropriating its budget each fiscal year, to the extent permitted by the State's finances, in order to secure funds necessary to cover the expenses required for the implementation of the Basic Ocean Plan.

Bearing in mind the change of the situation with regard to the oceans, as well as based on evaluation of the effect of measures with regard to oceans, the Government shall review the Basic Plan on Ocean Policy almost every five years and shall make necessary changes.

Basic Measures

It should be also noted that the Act stipulates 12 basic areas of measures (hereinafter referred to as "the Basic Measures") based on the Ocean Policy Guideline by the Study Group in which measures shall be taken in a comprehensive and systematic manner[3]. These are the fruits of the discussion of the Study Group.

The Basic Measures are listed here.

a. Promotion of the development and use of marine resources
b. Conservation of the marine environment
c. Promotion of Development, use, conservation in the EEZ and on the Continental Shelves
d. Securing maritime transport
e. Securing the safety and security of the oceans
f. Promotion of marine surveys
g. Promotion of research and development of marine science and technology
h. Promotion of marine industries and strengthening international competitiveness
i. Integrated management of the coastal zones

---

[2] Article 16
[3] Article 17 to 28 of the Act

j. Conservation of the remote islands
k. Securing international coordination and promotion of international cooperation
l. Enhancement of citizen's understanding of the oceans and the development of human resources

These form the framework of discussion on measures with regard to the oceans from now on. The Basic Measures we have adopted include not only new areas such as development, use and conservation of EEZ/CS, but also 'conventional' areas such as securing maritime transport, for which a comprehensive and systematic approach is also required.

Administrative Mechanism

The Act stipulates that in order to promote measures with regard to the oceans intensively and comprehensively, Headquarters on Ocean Policy (hereinafter referred to as "the Headquarters") shall be established in the Cabinet[4].

The Headquarters shall take charge of affairs listed in the following items:
(i) Matters with regard to drafting and to the promotion of execution of the Basic Ocean Plan.
(ii) Matters with regard to synthesis coordination of measures of implementation by relevant administrative bodies based on the Basic Ocean Plan.
(iii) In addition to the tasks referred to in preceding two Paragraphs, matters with regard to planning and drafting of important measures with regard to the oceans as well as synthesis coordination.

The Act also stipulates that the Prime Minister shall head the Headquarters and that the Deputy Heads of the Headquarters shall be the Chief Cabinet Secretary and the Minister for Ocean Policy, who are to assist the Prime Minister in the intensive and comprehensive promotion of measures relating to the oceans. All Ministers of State are members of the Headquarters.

With regard to the Headquarters, a comprehensive review shall be executed five years after the Act enters into force and necessary measures shall be taken based on the results of the review.

With regard to the administrative work of the Headquarters, the Act stipulates that affairs concerning the Headquarters shall be processed within the Cabinet Secretariat and administered by the Assistant Chief Secretary under commission. The Secretariat Office of the Headquarters was established in the in the Cabinet

[4] Article 29 to 38 of the Act

Secretariat in July 2007. Most of the ocean related Ministries and Agencies have sent their staff to the Secretariat Office totaling over thirty.

It is also desirable to have a ministry or agency who would take the lead for implementing the ocean policy.

The Ministry for Land, Infrastructure, Transport and Tourism oversees many ocean related areas, and in the recent Cabinets the MLIT Minister also serves as the Minister for Ocean Policy. However, MLIT has not been explicitly designated the lead agency for ocean policy.

More thought needs to be given to an administrative mechanism that can effectively promote comprehensive ocean policy.

The First Basic Plan on Ocean Policy

The public comments solicited in advance of the Plan elicited responses from 102 groups and individuals on 600 topics, though in the end the original draft remained largely unchanged. The Basic Plan on Ocean Policy was then adopted by the Cabinet on March 18, 2008. The ocean measures that the government is prepared to comprehensively and systematically implement for the first time ever in Japan are listed here, marking the country's entrance into a new phase in regard to its ocean policy.

The Basic Plan on Ocean Policy consists of 4parts shown below.

General Remarks

Chapter 1 Basic Policy of Measures with Regard to the Ocean

Chapter 2 Measures that the Government Should Take Comprehensively and Systematically with regard to the Ocean

Chapter 3 Other Matters Necessary to Comprehensively and Systematically Promote Measures with Regard to the Ocean

It states in the General Remarks section, that as "We …aim to establish a new Oceanic State with vast jurisdictional ocean areas, seeking the peace and safety of the ocean under international cooperation," "it is urgently required to establish a new system to plan and determine policy from the viewpoint of managing 'ocean space' with due consideration to the possibilities and capacities thereof. Such a new system is indispensable for the sustainable and rational utilization of the sea." It also states that, "For realizing a new Oceanic State, marine-related parties from various fields, with the Headquarters for Ocean Policy as their core, are expected to collaborate and cooperate to strategically promote ocean policy. This plan is to be the basis for achieving that purpose" and is "established with a view to being

reviewed after five years."

Chapter 1 includes the basic outline for developing measures according to the basic principles laid out in the Basic Act on Ocean Policy.

Chapter 2 elucidates those comprehensive and systematic measures from the Basic Act on Ocean Policy that need to be promoted, including measures requiring intensive implementation and those to be carried out with the coordination of relevant organizations.

Chapter 2 is the most important section in the Basic Plan on Ocean Policy, which will serve as the main force in promoting Japanese ocean policy in a comprehensive, systematic, and concrete fashion. It is desirable therefore that the goals, completion dates, roadmaps, and methods of the measures set forth here are made as explicit as possible. However, it was said not so many measures are described concretely and further efforts are necessary to promote implementation of the ocean measures comprehensively and systematically.

Looking at Chapter 2 from this perspective, the systematic development of energy and mineral resources would seem to meet all the requirements for being a focus of section 3, The Promotion of Development in the EEZ.

Regarding energy and mineral resources, it is said that necessary policy resources should be invested intensively in immediately urgent subjects of exploration and development in the EEZ and continental shelves, i.e., petroleum, natural gas, methane hydrate, and polymetallic sulphides. Regarding methane hydrate and polymetallic sulphides, commercialization in about ten years should be the goal.

The same is true regarding section 4, Securing Maritime Transport, and the need for international competitiveness in the maritime industry and the securing of Japanese seafarers and Japanese registered ships.

It is said that efforts should be made to establish a special tax treatment system, under which Japanese international shipping operators that try to increase Japanese-flag ships and Japanese crew members in a planned manner can select an income accounting method in accordance with the total tonnage of owning Japanese-flag ships (tonnage tax). Under this system, it is aimed to increase the number of Japanese-flag ships by 100% in five years and number of Japanese crew members by 50% in ten years, both from 2008.

Another example is 'Establishing Policies concerning Conservation and Management' at section10, Conservation and Management of Islands.

It said that it is necessary to clarify the position of islands including uninhabited islands in promoting the government's ocean policy and establish the "Basic Policy

concerning Conservation and Management of Islands for Management of the Sea"

Progress in Implementing the Basic Plan on Ocean Policy

Three years have passed since the Basic Plan on Ocean Policy was decided in 2008. In the first year it seemed promotion of comprehensive Ocean Policy was very slow and the ocean related ministries and agencies were rather defensive against new ocean initiatives. However, new initiatives have been emerging and new measures being implemented gradually in recent years. It seems the ocean related ministries and agencies have started to consider how to utilize the new framework on the oceans for fulfilling their respective missions. If it is so, this is a good trend toward implementing the Basic Plan on Ocean Policy and promises a bright future for ocean governance.

Progress in implementing the Basic Plan on Ocean Policy includes the Submission to the Commission on the Limits of the Continental Shelf in November 2008, Enactment of the Act for the Amendment of Maritime Transportation Act and Seafarers Act in June 2008, Establishment of the Plan for the Development of Marine Energy and Mineral Resources in March 2009, Enactment of the Act for Punishment of and Response to Piracy in May 2009, Establishment of Basic Guideline on Conservation and Management of Islands for Ocean Management in December 2009, and Enactment of the Act for Conservation of the Low-water Lines and Development of Basic Infrastructure of Remote Islands in the EEZ and CS in May 2010.

I would be most happy if this record of the initiatives we took toward adoption of a comprehensive ocean management policy might be of some use for those who are considering the Oceans Policy of SIDS.

Reference:

Basic Act on Ocean Policy and Basic Plan on Ocean Policy
http://www.kantei.go.jp/jp/singi/kaiyou/index.html

「On Becoming an Ocean State」 Hiroshi Terashima『Japan Echo』Volume 34 Number 1 February 2007

Remote Islands & the International Regime of the Protected Areas

Yasuhiko KAGAMI
College of International Studies, Chubu University

I. Introduction

The United Nations Convention on the Law of the Sea (UNCLOS) provide coastal states with exclusive economic zones (EEZ), large areas of ocean extending 200 nautical miles from their coastlines. Not limited to the continental territory, the insular territories (remote islands) as well are also granted EEZs. However, we must recall that UNCLOS does not just provide coastal states with rights; it also imposes upon them obligations to manage the marine environment, including the conservation of resources (both living and non-living), of the areas under their jurisdiction.

Due to their geographical characteristics, remote islands and their surrounding seas are a treasure trove of valuable ecosystems and biodiversity, and that alone means it is necessary to manage them that much more effectively. Nevertheless, the farther from the mainland the remote islands lie, the greater is the neglect in their management; and it is not an overstatement in saying that in many cases they are used solely for the purpose of claiming country's EEZs[1)].

On the other hand, through the implementation of international treaties related to protected area systems such as the Convention on Biological Diversity (CBD)[2)] and the World Heritage Convention (WHC), remote islands and their surrounding waters are being managed by means of protected areas, and slowly but surely very interesting practices which consider the need to protect biodiversity and also seek effective management are accumulating.

Within Japan, since the establishment of the Basic Act on Ocean Policy (of which article 26 deals with the "Conservation of the Remote Islands, etc.") in 2007, laws and plans concerning remote island management are being formulated[3)], one after another, and are now entering the implementation stage.

Some countries are now in the process of exploring ways in which they will actually go about managing their remote islands and their surrounding waters. This paper, by examining several national practices of the management of remote island, will attempt to draw out lessons that can be applied to Japanese remote island management. In doing so, this paper focuses on the practices of World Heritage sites, because the WHC is "the strongest" protected area regime and practices under this regime could be good model for other protected areas.

II. World Heritage Sites as a Model for Remote Island Management

The World Heritage Convention was adopted at the General Conference of UNESCO in 1972, and as of June 2010, 187 countries are members. The Convention has the purpose of "*establishing an effective system of collective protection of the cultural and natural heritage of outstanding universal value*" (preamble). One of the primary functions of the Convention is to register natural and/or cultural properties possessing "outstanding universal value (OUV)" on the World Heritage List (the List). For example, in the registration process, member states take initiative and submit recommendation of property within their own territories as nominated site.

The World Heritage Committee, comprised of 21 States Parties to the Convention, after considering the technical evaluation based on the field survey conducted by the International Union for Conservation of Nature (IUCN. The official advisory body of WHC), finds the nominated sites to have "OUV." Then it proceeds to inscribe the properties on the List.

It should be noted here that management of such properties (generally, prior to inscription, nominated properties have already been domestically designated as protected areas such as national parks) inscribed on the List becomes a "*matter of international concern*," and it could be said that this is one of the greatest features of the international regime of protected areas. As of June 2010, 911 properties were registered on the List with 704 being cultural properties, 180 natural properties, and 27 mixed properties. Of the natural properties 51 of them have marine components[4].

As represented in article 5 of the WHC, the details of the protective measures imposed on each country are rather general[5]. Additionally, they are preceded by the clause "*in so far as possible, and as appropriate for each country*," meaning each signatory has a great deal of discretion in deciding how and to what degree the measures are applied. Furthermore, there is no provision within the Convention stating what kind of places can be registered. As a result, many of the currently registered properties are in developed countries, with developing countries tending to have few (*see figure 1*). Heritage sites with marine areas are also few, and the methods for managing them are not alike.

Against this backdrop, the 29th Session of the World Heritage Committee (2005) established the "*World Heritage Marine Programme*." Its purpose is to support the effective conservation of marine and coastal protected areas possessing OUV as existing and potential World Heritages. To achieve this, the *Programme* seeks to encourage the registration of new sites, strengthen capacity building in order to raise area management effectiveness, and improve communication and outreach regarding the WHC[6]. Quite simply, a "*World Heritage Goes Marine*[7]" situation is coming into being.

Fig. 1　World Heritage sites in IUCN Marine regions

(Source) Fanny Douvere, "World Heritage Marine Programme: The Future 2010-2013," (26 Jan. 2010), at <http://whc.unesco.org/uploads/activities/documents/activity-13-7.pdf>.

III.　National Practices of remote island World Heritage Sites

Next, we will examine national practices of remote island management in which the property is both registered as a World Heritage site and also the base point for a vast EEZ[8)].

(1)　Lord Howe Island Group

The Lord Howe Island Group, which is located in the Tasman Sea about 600 km off of Australia's eastern coast, consists of the Admiralty Islands in the north, Lord Howe Island (2km wide and 10km north to south, it is the only inhabited island of the group. *See figure 2*), and Ball's Pyramid (The only known breeding ground in Australia for the Kermadec Petrel. *See figure 3*) in the south. The Group's EEZ encompasses 543,346 sq km[9)]. Though these are not oceanic islands, they are home to many endemic species and are blessed with rich and affluent ecosystems. Lord Howe Island is home to 350 people, and the number of tourists are restricted to 400 at any one time. The Lord Howe Island Group was inscribed on the List in 1982. The criteria for inscription are vii and x[10)]. In 1998 the surrounding waters extending 3 nautical miles from the Group's shores were designated as the State Marine Park[11)], and in 2000 the Park was extended out to 12 nautical miles (the first 3 nautical miles are under the

jurisdiction of the New South Wales state government while the sea areas outside of that fall under the jurisdiction of the Commonwealth government). As a result, seamounts and other submerged formations found at depths up to 100 meters existing around the Group are also subject to Marine Parks' protection.

Fig. 2　Lord Howe Island

(Source) Image Science and Analysis Laboratory, NASA-Johnson Space Center, "The Gateway to Astronaut Photography of Earth," ISS006-E-5731

Fig. 3　Ball's Pyramid

(Source)　Australian Museum

http://australianmuseum.net.au/Uploads/Images/8121/balls_pyramid_big.jpg

Management of the World Heritage Sites is overseen by the parks management unit of the Stats government and the three-person Lord Howe Island Board, one member of which is an island resident[12]. This type of community-participatory approach allows for face-to-face discussions between administration and community[13], and scientific studies of the ecosystem are also being actively carried out.

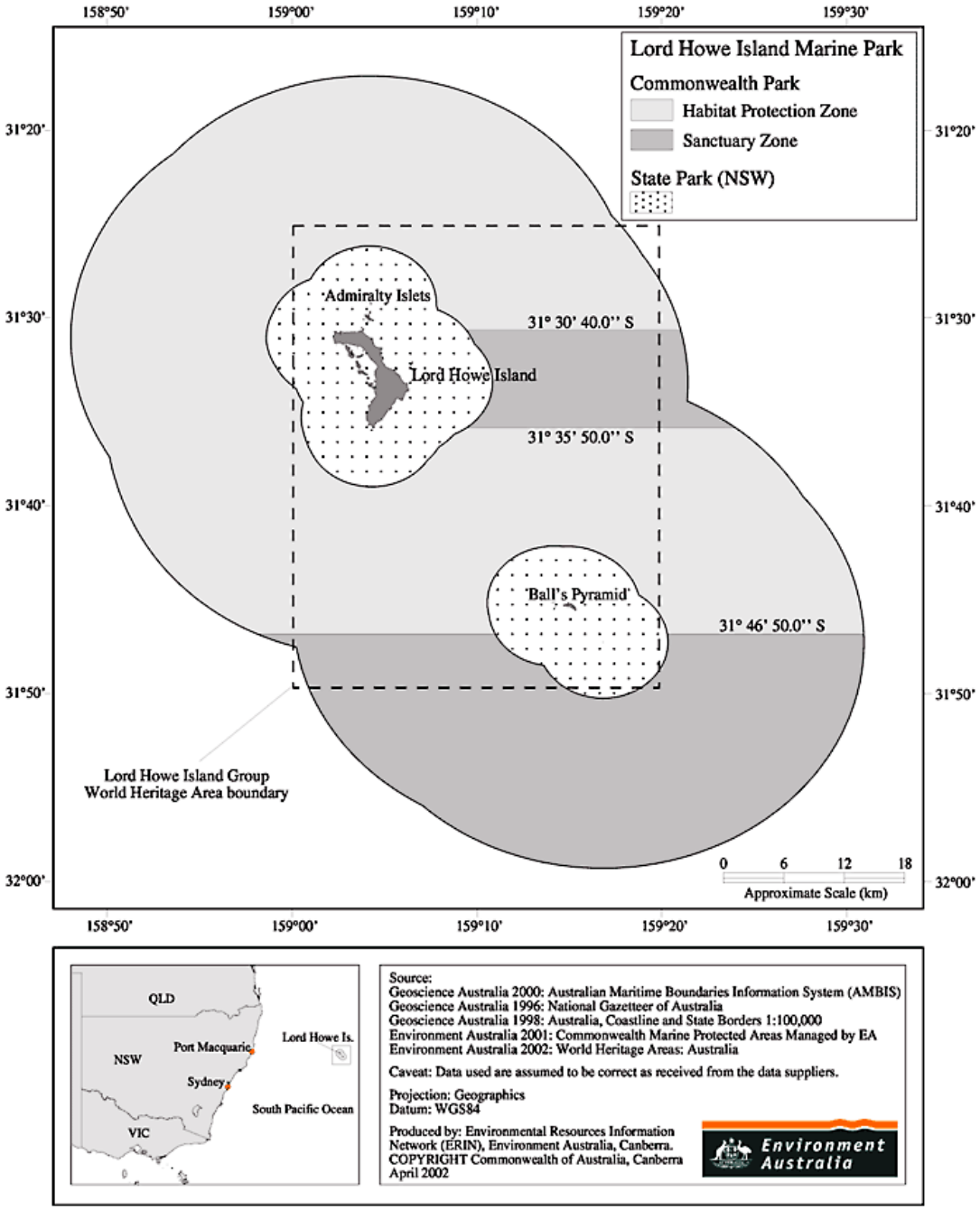


Fig. 4　Location of the Lord Howe Island Marine Park and zoning arrangements

(Source)　Lord Howe Island Marine Park Management Plan (2002)

http://www.environment.gov.au/coasts/mpa/publications/pubs/lordhowe-plan-figure1.pdf

The Lord Howe Island Marine Park Management Plan (2002)[14] set biodiversity conservation as its highest priority. The waters surrounding the island group consist of three protective areas: one habitat protection zone (IUCN Protected Area Management Category IV) and two sanctuary zones (category la)(*See figure 4*). Small-scale fishing is allowed in the habitat protection zone, while it is prohibited in the two sanctuary zones where it is also necessary to obtain permission for even scientific surveys and environmental monitoring.

The aforementioned management plan expired on September 24, 2009, and the area is currently being administered under an interim management arrangement in which the majority of activities in the protected areas require prior approval[15]. In a periodic report submitted to the World Heritage Committee by the Australian Commonwealth government in 2003, the government provided a self-assessment in which it stated that this world heritage site was secure from outside environmental influences and being generally well protected[16].

(2) Galápagos Islands

The Galápagos Islands[17], which are situated about 800-1,100 kilometers west of continental Ecuador, consist of many islands and also home to 28,000 human residents. However, the majority of the islands, like Darwin (Culpepper) Island (*See figure 5*) on the northwest edge of the group, are uninhabited. The EEZ created by the islands is 835, 936 sq km in size[18]. They are the most famous of the world's oceanic islands, home to many endemic species, blessed with an abundance of biodiversity, and their surrounding waters are rich with marine ecosystems. After the land area of the islands was registered as world heritage site in 1978 (criteria vii-x), the human population grew rapidly and more than one hundred thousand tourists began visiting the area annually. Human activity came to effect the environment in a very big way, and as a result, in 2007 the islands were designated as a World Heritage in Danger. Due to the efforts of the Ecuadorian government, they were removed from the danger list at the 34th session of the World Heritage Committee in 2010.

Fig. 5 Darwin (Culpepper) island

(Source) Teresa Zubi's web site "Starfish"
http://www.starfish.ch/photos/dive-Tauchen/Galapagos/Darwin-island.jpg

Many fishermen made up a part of the islands' population influx, and managing the surrounding waters became a challenge. As a result, in the 1980s, the government established the Galápagos Biological Marine Resources Reserve (GMRR), an area extending out 15 nautical miles from the islands' shorelines, but had difficulty with its management due to resistance by the fishermen. However, at last in March of 1998, the Special Law of the Galápagos[19] was enacted, and in addition to extending the GMRR's area of coverage out to 40 nautical miles (article 12), a marine management system was established for the purpose of sustainable development and the protection of marine resources (*See figure 6-a*). In 2001, the World Heritage marine component was expanded to include the GMRR (133,000 sq km).

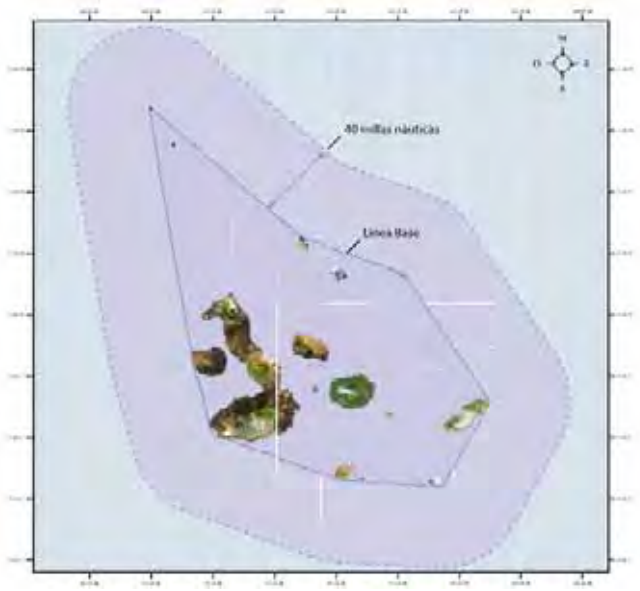


Fig. 6-a, 6-b Zoning map of Galápagos Marine Reserve

(Source) Danulat E & GJ Edgar (eds.) 2002. Reserva Marina de Galápagos. Línea Base de la Biodiversidad. Fundación Charles Darwin/Servicio Parque Nacional Galápagos, Santa Cruz, Galápagos, Ecuador. 484 pp.

Fig. 6-a

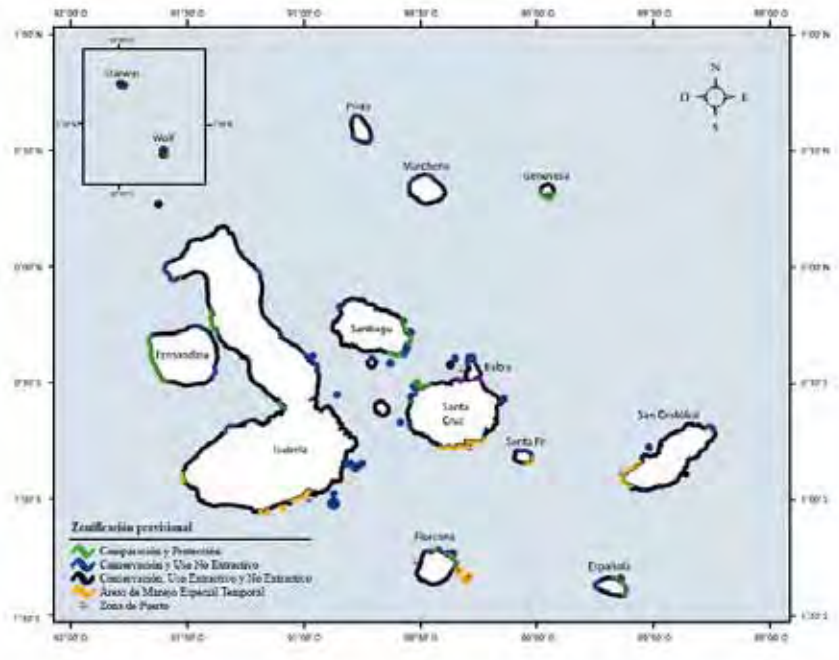


Fig. 6-b

Management of the GMRR has become meticulous. A Participant Management Board (PMB) comprising provincial and municipal governments, and local residents representing the tourism and fisheries industries and the scientific and conservation communities, submit proposals concerning matters such as the protected area, zoning, fishing season, fishing grounds, and quota sizes. These proposals are then deliberated on by the Inter-Institutional Management Authority (IMA) which is made up of representatives from national government ministries and offices related to environment, defense, trade and industry, and tourism, and also representatives from related departments and bureaus of the Galápagos provincial government. The IMA then goes on to draft general policies based on sustainable development and conservation principles. These policy drafts then need to receive the approval of the highest decision-making authority for conservation policy, the Galápagos National Institute (INGALA) (comprised of various governmental ministries, the provincial governor, the union of municipal authorities, the fishery association, Darwin Foundation and others), before finally being implemented by the Galápagos National Park Service (Special Law of the Galápagos, Chapter 4). These efforts have been highly evaluated by the World Heritage Committee, and are also supported by the Japan International Cooperation Agency (JICA).

Additionally, many smaller protected areas have been established near shorelines, these include multiple use zones, limited use zones, and port areas (*See figure 6-b*), each with its own set of governing regulations[20].

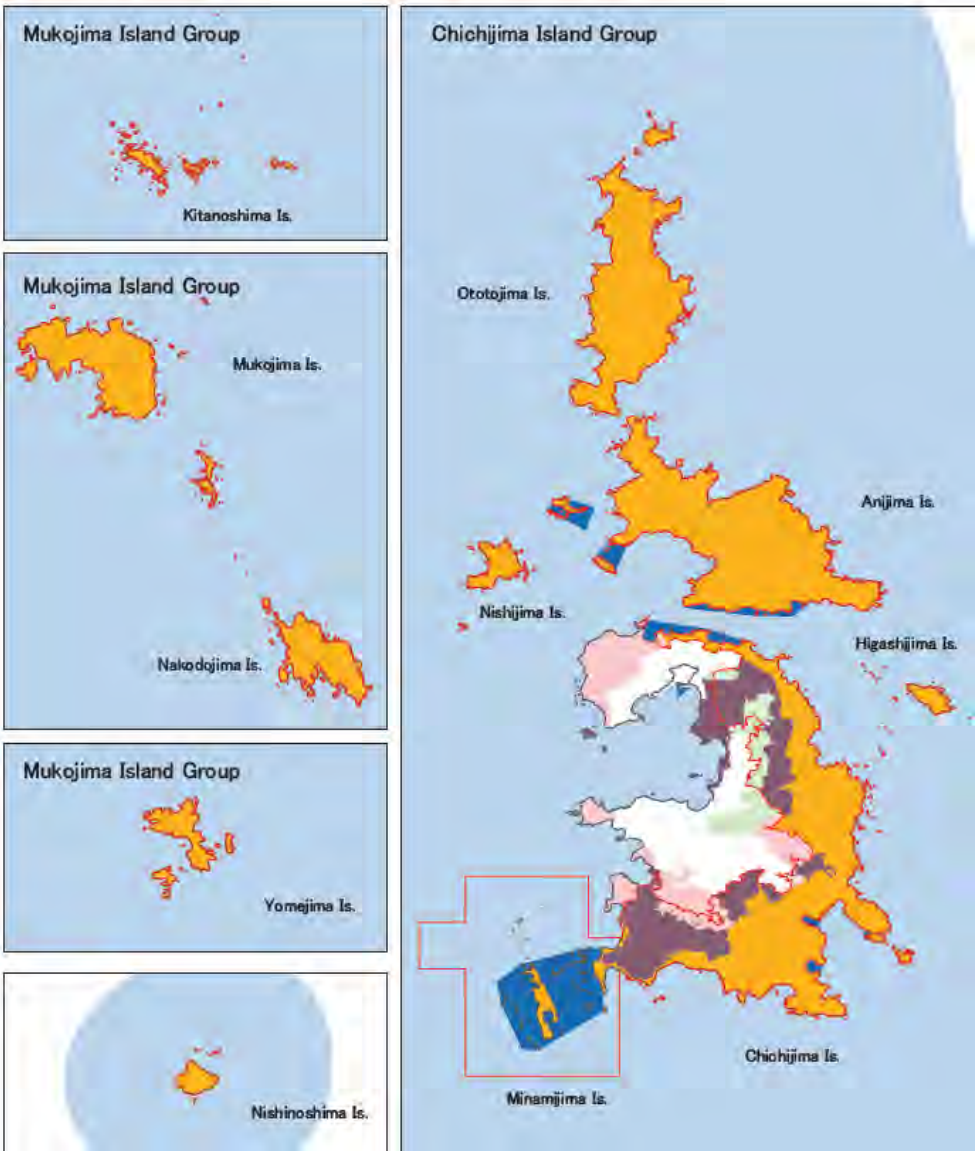
IV. Japanese Practice - Nomination of Ogasawara Islands

At the time of writing this paper, there were no Japanese remote islands whose marine zones registered as the World Heritage sites. However, the Ogasawara Islands, which is located approximately 1,000 km south of mainland Japan, has been nominated (as a Natural Heritage) for inscription on the List (Criteria: viii-x). The islands, called the “Galápagos of the Orient,” and associated islands group accounts for 30 percent of Japan’s total EEZ[21], have a population of 2,500 people, and are visited by 30,000 people annually.

In July of 2010 the IUCN conducted a field survey for technical evaluation of the site and confirmed among other things that the seas around Chichi-jima Island, one of the inhabited islands in the group, possessed a rich ecosystem which included various species of shark and ray, and that humpback whales seasonally migrated to the area.

However, with the exception of the sea areas around Miyajima in the southern part of Chihiijima Island, most of the nominated areas did not include marine components. More than half of the Ogasawara Islands’ current Marine Park Areas are also excluded (*See figure 7*). Although prior to nomination, Japanese government extended the seaward boundary of

National Parks ("Ordinary Zone" - the lowest protection status attached among National Park zoning system) from 1km to 5km offshore from most of the island groups, they are not totally included in the nominated sites. This may be the result of the influence of traditional fishing rights; however, in light of trends in the management of marine world heritage, it cannot be denied that this fact appears somewhat odd.



* Color legend: Pale blue = Ordinary Zone, Dark blue = Marine Park Area
Red lines = Nominated properties

Fig. 7 Ogasawara World Heritage Nominated Site

(Source) Government of Japan
"Nomination of the OGASAWARA ISLANDS for Inscription on the World Heritage List"
at <http://ogasawara-info.jp/pdf/isan/suisensho_eigo.pdf>

In fact, after completing its field survey, the IUCN, in a letter (which requested for supplementary information) addressed to the Japanese government, sought to have the marine components of the nominated site expanded to include the existing Marine Park Areas in their entirety. The reason given was "*[T]he mission felt that management effectiveness and therefore the integrity of the property would be better served if more marine areas were able to be included within the nominated property. The ecological function of an oceanic island ecosystem such as the Ogasawara Islands is a product of the dynamic interplay between terrestrial and marine environment.*[22)]" And that, the IUCN also requested the clarification of the relationship between the nominated property and the broader National Park (id est. "Ordinary Zone"): "*[T]he State Party is kindly asked to confirm that, in effect, the surrounding national park designation serves as a functional buffer zone for the nominated property in line with the provision in the Operational Guidelines.*[23)]" It is ironic that the letter from the IUCN was made public on the "Oceans Day" at the very venue where Japan was then hosting the CBD-COP10 session.

Furthermore, in the process of working to register world heritage sites, this is the second time Japan has been requested to expand the marine area of the nominated site; the first being during the nomination for the Shiretoko Peninsula[24)]. We can consider that this time, knowing the defect of Ogasawara's marine area management, the Japanese government chose to deliberately use external pressure to help it expand the marine area of the site.

Immediately after receiving the letter from the IUCN, the Japanese government entered into a discussion with the local fishery cooperative, and in November 2010 sent a reply to the IUCN stating that the existing Marine Park Areas in their entirety would be included in the nominated site (as a result the marine area increased by 5.31 sq km) and confirmed the buffer status of the Ordinary Zone of the National Park[25)].

However, management of the Ogasawara Islands marine area is still only maintaining the status quo. Before and after nomination, Marine Park Areas were slightly extended but no measures were taken to improve management standards and no special marine management body was established (while Shiretoko satisfied them). As we saw in section III, amidst the tendency in remote island heritage management to use protected areas as leverage, Japan’s policy here, in light of the article 7 of the Basic Act on Ocean Policy (which reads "*...promotion of measures with regard to the oceans shall be executed under the international partnership, aiming at bearing the leading role for the formation and development of the international order*"), has left room for doubt.

As long as the marine management standards of Ogasawara Islands World Heritage Nominated site would not improve, it is too much to hope for advancement of other Japanese remote islands management.

V. Conclusion

Leveraging the WHC, UNCLOS and CBD, etc., we are entering an age where the conservation of biodiversity in not only terrestrial properties, but in their surrounding marine environments as well, is being advocated, and comprehensive management using protected zones is being positively appraised. Although there are many unique aspects of remote island management such as the degree of isolation from the mainland, population and number of visitors, and economic conditions that should not always be discussed in a fashion similar to those of the mainland, approaches that seek to offer equivalent or greater marine management than that which is afforded the mainland are currently being sought.

If such practices accumulate, current situation (using remote islands only as a base point of claiming EEZ) need to be re-examined. Almost 30 years has passed since the adoption of the UNCLOS. Now we must quit a perpetual "rock or island" dispute and open the door for ecologically sustainable management of surrounding sea areas of remotes islands. In doing so, once again we must recall that UNCLOS provides not only rights to coastal states extending broad EEZ but also obligation to manage marine environment with sustainable manner.

** This work was supported by KAKENHI (21330012) Grant-in-Aid for Scientific Research (B)*

1) The relationship with Article 121 of the UNCLOS, the “Regime of Islands,” is what poses a problem here. Last year I discussed in my paper ("The Role of Remote Islands in the Management of the Seas with a Focus on Japan's Remote Island Policy," in *Proceedings of International Seminar on Islands and Oceans 2010*, Ocean Policy Research Foundation, March 2010), the current state of remote island management. Though very rare, I have heard that the paper’s effect is at times misunderstood, and I would like to once again clarify my meaning here. In light of the previous arguments regarding interpretation of the article 121 of the UNCLOS, I find myself it is difficult to sharply distinguish "rock" and "island," however I am not arguing that if a “rock” is properly managed it can be interpreted as an “island.” Conversely, what I posed a problem is that remote islands, which have been granted vast sea areas under the UNCLOS, are still now, almost 30 years after the adoption of UNCLOS, being used not as a base of marine environmental management but as a base point on a map only for claiming EEZs. In other words, my intent is that "if you want to retain EEZs, you have to manage remote islands properly based on the UNCLOS and other conventions such as CBD."

2) CBD-SBSTTA has also discussed the remote island management. However, there is little progress after the adoption of the *Recommendation X/1* ("Island Biodiversity"), 2005.

3) Details of the Japanese remote islands legislations, see Kagami, *supra* note 1.

4) As of August 2010, the number of the World Heritage sites with marine components are 51. Among them, 43 are identified for ecology/biodiversity, 16 are coastal sites. Beyond that, 49 are on the tentative list. See Fanny Douvere, "World Heritage Marine Programme: The Future 2010-2013," Power point presentation (26 Jan. 2010), at <http://whc.unesco.org/uploads/activities/documents/activity-13-7.pdf>. Figures are updated.

5) However, *Operational Guidelines for the Implementation of the World Heritage Convention* was also adopted. The latest version of it was adopted in January 2008 (WHC- 08/01).

6) WHC-05/29.COM/5, pp. 16-18.

7) Fanny Douvere, "World Heritage Goes Marine," in Smithsonian National Museum of National History, *Ocean Portal*, at <http://ocean.si.edu/blog/world-heritage-goes-marine>.

8) Practices regarding other newly inscribed World Heritages - Papahānaumokuākea Marine National Monument and Phoenix Islands Protected Area are examined in Yasuhiko Kagami, "Environmental Policy for Desert Islands - Beyond 'Island or Rock'," in *Proceedings of International Symposium on Islands and Oceans*, Ocean Policy Research Foundation (March, 2009), pp.104-115. In December 2010, the leaders of the 5 Marine Protected Areas - Papahānaumokuākea Marine National Monument (US) and the Phoenix Islands Protected Area (Kiribati), Great Barrier Reef Marine Park (Australia), Motu Motiro Hiva Marine Park (Chile) and the Marianas Trench Marine National Monument (US) - met for the first time at a summit called "Big Ocean – A Network of the World's Large Scale Marine Managed Areas" and made the Big Ocean managers network MPAs. See *"BIG OCEAN"–A NEW ERA FOR OCEAN PROTECTION*, at <http://bigoceanmanagers.org/document/Press%20Release%20Big%20Ocean.pdf>.

9) Sea Around Us Project website, at <http://www.seaaroundus.org/eez/>.

10) Some of the World Heritage values of the Lord Howe Island group specific to the marine environment include: the unusual combination of tropical and temperate marine flora and fauna, including many species living at their distributional limits, reflecting the extreme latitude of the coral reef ecosystems which comprise the southernmost true coral reef in the world; the diversity of marine benthic algae species, including at least 235 species of which 12 per cent are endemic; the diversity of marine fish species, including at least 500 species of which 400 are inshore species and 15 are endemic; and the diversity of marine invertebrate species, including more than 83 species of corals and 65 species of echinoderms of which 70 per cent are tropical, 24 per cent are temperate and 6 per cent are endemic. Department of Sustainability, Environment, Water, population and Communities of Australia website, at < http://www.environment.gov.au/coasts/mpa/lordhowe/index.html#history>.

11) For details, see Lord Howe Island website, at <http://www.lordhoweisland.info/conservation.htm>.

12) Commonwealth of Australia, *Lord Howe Island Marine Park (Commonwealth Waters) Management Plan,* at <http://www.environment.gov.au/coasts/mpa/publications/pubs/lordhowe-plan.pdf>

13) Lord Howe Island Tourism Association website, at <http://www.lordhoweisland.info/conservation/marine_park.htm>

14) UNEP-WCMC website, at <http://www.unep-wcmc.org/sites/wh/pdf/Lord%20Howe%20Is.pdf>.

15) Department of Sustainability, Environment, Water, population and Communities of Australia website, *Lord Howe Island Marine Park Management Plan*, at <http://www.environment.gov.au/coasts/mpa/lordhowe/management.html>.

16) Australian National Periodic Report, Section II, at <http://whc.unesco.org/archive/periodicreporting/APA/cycle01/section2/186.pdf>.

17) For details, see UNEP-WCMC website, *GALÁPAGOS ISLANDS NATIONAL PARK AND MARINE RESERVE ECUADOR*, at <http://www.unep-wcmc.org/sites/wh/pdf/Galapagos.pdf>.

18) Sea Around Us Project website, at <http://www.seaaroundus.org/eez/>.

19) Unofficial English version of *The Special Law of the Galápagos* or *Special Regime Law for the Preservation and Sustainable Development of the Province of Galápagos,* at <http://whc.unesco.org/archive/ecu-gal.pdf>.

20) Parque Nacional Galápagos website, *Environmental Management in Populated Areas,* at <http://www.galapagospark.org/nophprg.php?page=desarrollo_sustentable_zonificacion>.

21) Ministry of Land, Infrastructure, Transport and Tourism, *Basic Guidelines on the Promotion and Development for the Ogasawara Islands* (in *Japanese*), 2009.

22) Letter from Tim Badman, Head-World Heritage Programme, "IUCN Evaluation of the 'Ogasawara Islands' (Japan) - Request for Supplementary Information," (14 September 2010), at <http://www.env.go.jp/press/file_view.php?serial=16320&hou_id=12985>.

23) *Ibid*..

24) On the history of nomination of Shiretoko and its impacts on Japanese marine protected areas, see Yasuhiko

Kagami, "Japanese MPAs at a Turning Point: Nomination of Shiretoko For World Heritage Status," in Michael I. Jeffery, Jeremy Firestone, Karen Bubna-Litic (Eds.), *Biodiversity conservation, law + livelihoods : bridging the north-south divide*, Cambridge University Press, 2008, pp. 251-268.

25) Government of Japan, *Supplementary Information for IUCN Evaluation of the "Ogasawara Islands,"* November, 2010, at <http://ogasawara-info.jp/pdf/isan/kaitou_en.pdf>.


2nd International Seminar on Islands and Oceans
November 29, 30, December 1, 2010
OPRF Ocean Policy Research Foundation
Co-Organizers: ANCORS SOPAC

Administration and Editorial Office

Ocean Policy Research Foundation

'2nd International Seminar on Islands and Oceans'

Project Team

Hiroshi TERASHIMA	Executive Director
Takashi ICHIOKA	General Manager, Policy Research Department
Yoshinori SUGAWARA	〃
Shizuka KAWATSU	Research Fellow, Policy Research Department
Kazuyuki MAIWA	〃
Hiroko SASAKI	〃

ボートレースファンからの贈り物
この報告書は、ボートレースの交付金による日本財団の助成金を受けて作成しました。

Proceedings of 2nd International Seminar on Islands and Oceans

平成23年3月発行

発行　海洋政策研究財団（財団法人ｼｯﾌﾟ・ｱﾝﾄﾞ・ｵｰｼｬﾝ財団）

〒105-0001 東京都港区虎ノ門1-15-16　海洋船舶ビル
TEL 03-3502-1828　FAX 03-3502-2033
http://www.sof.or.jp　E-mail：info@sof.or.jp

ISBN978-4-88404-254-7