This issue of "ISLAND STUDIES – Indian Ocean/Océan Indien" is a collective effort of individuals and institutions sharing their thoughts on some aspects of the Blue Economy paradigm, opportunities emerging and challenges posed to small island states of the Indian Ocean region and beyond. Its release, coinciding with the United Nations Framework Convention on Climate Change in Paris, serves as a reminder of the looming effects of climate change on ocean resources. The contents also touch upon anthropogenic pressures on these resources, which can deal a severe blow to the legitimate expectations of island states for expanded economic growth and sustainable development.

While in the first issue of the publication we were mostly bent towards addressing the vulnerability of Small Island Developing States (SIDS), in the present one, we are making a perspective shift as we contemplate the vast expanse of sea that stretches around the islands, convinced that it can open the door to opportunities likely to enhance the quality of life of millions of islanders. Key to these potential openings, the Blue Economy is for most of the islands the unexplored vehicle for sustainable development. This new economic paradigm can drive income growth and employment prospects without environmental risks if the context provides for the right policies and their proper implementation.

Promoting the Blue Economy agenda of islands will rest on a strong sense of solidarity from those countries that are far advanced in terms of knowledge in the area and potential for investment. The partnership between small islands and established pioneer countries in marine resource use and management cannot be overstated. In the same vein, the cooperation among islands exploring the opportunities that lie at their shores is becoming a condition for progress that requires further strengthening.

Seychelles has clearly set its sustainable development agenda, and promoting the Blue Economy holds a priority rank therein. The country is developing its Blue Economy Roadmap. This is in relation to the utilisation of coastal and marine resources as applied to the development of the Blue Economy for SIDS (itself evolving from the Green Economy). It is focusing at this stage on a few achievable areas in relation to Biotechnology, Renewables and Fisheries/Mariculture. It is in support of this enterprise that the Blue Economy Research Institute (BERI) has been established within the University of Seychelles. Its broad objective is to stimulate thinking and establish a knowledge sharing platform: essential ingredients for successfully embarking on and implementing a relatively new endeavour. The networking with individuals and institutions likely to contribute to attaining this objective is a key strategy of BERI, and the present publication is a reflection of the efforts made to that end.

Contributions contained in this ‘Blue Economy’ issue sit well with the spirit that guides ISLAND STUDIES as a forum promoting the understanding of complex issues that challenge the development of the islands of the Indian Ocean Sub region and beyond. The publication aims at going beyond constraints of an exclusive periodical solely destined for scholarly discourse. Apart from articles linked to research, it welcomes other contributions of academic value, policy analysis, reviews, as well as technical and opinion papers that contribute to an understanding of issues pertaining to islands.

This edition – Exploring the Blue Economy – brings together intellectuals and professionals from the public and private sectors, NGOs, universities, teachers, researchers, and policy makers to discuss and share knowledge. The readers also are drawn from beyond the parameters of the academic circle. Altogether, this creates a larger forum than what is traditionally expected in journal publication enterprises.

The reader is therefore presented with articles of diverse tenors and styles, covering government policies, the legal framework, shoreline resilience, untapped opportunities in tourism in a small settlement, the significance of knowledge management in the new Blue Economy concept, and an exchange with an author who pioneered his own version of the Blue Economy. These contributions have been reviewed and we here acknowledge the efforts put in by authors and reviewers in the realisation of the present publication.

In the spirit of Exploring the Blue Economy, BERI and the University of Seychelles, which led the present publication, would be pleased to hear from individuals and organisations interested in the subject, an invitation that is in line with their networking and knowledge sharing mission for advancing the blue economy agenda.

Dr Kris M. Valaydon
Developing Knowledge to Transition to a Blue Economy:
A Strategic Approach

Keywords: Blue Economy, Blue Knowledge, Knowledge Transfer, Small Island Developing States, Sustainable Development

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Abstract

The emerging concept of the Blue Economy is being pioneered by Small Island Developing States (SIDS) as a mechanism for sustainable development of their ocean-based economies. SIDS share common drivers of socioeconomic progress, energy and food security as well as common realities with regard to the adverse impacts of climate change. An integrated and holistic approach is essential to enable growth and innovation in multiple maritime sectors within a Blue Economy, while fully accounting for the social, ecological and economic consequences. Challenges faced in implementing the Blue Economy are complex, multi-faceted and interdisciplinary, and development and application of new knowledge, tools and processes is needed to enable SIDS to maximise available opportunities while effectively accounting for risks. This article lays out a pathway for the development of knowledge management, as a key facet of Blue Economy realisation. To support SIDS in progressing towards coherence between policy, planning and management action, and the emerging vision of a Blue Economy, this paper provides a basis for developing a strategic approach to addressing knowledge needs. It highlights that since different types of knowledge are required for the multi-level purposes of policy, planning and management action, there is a need for considered design of knowledge development agenda. The implementation of cutting-edge policy challenges traditional approaches to research and there is a further need to reassess the roles of key actors in knowledge development and for new mechanisms to transfer knowledge into action when implementing the Blue Economy.

Knowledge required to support a Blue Economy

These aims are highly laudable; however, while they are easy to articulate at the level of political ambition, their execution is highly complex, and the pathway from intent to action is uncharted. This article lays out a pathway for the development of one key facet of this process, that of knowledge management. There are parallels between the goals and mechanisms of a Blue Economy and the ‘knowledge-based economy’ in delivering sustainable development, including emphasis on the central role of intellectual capacity in maximising returns on natural capital (OECD 1996). If the Blue Economy is to meet its aims, then those developing it must have access to the best available knowledge. This will ensure that the maximum value can be achieved from any resource through sound planning and management, ensuring that the best decisions can be made regarding the balance between economic development and sustainable resource use.

Introduction

The Blue Economy is an emerging mechanism to address sustainable development of ocean states, and has been strongly championed by small island developing states (SIDS), with particular political emphasis being given to it by the Republic of Seychelles. The defining parameters of the Blue Economy are not new, being derived from the preceding emphasis on sustainable (green) terrestrial development (UNEP 2011). These core parameters recognise that environmental and economic sustainability are inexorably linked. For the continued provision of resources for future generations to be safeguarded, decisions linked to further economic activity must be fully informed to ensure that critical social or ecological limits are not exceeded. Many SIDS see the Blue Economy as a mechanism to create economic development for poverty alleviation, health, food and energy, while protecting the ecosystem upon whose services many of the SIDS economies are predominantly based, including tourism and fisheries.
according to their potential socio-economic and ecological benefits as well as their costs in order to determine appropriate policy, planning and management actions. Effective, open and fair debate over desirable pathways of action can only be facilitated based on good information and scientific evidence, and the development of evidence-based policy (Solesbury 2001).

Each of these “stepping stones” is relevant to different tiers of policy, planning or management action. The actions require different types of information, combinations of qualitative and quantitative data (physical, ecological, geological, etc.) and social input (cultural views, economic information, etc.), to facilitate the practical development of specific maritime activities.

The first step is to move from the strategic political vision to develop the Blue Economy to the development of the policy framework that stimulates and steers development. This requires interpretation and translation of the concept into policy objectives at a national level, considering the complex relationships between sectors (such as energy, aquaculture, tourism, etc.), local and global markets, etc. While initially daunting and complex, the integration of multiple objectives (economic, energy, food, etc.) within a strategic Blue Economy framework is positive and desirable, as it signals transition from fragmented, disparate policies and governance mechanisms, to more integrated approaches. In addition to embedding sustainability as a core consideration in developing maritime activities, more coherent, effective and resource-efficient plans can be implemented under such a framework. Where governments are proactive, reflexive and adaptive, implementing the Blue Economy allows overlaps, redundancies and synergies to be identified and addressed through more efficient national policy and planning. Targeted development of knowledge through strategic high level studies, complemented with international expertise, can provide knowledge and examples that can enable such novel integrated governance to emerge from existing institutional practice.

Once this is achieved, the next step is from policy to implementation, requiring national strategic planning in relation to specific maritime sectors (e.g. mariculture or tourism), or other objectives (e.g. welfare, education). On the basis of supporting policies, research needs to focus on understanding the feasibility and desirability of expanding existing maritime sectors, in addition to exploring the appropriate scale and location of new ones (such as aquaculture or marine renewable energy). Strategic sectoral planning must be integrated across sectors at the highest level to ensure synergies and mitigate conflicts, adapting traditional institutional practice as necessary. The spatial element of strategic planning then follows, using regional and national datasets to support indicative locations of developments. This step should be addressed through marine spatial planning, which can account for multiple sectors and develop solutions to optimise the use of space and resources.

Operationaılisation of the Blue Economy is realised at the level of project installation, whether aquaculture or renewable energy, etc. At this stage, detailed local investigations are required to establish specific potential social and ecological effects, in order to make management decisions (which in some cases may include trade-offs between different sectors). Communication and flow of information between these levels is critical to ensure feedback and refinement of evidence-based approaches to decision making in policy and management.

**Types of Knowledge**

A strategic approach is required to consider the broad range of knowledge requirements within a Blue Economy and to address them in a cost- and time-efficient manner. As highlighted above, a range of different types of information and quality of data and knowledge is relevant at the different stages of policy, planning and project development. Developing a strategy for research around specific needs (e.g. a policy on specific targets for renewable energy, planning of particular spatial zones for aquaculture development, or management decisions to issue licenses for development) provides greater clarity on the knowledge activities needed, the costs involved, and the appropriate actors to lead them.
Figure 2. Different levels of information / knowledge are needed to support translation of a Blue Economy vision to an operational level of project development.

Figure 2 gives examples of the different types of information needed relevant to specific activities and programmes of data collection should be designed using appropriate scientific rigour, to ensure that they are of appropriate temporal and spatial scale, and suitable for the evidence needs of particular actions. For example, broad level understanding of seabed habitat information may be appropriate for strategic planning regarding sector development (e.g. the location of activities such as wind farms or aquaculture cages to minimise the risk of negative effects). However, a more detailed understanding of specific environmental conditions will be required upon development of a particular project site, in order to quantify, with relative accuracy, the potential impacts and to fulfil regulatory requirements (e.g. through Environmental Impact Assessment). The level of accuracy and precision is strongly correlated to the investment required for new studies.

Considering the ultimate use of data or knowledge in terms of policy, planning or management is important when reviewing the availability and ‘quality’ of data, as well as in ascertaining the appropriate level of investment required for new studies.

**Interdisciplinary Research and Dialogue**

In a Blue Economy framework, greater integration between scientific disciplines is needed to evaluate the implications for the environment and society, and to support decision making in relation to diverse social, economic and ecological objectives. At the operational level of planning and management, this includes the ability to integrate evaluation of potential socio-ecological effects of multiple sectors, in order to make comparisons, address synergies and consider trade-offs.

Active participation of non-scientists (including formal and informal governance actors) is crucial to develop the science to deal with interdisciplinary questions related to socio-ecological systems. Issues of ‘sustainability’ are inevitably a process of ‘social negotiation’ requiring shared expression and acknowledgement of different perspectives, worldviews and priorities. This calls for ongoing, inclusive processes of negotiation over appropriate future development scenarios. Processes of dialogue in implementing the Blue Economy are therefore of critical importance in enabling shared learning and participation in implementing sustainability policy.

The limits of traditional scientific approaches in addressing objectives of sustainability have been previously noted (Mayumi & Giampietro 2006; Ravetz 2006), and the importance of integration across disciplines, with other forms of knowledge, including that of key actors in the process, has been clearly stated. There are significant methodological and conceptual challenges in developing such forms of knowledge. However, there is an emerging field of thought that addresses interdisciplinary (and multi-disciplinary, trans-disciplinary) science, and considers new methods of knowledge ‘co-production’ (Future Earth 2014), involving governance actors and stakeholders directly in research activities, which is highly relevant to the ongoing development of knowledge to inform a Blue Economy.

**Actors in Knowledge Development**

Strategic use of limited capacity and resources in gathering and managing information is essential, particularly in the constrained economies of SIDS, as is collaboration between key actors (including public and private resources). Leadership is required at the level of Government (with appropriate input from business, academic and NGO communities) to initiate and direct appropriate high level studies which shape the policy agenda, as well as the political direction and ownership of Blue Economy initiatives. At the beginning of the process, the capacity to do this may be locally absent, and there may be a need to strategically create this through external collaboration (while retaining ownership of the process and its products). The role of industry, as primarily motivated by business interests, becomes more relevant at the level of specific project development. Their focus will necessarily be on detailed investigations to ensure
project feasibility, inform design in addition to addressing specific regulatory and licensing requirements. Business interests can be motivated to invest in strategic research activities where there is clear supportive government policy and where they are likely to see benefits for their sector in the longer term. Throughout the entire process, those actors with an interest and a role to play in implementation (i.e. academics, NGOs and civil society) need to be engaged to ensure their input is considered where most relevant.

Collaboration and Integration

Data is collected by many agencies for a multitude of purposes, such as industry conducting an EIA, government assessing a fishery stock, or academia undertaking scientific studies. These data offer considerable value beyond their original intended use, underlining the importance of a collaborative and strategic approach to both acquiring and facilitating access to data. Mechanisms need to be put in place to enable the sharing of data among actors, including identifying an appropriate central platform and developing data sharing agreements to address quality issues and ensure proper use (accounting for uncertainty, etc.).

Active leadership is critical in establishing an integrated strategy of knowledge management, where collaboration between public / private actors (Government, academia, external investment, business interests, NGOs, etc.) can make the best use of available resources. The value of such collaboration will be of great help in supporting collective ownership of knowledge activities to implement the Blue Economy through sound, evidence-based policy, plans and projects, and the on-going learning process through adaptive management cycles.

Knowledge Transfer and Communication Mechanisms

Knowledge exchange is essential to ensure a flow of knowledge both into and out of the Blue Economy knowledge management framework. The establishment of formal mechanisms and communication channels to discuss information is essential to ensure sound, evidence-based decision making. These mechanisms must enable the review and evaluation of inter-disciplinary scientific evidence, and elicitation of expert judgement to support decision making which accounts for uncertainty, without limiting progress.

Data and understanding generated through studies undertaken locally and through practical experience, need to feed back into higher level policy and planning to enable continued refinement of approaches through adaptive management (see below). The two-way flow of information also facilitates the response of the scientific community in addressing particular knowledge gaps in achieving the objectives of the Blue Economy.

“**A strategic research agenda is essential to consider the relevance of information gathered to date**”

Mechanisms for the flow of information may require identification, or the development of committees / fora with both the technical capacity to discuss information arising from scientific studies and the authority to make decisions on changes in particular courses of action. Bearing in mind capacity challenges, this should be considered in light of existing institutional organisation and fora, for example parliamentary steering committees, national research committees, etc., rationalising wherever possible.

Strategic Research Agenda

A strategic research agenda is essential to consider the relevance of information gathered to date, identify remaining knowledge gaps and prioritise research activities over the short, medium and long term. Co-ordinating this strategically balances the capacity and remit of other actors, including industry and NGOs, in delivering appropriate information. Integrating planning of data needs and activities across all areas could highlight where most strategic investment in research should be made, including for the delivery of ‘quick wins’ and how to collaborate in addressing more complex challenges to ensure a sustainable Blue Economy over the long term. The strategic research agenda is also a good mechanism to foster the necessary collaborative links between industry, academia, government and NGOs. Developing a specific timetable and framework for refining the research strategy is essential, and could be helpfully aligned with other key processes which will highlight key knowledge gaps such as review cycles of marine spatial planning initiatives, and associated monitoring and evaluation programmes. Given the interlinked terrestrial and marine activities and the need to consider planning across the coastal zone, the broader integration of research, knowledge developments and activities with non-marine activities may be relevant.

Adaptive Management

On-going monitoring and evaluation of governance processes involving governing institutions, scientific experts, and civil society is a key tool to monitor feedback from the system, enabling collective learning and improvement as understanding increases (Kaufman, cited in Ruckelshaus et al. 2008). Adaptive approaches provide critical opportunities for reflection and adjustment that ensure that institutional arrangements are appropriately addressing the objectives of the Blue Economy. Programmes of review and adaptive management should be aligned with other relevant processes, such as on-going development of marine spatial planning (MSP), sustainable development strategies, etc.

Adaptive management relies on feedback from monitoring (on-going surveillance of activities and the socio-ecological effects) to ensure that there is progress towards objectives, without unacceptable negative consequences. At the earliest stages of Blue Economy implementation, it is appropriate to consider questions such as –“How will we know what ‘success’ looks like? And what are the indicators which would require a change in approach?”
Defining clear and measurable objectives related to sustainable development is a challenging task, hence the importance of a monitoring programme which enables "learning by doing" with the confidence that social/environmental thresholds will not be crossed. Indicators would need to be established for individual activities, or parameters of concern, such as in the case of aquaculture in Seychelles, to address the objective of the Seychelles Mariculture Master Plan to "maintain the genetic diversity of farmed aquatic species".

**Conclusion**

Progressing towards a Blue Economy is a long-term ambition and a programme of adaptive management is critical to enable "learning by doing", taking a risk-based approach to development that balances economic progress with the need to respect social and ecological limits. Novel approaches to knowledge development and transfer, as well as management mechanisms that facilitate informed decision making, will be required. In most scenarios this may best be achieved by adapting and rationalising existing arrangements. Processes of dialogue and engagement are essential, including involvement of a wide range of stakeholders, in order to bridge the gap between best available evidence and fair judgement in decision making. Addressing the complex and novel challenges of the Blue Economy requires openness, the capacity to adapt traditional roles and to enable innovative collaboration between actors (such as government, academia, NGOs, industry, civil society, etc.). This is essential to both ensure collective ownership of the Blue Economy concept, and that capacity for research and knowledge management is used to best effect.

Implementing the Blue Economy provides an opportunity for societal, political, economic changes to address multiple and diverse policy objectives, underpinned by sound scientific evidence, data and knowledge. This evidence-base can be strategically developed through national research agenda, with emphasis on inter-disciplinary research to fully evaluate and compare social and ecological development. These iterative mechanisms of knowledge development and transfer can assist in addressing the broad range of knowledge and information needed to translate the Blue Economy concept into reality.

**Résumé**

Promu par les Petits Etats Insulaires en Développement (PEID), le concept émergent de l’économie bleue constitue un mécanisme de développement durable pour les économies axées sur l’océan. Ces Petits États ont en commun les mêmes moteurs de croissance socioéconomique, parmi d’autres facteurs, comme la production d’énergie, la sécurité alimentaire, ainsi que les mesures d’adaptation aux effets néfastes du changement climatique. Une approche intégrée et holistique est requise pour assurer la croissance et l’innovation au sein de divers secteurs de l’économie bleue, tout en tenant pleinement compte des conséquences sociales, écologiques et économiques. Les défis inhérents à l’implémentation de l’économie bleue étant complexes, multidimensionnels et interdisciplinaires, de nouvelles connaissances et de nouveaux outils et procédés doivent être développés et implémentés pour permettre aux PEID d’optimiser les opportunités qui s’offrent à eux, tout en prenant compte des risques de manière efficace. Cette communication propose une voie vers le développement de la gestion du savoir en tant que facteur-clé de la matérialisation de l’économie bleue.

Afin d’aider les PEID à aller vers des actions cohérentes entre politiques, démarches de planification et de gestion, et une vision émergente de l’économie bleue, cette communication pose les bases en vue du développement d’une approche stratégique pour répondre aux besoins sur le plan de la connaissance. Elle met en exergue que – compte tenu des différentes formes de connaissance requises pour les besoins multiples en termes de politique, de planification et de gestion – l’élaboration minutieuse d’un programme de développement de la connaissance est requise. L’implémentation d’une politique de pointe repose en question les approches traditionnelles envers la recherche. Il y a, de plus, un besoin accru de reconsidérer le rôle des acteurs-clés du développement des savoirs et de créer de nouveaux mécanismes pour traduire les connaissances en actions lors de l’implémentation de l’économie bleue.

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The Seychelles consists of 115 Islands set within a vast ocean space. Its abounding natural environment supports the local community and attracts tourists, nature lovers and researchers from all over the world. With the international community working on progressing sustainable development agendas, the Seychelles has valorized its coastal and ocean space as the key to sustainable development initiatives in the country. This aligns with international initiatives focusing on the concept of a sustainable ocean-based economy or “Blue Economy”, as endorsed by the 2012 Rio +20 United Nations Conference on Sustainable Development. Unless the environment is carefully explored and monitored, the potential wealth of our ocean-based economy itself will be diminished.

To support the development of a knowledge-based society, the University of Seychelles has formed the Blue Economy Research Institute (BERI), which will identify and coordinate research synergies between different sectors and actively seek partners to support and advance sustainable development initiatives.

Research and activities relating to the utilization of our coastal and ocean space being already underway in some areas, where is, therefore, the added value? The answer lies in a difference of approach, one that is:

- **global** as it will embrace all of the coastal and ocean resources that may be of value to all nations, but also **localised**, so that initiatives are embedded in the community
- **sustainable** in that it looks to the long-term development of a stronger ocean-based economy that has considered the needs of a healthy and dynamic environment through its development, particularly in Small Island Developing States where challenges to sustainable development are influenced by capacity constraints and a narrow terrestrial resource base

- **scientific, systematic, transdisciplinary and innovative**, so that the approaches to exploring and utilizing resources are guided by evidence-based monitoring, evaluation and management practices, while allowing innovative collaborations that promote continued advancement

- **impartial, inclusive and participatory** in its aims to stimulate research, while complying with Seychelles legislation and regulations, in a spirit of partnership with various institutions and individuals to allow for equitable sharing of benefits

The purpose of the BERI (as part of the University of Seychelles) is:

- to become a viable and active project and research management centre in its own right, that not only encourages local and international research collaboration, but also creates a hub within the western Indian Ocean region for generating, storing, managing, and transferring knowledge

- to create an active regional network of researchers and knowledge that facilitates partnerships, research development and knowledge transfer

- to provide a transparent, stimulating and innovative environment for undergraduate and postgraduate students, as well as international researchers to effectively undertake their own projects in the unique environment of Seychelles
How is it organised?

The BERI was established at the start of March 2015. Mrs Kelly Hoareau was appointed Director, working under the guidance of the Vice-Chancellor, Professor Dennis Hardy. The Institute serves as an umbrella organisation for organisations affiliated with the University and that aim to promote scientific studies, research and capacity building in Seychelles, such as the Island Biodiversity & Conservation Centre and the University Centre for Environmental Education.

An advisory board will guide and support the interests and activities of the Blue Economy Research Institute. It will monitor progress to guarantee excellence in all of the Institute’s activities, and ensure that its work is consistent with the Vision, Mission and Values of the University of Seychelles.

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Human Resource Planning and Development
Human Resource Information Systems
Principles of Human Resource Management

Labour Studies
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English Proficiency
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Seychelles Blue Economy Strategy

Keywords: Blue Economy, Sustainable Development, Oceans and Seas, Strategy, Conservation.

By Dr Marie-Therese Purvis

Abstract

The Seychelles Government has played a leading role in promoting the Blue Economy concept, especially on the international scene. It has consistently championed the principles of sustainable development and the protection of biodiversity since the launching of Agenda 21 at the 1992 Rio de Janeiro Earth Summit. Through the concerted efforts of coastal countries and Small Island Developing States (SIDS), including Seychelles, the role of oceans was finally acknowledged as crucial in planetary survival and human well-being at the Rio+20 Conference in 2012. Specific detailed actions aimed at the conservation and sustainable use of oceans and seas and of their resources were included in the conference outcome document ‘The Future We Want’. This is now being further reinforced by Goal 14 of the proposed Sustainable Development Goals.

In the Seychelles context, the Blue Economy refers to those economic activities that directly or indirectly take place in the ocean and coastal areas, use outputs from the ocean, and place ‘goods and services’ into ocean activities, as well as the contribution of those activities to economic growth, social, cultural and environmental wellbeing. It aims to transform economic development and human well-being through the judicious use of the resources that exist in the ocean. By conceptualizing the ocean as a development space where spatial planning integrates conservation, sustainable use, resource extraction, sustainable energy production and transport, the Blue Economy offers an alternative economic approach that is guided by environmental preservation principles. A number of related actions are already under way to effect the shift towards economic diversification and sustainable growth.

Background

Valuing the ocean is a concept that is not new to Seychelles. Since the islands were inhabited almost 250 years ago, the growing population lived in close proximity to the sea and largely depended on the ocean for food, trade, travel and communication with the rest of the world. Over time the country has drawn considerable benefits from its ocean resources, with the development of fisheries, tourism, trade, international and domestic shipping to support trade. At the same time, it has established itself at the forefront of marine conservation in the region, the government having consistently maintained that healthy oceans and seas are essential to a sustainable future for all, and not only for small island developing states. This point was reiterated by President James Michel in a recent meeting with the UN General Assembly President:

The Government of Seychelles is pleased that the United Nations has accepted ocean development and the concept of the Blue Economy as part of its development goals. The Blue Economy does not only represent small islands states but all the coastal states of all continents, Kenya, Somalia, Mozambique, Tanzania and South Africa... It has a massive potential for Africa, for the continent, for the islands of the coastal states and together we can harness its potential in a sustainable way, so that we can develop our resources (State House Newsroom, January 2015).

Indeed over the past few years the emerging concept of the Blue Economy has been embraced by many Small Island Developing States (SIDS) as a mechanism to realize sustainable growth based around an ocean economy. The term was first coined by SIDS and other coastal countries during the 2012 Rio +20 United Nations Conference on Sustainable Development, in recognition of the need to enhance marine-based economic development that brings about improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (United Nations 2013). At its core, this concept implies the decoupling of socio-economic development and environmental degradation.

Since then, the Blue Economy (also referred to as the ocean economy or blue growth) has become a key component of the new global dialogue about the role of seas and oceans in sustainable development. In particular the Open Working Group for Sustainable Development Goals has stipulated Proposed Goal 14 as follows: ‘Conserve and sustainably use the oceans, seas and marine resources for sustainable development’ (United Nations July 2015, p18). Ten targets, focusing mainly on conservation and damage mitigation, point...
towards expected actions to be taken under this goal, including one specific to SIDS: ‘by 2030 increase the economic benefits to SIDS and LDCs (Least Developed Countries) from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism’ (United Nations July 2015, Target 14.7).

Seychelles and the Blue Economy Concept

Like many other island nations, Seychelles has jurisdiction over a large area of ocean, claiming a vast Exclusive Economic Zone (EEZ) of 1.37 million square kilometres - the second largest in Africa. The government is therefore eager to realize the optimal potential of Seychelles’ oceanic territory by applying the Blue Economy concept as the foundation for economic diversification and sustainable growth. But what is the ‘Blue Economy’ concept for Seychelles?

While there is as yet no universally accepted definition for the Blue Economy, for Seychelles, the notion of the Blue Economy refers to those economic activities that directly or indirectly take place in the ocean and coastal areas, use outputs from the ocean, and place ‘goods and services’ into ocean activities, and also to the contribution of those activities to economic growth, social, cultural and environmental well-being.

The scope of the Blue Economy therefore includes:

1. Activities which explore and develop ocean resources
2. Activities which use ocean and coastal space
3. Activities which protect the coastal and ocean environment
4. Activities which use ocean products as a main input
5. Activities which provide goods and services to support ocean activities, and
6. Activities which develop mechanisms to ensure the benefits and equitable sharing of national wealth derived from the blue economy.

Central to this concept is an integrated approach to the sustainable use of the ocean, with clear commitments to ocean conservation and restoration, as illustrated by current policies and practices: over 50% of Seychelles terrestrial area is under protection and the Government has committed to increasing the marine protected areas to 30%, with 15% as “no-take” zones. Consequently the core principle encompassed within the Seychelles Blue Economy is the idea that all components must come together to support the ultimate goal of sustainable development for the Seychellois people and for future generations.

By conceptualizing the ocean as a development space where spatial planning integrates conservation, sustainable use, resource extraction, sustainable energy production and transport, the Blue Economy offers an alternative economic approach that is guided by environmental conservation principles. It challenges the status quo whereby oceans have been viewed as a means of free resources and an unlimited sink for the disposal of waste; it shifts the focus to where ocean values and services are included in economic modeling and decision-making, and where the benefits are shared more equitably among all Seychellois.

Overall Goals of the Seychelles Blue Economy

With respect to the Blue Economy, the Government’s overarching goals are:

1. Managing and protecting the coastal and marine environment in a sustainable and responsible manner for present and future generations.
2. The promotion of economic diversification - to reduce vulnerability from reliance on a small number of existing sectors and to increase the percentage of GDP derived from coastal and marine sectors.
3. Creation of high value jobs – while unemployment levels in Seychelles are not high, the creation of higher value jobs is essential for a science-based approach.
4. Ensuring food security, through effective and sustainable utilization of marine resources.

The expected outcomes of the Blue Economy approach to sustainable development therefore include:

- Increased investment in existing ocean-based economic sectors (particularly tourism, fisheries and shipping) to realise greater monetary value from the existing resource base.
- The development of new economic sectors based on existing marine resources (for example marine-based aquaculture, offshore petroleum and marine biotechnology creating products and processes).
- Greater protection for Seychelles’ ocean spaces and resources through better coordination across different sectors, application of protective measures and greater use of surveillance and enforcement tools, and
- New research, innovation and generation of knowledge about Seychelles’ ocean space and management needs.

Translating new opportunities into productive sectors will require investment in research and development, building technical capacity and creating the right environment to attract and retain human capacities and outside investment. Furthermore, the Blue Economy is fundamentally about social inclusion. It is founded on the belief that real, tangible, effective results may only be achieved if an entire community is involved and works together. The ocean remains a space of equal opportunity for all.

Seven key thematic areas (or ‘enabling conditions’) have been identified as being vital for creating the conditions for growth, investment and conservation in Seychelles:

1. A healthy, resilient and productive coastal and marine environment
2. Effective and transparent ocean
If successfully implemented, a number of features should be prominent in Seychelles’ Blue Economy:

- Protection and recovery of coastal and ocean ecosystems and biodiversity would be prioritised;
- Existing ocean industries (e.g. fisheries, shipping and offshore petroleum exploration) would have upgraded their activities to ensure that their operations cause minimal environmental impact and meet the highest levels of sustainable practice;
- Integrated cross-sectoral spatial planning, including coastal zone management, would be in place for all sea uses at the national level;
- Optimisation of and sustaining revenues derived from fisheries and fisheries-related products;
- Established and increasing sustainable use of bio-resources, including biotechnology (bio-prospecting, access and benefit sharing) and marine ecosystem services;
- Greater production and utilisation of renewable energy from the ocean would occur and renewable energy strategies would be engaged in development initiatives/activities;
- Disaster risk management practices and adaptation planning would be in place for rising sea levels and foreseeable climate change impacts;
- Surveillance of offshore waters would be strengthened through enhanced maritime domain awareness, and existing laws would be robustly enforced;
- Branding Seychelles as a “blue” tourism destination would be used to promote the nation’s comparative advantage in this sector;
- Knowledge generation and collaboration will be facilitated to assist with capacity development and enhanced/informed/joint decision making.

**Actions so far and a Way Forward**

The Seychelles Government has played a leading role in promoting the Blue Economy concept nationally, regionally and internationally. It has consistently championed the principles of sustainable development and the protection of biodiversity since the launching of Agenda 21 at the 1992 Rio de Janeiro Earth Summit, through to the Barbados Programme of Action of 1994 (BPOA), the Johannesburg 2002 Plan of Implementation, the 2005 Mauritius Strategy, and more recently at the RIO+20 Conference on Sustainable Development. The outcome document of this conference, entitled “The Future We Want” (2012) includes in its ‘Framework for action and follow-up’ detailed actions related to ‘Oceans and Seas’ (United Nations, 2012 p.27), emphasising in its introductory section the importance of the conservation and sustainable use of oceans and seas:

We stress the importance of the conservation and sustainable use of the oceans and seas and of their resources for sustainable development, including through the contributions to poverty eradication, sustained economic growth, food security, creation of sustainable livelihoods and decent work, while at the same time protecting biodiversity and the marine environment and addressing the impacts of climate change. We therefore commit to protect, and restore, the health, productivity and resilience of oceans and marine ecosystems, and to maintain their biodiversity, enabling their conservation and sustainable use for present and future generations, and to effectively apply an ecosystem approach and the precautionary approach in the management, in accordance with international law, of activities impacting on the marine environment, to deliver on all three dimensions of sustainable development (UN 2012, p.27).

This significant shift at Rio+20 in fully acknowledging the crucial role of oceans in planetary survival and human well-being, was largely due to the concerted efforts of Small Island Developing States (SIDS), including Seychelles, Indian Ocean Rim and other coastal countries (UN, 2014). Since then Seychelles has maintained its position as a leader in the promotion of the Blue Economy for the realisation of sustainable development.

At local and international levels the government has engaged in consultation and dialogue with stakeholders and development partners. A number of actions have been taken to spearhead the country’s move towards embracing the Blue Economy paradigm, including the setting up of a Blue Economy Department within the Ministry of Finance, Trade and the Blue Economy. The highlights of such actions are outlined below.

**The First Blue Economy Summit – January 19-20, 2014**

The Government of Seychelles and the Government of the United Arab Emirates co-hosted the first ‘Blue Economy Summit’ during the Abu Dhabi Sustainability Week of January 2014, to explore ways in which the Blue Economy concept could be utilised as a tool to enable the transition of development models for small island and coastal states towards sustainable development, building on the Rio+20 consensus.

The summit was attended by Heads of States and high level representatives of governments, as well as representatives of international organisations, including the Food and Agricultural Organisation (FAO), the United Nations Conference on Trade and Development (UNCTAD) and the President of the UN General Assembly.
Participants adopted the Abu Dhabi Declaration which presents the Blue Economy concept as one that emphasizes conservation and sustainable management of oceans, and complements the green economy. The blue economy approach also recognizes the productivity of healthy ocean ecosystems as a way of safeguarding sustainable ocean-based economies, while ensuring that SIDS and other coastal countries benefit from their marine resources.

The Declaration stresses the importance of an enhanced mechanism for governing the high seas and urges further development of an integrated ecosystems approach to maintain balanced, healthy and productive marine ecosystems, including valuing blue capital and considering blue carbon trading. The Declaration also expresses concern about threats to oceans, including acidification, habitat destruction, pollution and unsustainable exploitation. It recognizes that States should enhance management of ocean and seas to minimize and mitigate unsustainable exploitation of marine resources. It reaffirms the integral importance of cooperation, both national and international, including civil society organisations; and it urges states, international agencies and donors to develop means to support and facilitate the implementation of the Blue Economy in developing countries.

The Abu Dhabi Declaration also informed further debates on how island nations and ocean-linked communities move towards a more sustainable development trajectory, during the United Nation’s Third International Conference on Small Island Developing States in September 2014, in Apia, Samoa.

UN Third International Conference on SIDS – September 1-4, 2014, Samoa

The theme of the conference was ‘The Sustainable Development of SIDS through Genuine and Durable Partnerships’. The conference was attended by twenty-one Heads of States and governments, along with 3,500 delegates, including representatives of governments, civil society and the private sector. In addition to the main proceedings, a large number of side events took place on issues important to SIDS.

The Seychelles delegation led by President Michel included representatives of government, the private sector, youth and civil society. Members participated in the plenary discussions as well as in the six multi-stakeholder Partnership Dialogues which were organised in parallel.

Each Dialogue focused on a specific theme, namely:
1. sustainable economic development
2. climate change and disaster risk management
3. social development, health and non-communicable diseases
4. youth and women; sustainable energy
5. oceans, seas and biodiversity
6. water and sanitation, food security and waste management.

Several members of the delegation also attended forums organised by major groups and other stakeholders.

The President and other delegates highlighted the challenges faced by SIDS, particularly the high costs of energy and transportation, climate change and susceptibility to natural disasters, and vulnerability to external shocks. They also addressed debt restructuring, affordable financing for SIDS, promoting renewable energy and energy efficiency, and better representation of SIDS in international partnerships.

Delegates called for the need to reconsider the use of gross domestic product (GDP) as the sole measure of wealth – as pointed out by President Michel: ‘the globalisation of development measures wealth and forgets people, through indices such as GDP per capita.’ He also referred specifically to the Abu Dhabi Declaration, noting that participants at the summit had agreed on harnessing the resources of the oceans to accelerate their abilities to produce food and energy, whilst also diversifying their economies. He observed that this would require the development of substantial research capacity and technology transfer.

As part of the preparation for the Samoa SIDS conference, Seychelles also hosted the Atlantic, Indian Ocean, Mediterranean and South China Seas (AIMS) Regional Preparatory Meeting.

The Conference document titled ‘The Samoa Pathway’ devotes a section to Oceans and Seas, where it reaffirms the UN Convention on the Law of the Sea as the legal framework for the conservation and sustainable use of oceans and their resources; it strongly supports national, sub-regional and regional efforts on research and the implementation of strategies on coastal zone management and ecosystem-based management; it commits to addressing marine pollution, and calls for urgent action to protect coral reefs and other vulnerable marine ecosystems, including through measures such as those identified in the Framework for Action 2013 of the International Coral Reef Initiative.

The Samoa Pathway also supports actions to develop the technological and research capacities of SIDS in marine science; monitor fishing vessels so as to eliminate illegal, unreported and unregulated (IUU) fishing; promote the sustainable development of small-scale fisheries; strengthen disciplines on subsidies in the fisheries sector, including the prohibition of subsidies that contribute to over-capacity and overfishing; and promote the conservation, sustainable use and management of straddling and highly migratory fish stocks (International Institute for Sustainable Development (IISD), 2014).

As part of the preparation for the Samoa SIDS conference, Seychelles also hosted the Atlantic, Indian Ocean, Mediterranean and South China Seas.
The major themes covered included the oceans’ living and non-living resources from the marine environment, the sustainable use of living resources, necessary infrastructural development and services for a blue economy, investment opportunities in the blue economy, marine mineral resources and energy, and maritime security and challenges.

A number of pertinent issues emerged from the deliberations of the Forum, the main ones being:

- The importance of knowing what constitutes our marine ecosystems so that we may better use and protect them;
- The need to work out an operational definition of what is meant by the Blue Economy concept for Seychelles;
- Identifying the sources of and the development of a framework for sourcing and using funds judiciously;
- The importance of exploring opportunities for maximising the value of existing products;
- The primary importance of developing human technical and professional capacities in the maritime and related fields so that more Seychellois may benefit from the opportunities presented by the blue economy;
- Adopting an inclusive approach that provides the necessary support and enabling environment for Seychellois entrepreneurs and professionals to have the space to participate in the development of the blue economy;
- The importance of continued consultation and involvement of Seychellois entrepreneurs and professionals as well as local communities in the Blue Economy strategic development and implementation processes;
- The need for a strong governance mechanism that acts as the driving force for the BE from the centre of government, backed by adequate funding.

Further stakeholder dialogues on the Blue Economy are expected to take place over the course of 2015 through other consultative meetings at different levels in the community.

**Establishment of the Blue Economy Department**

A Government restructuring at the start of 2015 saw the establishment of a new Blue Economy Department within the Ministry of Finance and Trade – now renamed the Ministry of Finance, Trade and the Blue Economy. The main role of the Department is to provide a high level focal point that will ensure a more effective coordination of oceans and marine-related initiatives. It should help Seychelles in promoting the sustainable use and conservation of its vast ocean territory, through complementing and better coordinating the work being done by other departments and agencies (Ministry of Finance, Trade and the Blue Economy 2015).

The Blue Economy Department is already undertaking a number of projects and other initiatives, many of them linked to the development of a strategy for mainstreaming the Blue Economy into existing and future planning and development frameworks. With the assistance of the Commonwealth Secretariat’s Oceans and Natural Resources Advisory Division, the Department is working on a Roadmap for the Blue Economy.

While acknowledging that the protection and sustainable use of Seychelles’ extensive marine resources is already reflected in all of the country’s national strategies and plans, (including Strategy 2017, the Seychelles Sustainable Development Strategy 2011-2020 (SSDS), the Seychelles medium term National Development Strategy and the Seychelles Strategic Plan 2017-2040), the Department is working with the Ministry of Environment, Energy and Climate Change and other partners to explore the most effective ways of streamlining the planned activities and...
coordinating the related implementation mechanisms to ensure the optimisation of all outputs. In particular it is looking at ways of enhancing the country’s knowledge generation and research capacities through knowledge sharing and technology transfers.

As part of the process of ascertaining the resources of the oceans and ensuring their protection, a full marine spatial plan of Seychelles’ Exclusive Economic Zone (EEZ) is nearing completion. Such an exercise should provide innovative ways to help the country better manage its oceanic and coastal assets. It is also linked to the financial mechanism known as the ‘debt-for-adaptation swap’, whereby a commitment to protect 30% of the EEZ will enable the Government to buy back almost $30 million of the national debt with the Paris Club of creditors.

The Department is taking a leading role in a number of local and international ocean-related activities, including the organization of an investment forum in the margins of ‘Le Festival de la Mer’ being organised in Seychelles in December 2015; the setting up of a Blue Economy Think Tank and further stakeholder consultations, to enhance participation and enrich the ongoing dialogue on the Blue Economy.

The government will continue to call for strong global action in the Post-2015 Development Agenda, especially with regard to Goal 14 (which is dedicated to oceans, seas and marine resources) and at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in December 2015 in Paris. Seychelles will also be co-hosting the Second Blue Economy Summit in Abu Dhabi together with the Government of the United Arab Emirates, in January 2016.

Conclusion
Ultimately the Seychelles Blue Economy concept aims to transform economic development and human well-being through the judicious use of the resources that exist in the ocean. This implies the need for wisdom and careful management of one of the world’s essential global resources. In the words of the Minister of Finance, Trade and the Blue Economy, Mr Jean-Paul Adam, on the occasion of the 2015 World Oceans Day, on 8th June:

We must never forget our oceans are a source of life, and we must ensure we empower our future generations to access its potential to the fullest. Each and every one of us can help change perspectives and encourage others to think about what the oceans mean to us and what they have to offer us all. We need to learn and discover the wealth of diverse and beautiful ocean creatures and habitats, and how our daily actions affect them... we are all linked to, and through, the ocean. Let us encourage our whole community to become caretakers of our ocean. By making small modifications to our daily habits, by involving our families and friends, we will all greatly benefit.

Résumé

Dans le contexte des Seychelles, l’économie bleue se réfère aux activités économiques qui se déroulent directement ou indirectement dans l’océan et sur les zones côtières, et qui utilisent des éléments provenant de l’océan, tout en concevant les activités océaniques en tant que produits et services. Il comprend également la contribution de ces activités à la croissance économique ainsi qu’au bien-être social, culturel et environnemental. Il vise aussi à la transformation du développement économique et celle du bien-être humain à travers l’utilisation judicieuse des ressources se trouvant dans l’océan. En conceptualisant l’océan en tant qu’espace de développement où la planification de l’espace maritime comprend la conservation, l’extraction des ressources, la production durable d’énergie et le transport, l’économie bleue offre une alternative économique viable, qui est elle-même guidée par des principes liés à la préservation environnementale. Plusieurs mesures connexes sont déjà en cours pour effectuer la transition vers la diversification économique et le développement durable.

References
Sustainable resource use and the problem of declining shoreline resilience to sea level rise: a Seychelles case study

**Keywords**: Coastal Development, Coastal Ecosystems, Interconnectivity, Resilience, Sea Level Rise

**By Dr Ashton J. Berry, University of Seychelles**

**Abstract**

Small Island Developing States, such as the Seychelles, are dependent upon the rich array of goods and services offered by coastal and ocean ecosystems. This has resulted in significant investment in the industries that convert these resources into products that are of benefit to humans. The Blue Economy concept is one such investment. The Blue Economy aims to sustainably manage coastal and marine resources, while acknowledging the socioeconomic drivers that take advantage of these resources. It also recognises the importance of the relationships between coastal and pelagic ecosystems. This article explores this interconnectivity and describes how the degradation of coastal ecosystems is impeding the ability of natural resource managers to sustainably manage coastal and pelagic systems. The over-development and use of shoreline ecosystems provides one such example whereby coastal management practices are resulting in long-term and far-reaching implications for sustainable resource use. To solve these problems, a change in the way we think about the management of environmental issues is required. Recognition of the impacts resulting from climate change is of particular significance. Only by maintaining the resilience of coastal ecosystems to sea level rise, and by recognising their interconnectivity, can the management of coastal and marine ecosystems become sustainable over the coming decades and centuries.

**Interconnectivity between coastal and pelagic ecosystems**

Coastal and Island economies are dependent upon the rich array of resources and services offered by shoreline ecosystems (Defeo et al. 2009; Leewis et al. 2012). This is particularly the case with Small Island Developing States (SIDS) such as Seychelles (McElroy 2003; Shareef and McAleer 2008). The pillars on which Seychelles’ economy rests are tourism and fisheries (Campling and Rosalie 2006). The promise of secluded, palm lined beaches, snorkeling with colourful coral and fish, and the relaxed, laid back lifestyle, are strong attractants for many people the world over (Everard et al. 2010; Nordstrom 2000; Payet 2007). This combined with the growing global appetite for seafood and other marine based products has resulted in significant investment in these industries (Merino et al. 2012). The development of the Blue Economy concept is one example of such an investment. Sharing the same goals of ecologically sound and sustainable practice, the Blue Economy owes its pedigree to its older sibling, the Green Economy (Government of Seychelles 2012; UNEP 2012). A relatively new concept, the Blue Economy promises to be more than just a rebranding of old ideas. With the inclusion of socioecological frameworks, the Blue Economy aims for the sustainable use of coastal and marine resources, while at the same time acknowledging the importance of socioeconomic necessity for current and future generations.

However, for the Blue Economy concept to truly take root and deliver on the promise of sustainability, the importance of the interconnectivity between coastal and marine ecosystems needs to be recognised with greater emphasis on decision making processes. Proponents need to be sure that they themselves understand the implications of these ecological imperatives being insufficiently considered when making decisions about the use of natural resources. The conservation and sustainable use of marine resources is as important as the benefits derived from their exploitation. Consideration of the connectivity between coastal and pelagic (open ocean) zones and a recognition that one cannot be managed sustainably without due consideration of the other is of vital significance to the long-term success of the Blue Economy. Thus, the need to consider coastal environments, such as shoreline ecosystems and their sustainable management, is essential. This article describes the ecosystem services or benefits of coastal ecosystems and explores the importance of their relationships and interconnectivity with the pelagic zone. It also explores the impacts of coastal management practices on both coastal and pelagic ecosystems.

Forming the interface between terrestrial and oceanic influences, coastal ecosystems not only benefit tourism and fishing industries; they also provide services in the form of food and amenity, and have significant cultural, recreational and lifestyle value (Everard et al. 2010; Nordstrom 2000). Coastal ecosystems form a vital link upon which many pelagic ecosystems depend. The movement of fish from coastal to pelagic waters has a significant role in the transfer of nutrients from coastal to pelagic zones (Allain et al. 2012). Some reef and coastal lagoon fish species, for example rabbitfish (Siganidae spp) spend part of their lifecycle in coastal waters before migrating to the open ocean. Moving to the pelagic zone exposes them to predation by pelagic species. Some ephemeral species, such as pelagic fishes,
Coastal ecosystems cover a relatively large geographical area, referred to as the coastal zone, in comparison to the shoreline. This is because the coastal zone and its ecosystems are often defined by their relationship with terrestrial systems, relative to flows of freshwater, sediment and nutrients. Thus, coastal ecosystems are often inclusive of terrestrial rainwater catchment areas, and can extend out to sea relative to the extent of terrestrial influences. For the purposes of this article, however, shoreline ecosystems, such as sandy beaches, seagrass meadows, mangrove forests and coral reefs, will provide the focus of discussion. Amongst other coastal ecosystems, shorelines are of particular importance, providing habitat for a diversity of species and a range of ecosystem functions, upon which humans depend. Sandy beaches are one such example of a shoreline ecosystem providing many benefits to pelagic ecosystems and humans alike. Beneath the sand, a diversity of species that form the basis of many coastal food chains exist, such as micro, meio and macro fauna (see Beach Cleaning below) (Gimenez and Yannicelli 2000). Above ground beaches form critical feeding grounds for wading birds, fish and crustaceans, and provide suitable substrate for nesting sea turtles (McLachlan and Brown 2006). Apart from the extraordinary biodiversity, shoreline ecosystems also act as an important link between marine and terrestrial environments through the flow of sediment, a major contributor to the formation of beach sand (Boyd et al. 2004). A dominant feature of the granitic islands of the Seychelles is the towering granite cliffs and boulders. The forces of water, wind and heat, amongst other factors, slowly dissolve the granite, allowing the release of the harder quartz minerals in the form of sand grains. Over time, these particles make their way to the sea, where they are eventually washed onto the shore by waves, forming the beach (Boyd et al. 2004). Long-term processes such as these are often poorly understood or poorly considered, and coastal management plans are often developed without due consideration of these factors (Berry et al. 2013). A further important example of this breakdown in understanding is the need for coastal ecosystems, such as sandy beaches and mangroves, to retreat landward. Through retreat, sandy shorelines maintain their structure and function by maintaining habitat elevation relative to increases in sea level and the resulting changes in tidal reach (Berry et al. 2014). These beaches avoid drowning and the erosion of their backshore areas, such as dunes, aids in the provision of sediment to rebuild the beach and maintain ecological processes.

Climates have changed and sea levels have fluctuated throughout Earth’s history (Lambecka et al. 2002), but in the 21st century human impacts have added a new dimension. Shoreline ecosystems are now threatened in ways never before experienced. Historically, shoreline ecosystems, such as sandy beaches, retreated landward where possible to escape advancing seas (Feagin et al. 2005). Motile species were able to follow, shifting with their habitats as they tracked across the landscape. The animals and plants, and the resulting functions they provide, were able to find refuge and persist until sea levels decreased (Keppel et al. 2011). Likewise, similar successional pathways exist for different shoreline ecosystems (Feagin et al. 2005). For example, mangrove plants also historically moved to higher ground as sea level increased. Higher sea levels enabled the floating propagules of mangrove plants to float further inland and invade habitats previously the realm of freshwater species (Cheeseman 2012; Di Nitto et al. 2008). Mangrove plants modify habitats ensuring suitable conditions for the progressive colonisation and development of habitats capable of supporting species as sea levels increase (French 2006; Lara et al. 2002; Teh et al. 2008). In this way, shoreline ecosystems maintain resilience to sea level rise and continue allowing species and ecosystem services to persist (Fish et al. 2005; Galbraith et al. 2002; Gilman et al. 2008; Jones et al. 2007).

Resilient ecosystems can be defined as those that adapt to disturbance, while continuing to maintain their function and structure (Holling 1973). As such, resilient ecosystems are able to adapt
Resilient ecosystems often exhibit high levels of biodiversity and species redundancy. Species redundancy occurs when ecosystems have sufficient levels of biodiversity for some species to perform the same function (Walker 1992). This enables some species to be removed from the system without losing essential ecosystem functions (Kremen 2005). This potential to withstand impact and maintain function is reduced as degradation continues and biodiversity falls. Therefore, for shoreline ecosystems to continue providing goods and services, they must maintain their resilience to disturbances, such as sea level rise. Maintaining resilience should thus be a key consideration in the management of coastal resources.

The degradation of shoreline ecosystems results from a range of factors that impede the function and structure of these systems. The factors are not limited to those mentioned above, but also include the overuse of fragile habitats resulting in the trampling of beach vegetation, the extraction of seagrass and microalgae from the beach, the removal of vegetation, the release of excess land-based sediment and nutrient and the diversion of inshore currents and sediment transport systems through engineering works. The following discussion will explore each of these areas in greater detail.

Coastal development and hard-engineering

Due to the stability of sea level over the past 6000-7000 years (Sloss et al. 2007), coastal development has been able to continue in low-lying areas for millennia (McGranahan et al. 2007). This has continued in modern times until human populations are now predominantly living in coastal areas. Stable sea levels are now a thing of the past, with projected sea level rises of >1m by the turn of the century (Jevrejeva et al. 2010; Jevrejeva et al. 2012). As a result, human populations and developments in erosion-prone and low-lying areas are at extreme risk from sea level rise, along with increases in storm frequency and intensity (Nicholls et al. 2007).

Coastal development setbacks and erosion corridors would help to alleviate the need for coastal armouring and enable beaches to maintain a desirable state suitable for tourism. As such, current knowledge in this area can be used to ensure current and future erosion and retreat parameters are integrated into coastal management regimes.

Large scale coastal development and the use of hard-engineered adaptive responses to combat shoreline erosion have formed significant barriers preventing many shoreline ecosystems from adapting to sea level rise (Berry et al. 2013; 2014; Nordstrom 2000). Ecosystems that are unable to adapt through inland retreat have reduced resilience to sea level rise. Protect, Accommodate, and Retreat are the most common strategies used in adapting shoreline areas to sea level rise (Abel et al. 2011; Nicholls et al. 2007). The use of hard- and soft-engineered structures that protect shoreline investments are the most popular, although managed retreat and ecosystem conservation are more frequently considered as a practical means of maintaining the resilience of shoreline ecosystems to sea level rise (Fish et al. 2008; Hansen et al. 2010). However, the managed retreat option is seldom selected. For many communities the costs involved in shifting coastal developments away from vulnerable shorelines within economically and climatically feasible timelines are prohibitive.

Hard-engineered adaptation options are designed solely to protect coastal development and urbanisation and include revetments, groynes and breakwaters (El-Raey et al. 1999). Such structures are spatially fixed and are predominately made from rock, cement, steel and wood (Capobianco and Stive 2000). Hard structures such as these separate marine influences from terrestrial factors and prevent their interaction (Runyan and Griggs 2003). They not only impede shoreline ecosystems from retreating to higher ground, they also prevent waves from accessing sand or sediment that would normally erode and play a crucial role in rebuilding the shoreline after erosion.
Coastal systems are managed. The cost will require a change in thinking about how coastal ecosystems manage sea level rise (Brown and McLachlan 2002). The loss of more than 80% of sandy beach structures now considered responsible for habitat for species to persist. Such beaches becomes more and more unsuitable as a food source and the beach elevation. Excessive inundation exceeds the tolerance of species and the beach becomes more and more unsuitable as a habitat for species to persist. Such beaches are also not popular with tourists. This is a global problem with hard-engineered structures now considered responsible for the loss of more than 80% of sandy beach shorelines (Brown and McLachlan 2002).

Lowered beaches are more susceptible to more frequent and longer periods of wave inundation due to a drop in elevation. Excessive inundation exceeds the tolerance of species and the beach becomes more and more unsuitable as a habitat for species to persist. Such beaches are also not popular with tourists. This is a global problem with hard-engineered structures now considered responsible for the loss of more than 80% of sandy beach shorelines (Brown and McLachlan 2002).

Ashton Berry, Sept 2015

Figure 1a: Beach sand removed from the road after it was pushed over the cement revetment and road by high tide wave action in Au Cap, Mahé Island.

Ashton Berry, Sept 2015

Figure 1b: Beach sand pushed over the riprap revetment and road by high tide wave action in Anse Royale, Mahé Island.

Maintaining the adaptive capacity of coastal ecosystems to sea level rise will require a change in thinking about how coastal systems are managed. The cost of constructing, maintaining and removing hard-engineered structures and the damage they cause to shoreline ecosystem resilience provide significant incentive to re-evaluate coastal development planning strategies and, in particular, the placement of fixed structures, such as buildings, roads and rock revetments. The use of adaptation options that are proactive in approach needs to become the usual approach (Gibbs 2009). Anticipatory or proactive adaptation options such as setbacks, managed retreat, revegetation, ecological engineering and ecosystem engineering, recognise the susceptibility of shorelines to erosion and acknowledge the importance of maintaining the interconnectivity between ecosystems (Bass and Dalal-Clayton 1995; Berry et al. 2013). Such adaptation options – that have the function of ecosystems factored into their design – can either be applied from the start as a substitute for coastal development or hard-engineered structures, or retrospectively, as an add-on to existing structures to improve their habitat potential or as a complete replacement (Borsje et al. 2010; Chapman and Underwood 2011).

Beach raking and harvesting of beach cast seaweed

Beach raking is an activity designed to increase the perceived aesthetic quality of the beach through removal of beach cast materials such as seaweed, wood, shells, mangrove propagules, leaves and many other forms of detritus. The removal of these materials deprives sandy beach ecosystems of an important food source and a means of sand retention and accretion (Rossi and Underwood 2002). On a typical beach the sand supports an array of benthic organisms living within the layer of moist sand (Gimenez and Yannicelli 2000; McLachlan and Turne 1994). These organisms generally occur in three size classifications: micro benthic, meio benthic and macro benthic. Benthic organisms rely upon the organic materials washed up on beaches for food, and seaweed plays an important role (Colombini et al. 2010; Dugan and Hubbard 2010). Benthic organisms form the basis of the beach food chain, with the micro benthics being consumed by the meio benthics, which are in turn consumed by the macro benthics (including crabs, worms, insects, molluscs) (Bergamino et al. 2011; Maria et al. 2011). Further up the food chain, macro benthic organisms play an important role as a food source for fish populations, many of which are commercially and recreationally significant (Dunn et al. 2013). A number of bird species are also dependent on benthic organisms as a food source. Seaweed on the beach plays an important role in capturing wind-blown sand and building the beach (Nordstrom et al. 2011). Acting as a food source and in the retention and accumulation of sand, beach cast seaweed is of vital significance to the resilience of Seychelles beaches to sea level rise-induced coastal erosion and retreat, and in maintaining healthy beaches for the benefit of tourism.

‘Beach creepers or ground covers, such as Ipomoea pes-caprae (locally known as Beach Morning Glory or Patatran), help to bind beach sand together to slow or even prevent erosion.’

The indiscriminate nature of what beach cleaning removes from the beach provides a further problem. This is especially the case when using mechanised beach cleaning equipment, but also results from hand raking. It is difficult or impractical to only remove the targeted items such as seaweed or rubbish from the beach. A range of other non-targeted materials are also removed, such as shells, coral, crabs, driftwood and vegetation. Vegetation is removed, trampled or trimmed in an attempt to provide larger areas of “clean” (bare) sand for beach goers to enjoy. This is particularly evident on popular tourist beaches, but is also the case for beaches and dunes frequented by locals. Beach creepers or ground covers, such as Ipomoea pes-caprae (locally known as Beach Morning Glory or Patatran), help to bind beach sand together to slow or even prevent erosion. Beach vegetation also
aids in the accumulation of beach sand by capturing and trapping wind-blown sand as it moves up the beach (Miller 2009). Beach raking results in the removal of vegetation and leads to the erosion of sandy beaches and impedes the timely accretion of sand to repair erosion. In the same way, the removal of dune vegetation at the point where the frontal dune meets the beach impedes the formation of new dunes (also known as incipient or embryo dunes) (Hesp 2002).

The area of beach where seaweed and other materials are removed tends to increase over time as the operator strives to maximise yield or produce the cleanest beach possible. Figure 2a and 2b show the extent of sand erosion resulting from excessive foot trampling and raking around beach access and dune vegetation in Anse Royale, Seychelles. Areas such as this are common features of sandy beaches along the island coasts of Mahé, Praslin and La Digue. Sand compaction and lowering of the dune profile are also a significant issue with beach raking. Lowering of the dune profile is particularly evident when comparing the original elevation of the sand around the base of trees or other fixed objects where sand cannot be removed. Figure 3 demonstrates the decrease in dune elevation as a result of beach raking. Each time the beach or dune is raked, a layer of sand is removed and the profile drops over time. Compacted beach sand also produces a number of problems. Benthic organisms that burrow through the sand in search of food or shelter find compacted sand difficult to navigate through (Schlacher and Lucrezi 2010; Speybroeck et al. 2005) and a number of bird species that forage for submerged beach species also struggle to penetrate the sand with their beaks (Speybroeck et al. 2005). Considering that Seychelles beaches are already severely threatened from sea level rise and the use of coastal armouring to protect coastal development, the raking of beaches and the removal of seaweed and other forms of detritus, including leaf litter, will only intensify the erosion of these beaches and reduce their resilience to sea level rise and coastal erosion.

Alternatives to beach raking are limited to the implementation of policies that prevent the removal of seaweed from the beach to ensure the ecological benefits of beach cast seaweed continue unabated. Complementary policies ensure that only rubbish produced and discarded by humans is removed from the beach. In this regard, the removal of rubbish by hand is the most effective.

**Conclusion**

The Blue Economy is a concept that aims at increasing human well-being and social equity through the long-term sustainable use of coastal and marine resources. For this to become a reality the Blue Economy needs to consider the full gamut of both coastal and marine ecosystems, along with their structure, function and interconnectivity. Unfortunately, a lack of scientific understanding of coastal processes in the past has produced a range of ‘wicked problems’, the solutions to which require a change of thinking in the way environmental issues are managed. Creative and innovative solutions will be required from decision makers. Recognition of the severity of current and future changes in climate, and the need to maintain the resilience of coastal ecosystems to enable them to adapt to these changes are of vital significance. Only in this way can the management of coastal and marine ecosystems become sustainable over the coming decades and centuries.
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RESILIENT ECOSYSTEMS

Baie Ternay Marine National Park — A small bay with a big future

By Christophe Mason-Parker, Global Vision International, Seychelles

Abstract

The Baie Ternay Marine National Park is home to a well-developed coral reef, shallow-water seagrass beds and extensive tidal flats. The interconnected ecosystems within the bay have been subjected to numerous natural and anthropogenic impacts over the years, but none more damaging than the coral bleaching event of 1998. Monitoring efforts began soon afterwards and continue to this day, with data collected by Global Vision International Seychelles indicating the coral reef has recovered significantly. As Cap Ternay looks set to play a pivotal role in the new Blue Economy concept, consideration will need to be given to the site’s neighbouring marine ecosystems. With rising sea temperatures likely to lead to further coral bleaching events, it is increasingly important that those coral reefs identified as being resilient, receive minimal disturbance and maximum protection.

Into the Blue

The ‘Blue Economy’ will look to capitalise upon the vast expanse of marine environment that accounts for the majority of Seychelles’ Exclusive Economic Zone, to provide future economic growth and development. This concept will undoubtedly face fiscal, sociocultural, political and environmental hurdles along the way and with tourism standing firmly as one of the two pillars of the Seychelles economy, the often-fractured relationship between coastal development and ecological preservation will increasingly appear under the spotlight.

Nowhere is this more apparent than on the island of Mahé. Home to the majority of Seychelles’ population of 90,000 inhabitants, and with the nation’s only international airport, this small island in the western Indian Ocean has already undergone a substantial transformation. The east coast in particular has witnessed significant land reclamation, and in the process has lost large areas of coral reef. To the north, development along the coastline from Bel Ombre to Glacis has resulted in a virtually unbroken strip of hotels and holiday homes.

It was therefore with much relief that many within Seychelles’ environment sector received the news of the cancellation of the proposed hotel development at Cap Ternay. The area is well known for its natural beauty and its biological significance, and is one of only a handful of ecologically intact coastal bays remaining on Mahé Island.

Tourism in Seychelles is highly dependent on a healthy marine ecosystem, and yet if left unchecked, this industry threatens the very same coastal environments upon which it relies. Habitat destruction, overfishing and increased nutrient loading are examples of some of the threats associated with a burgeoning tourism market. Simultaneously, the financial revenue the tourism sector generates has the potential, if harnessed correctly, to assist with maintaining a functioning coastal environment. National parks generate income from tourism, which provides funding for scientific research, for the removal of invasive species and to protect sensitive areas. This complex co-dependency, juxtaposed with conflicting sectorial interests, highlights the necessity to ensure that ecological and socioeconomic implications of future developments receive adequate investigation prior to project commencement, and that any immediate and long-term collective benefits and potentially deleterious impacts are adequately assessed. Furthermore, if development is to be ‘sustainable’, it is essential that certain areas are set aside for protection, to act as refugia for marine species, and to provide source sites for replenishment of nearby coral reefs. While the concept of a refuge describes how undisturbed areas have the capacity to act as sources of replenishment or to compensate for overfishing (Dugan and Davis 2011), more recently scientists have looked to build resilience through climate change adaptation, and the idea of refugia has expanded to encompass the need to protect thermotolerant coral species.

The Baie Ternay Marine National Park (MNP) is an obvious candidate for preservation. Home to a vibrant coral reef ecosystem, extensive plurispecific seagrass beds and tidal sand flats, the MNP supports a remarkable diversity of marine and coastal species. The shallow waters act as critical nursery grounds for commercially valuable fish and elasmobranch species, while the coral reef and adjacent habitats are home to over 300 species of reef fish and 50 genera of corals (Mason-Parker observations 2015).

Though the coral reef within the Baie Ternay MNP appears to be healthy, this has not always been the case and only now is it returning to somewhere near its former state.
Coral Reef Monitoring

In 1998, a worldwide coral bleaching event decimated many of the coral reefs in Seychelles. In some areas coral mortality reached 95% (Spencer et al. 2000). Baie Ternay was not spared. Goreau (1998) describes the destruction in his preliminary report following the event, “In 1997 this reef was in nearly perfect condition…..and ranked with the most beautiful reefs I had seen anywhere in the world. A year later it was a graveyard”.

Following the bleaching event of 1998, efforts began to monitor the regeneration of coral reefs within the granitic islands of Seychelles. The Shoals of Capricorn Programme was a three-year study initiated by the Royal Geographic Society in association with the Royal Society and the Governments of Seychelles and Mauritius. Upon completion of the programme, the Shoals of Capricorn established the Seychelles Centre for Marine Research and Technology in order to continue surveying the island’s coral reefs. The Australian non-governmental organisation, Reefcare International, continued monitoring efforts and provided the foundation for future monitoring methodologies employed within the area.

In 2004 the international community development and conservation organisation Global Vision International (GVI) began coral reef monitoring under the invitation of the Seychelles National Parks Authority (SNPA). GVI’s logistical constraints, which included number of personnel and distance to survey sites, dictated that monitoring efforts focussed on a series of locations chosen by SNPA along the coast of northwest Mahé. The data collected by GVI staff and volunteers has always been passed directly to the SNPA for use in coastal management decisions.

The GVI model of using trained volunteers permits the collection of long-term data and continuous monitoring where resources and availability of local experts may otherwise be restricted. Previous studies have identified limited differences in the accuracy of data collected by sufficiently trained volunteers and those of experienced coral reef surveyors (Harding 2000).

The objectives of the coral reef monitoring programme undertaken by GVI and SNPA are as follows (GVI 2014):

• Assess diversity and density of fish species across all survey sites
• Estimate size of commercially important fish species
• Record the diversity of hard coral genera across all sites
• Assess benthic assemblages, including evaluation of hard corals, soft corals, sessile organisms coverage and substrate composition
• Evaluate coral recruitment rate
• Monitor coral predation and algal grazing pressures through density estimates of hard coral predators, sea urchins and specific fish feeding guilds
• Assess abundance and diversity of commercially targeted invertebrate species including sea cucumbers, lobster and octopus

The monitoring methodologies used by GVI are based upon the Global Coral Reef Monitoring Network (GCRMN), and have been adapted by SNPA and GVI to accommodate particular requirements and local needs.

Data on hard corals is recorded utilising three separate survey techniques. Line Intercept Transects (LIT) are used to collect data on substrate benthic assemblages. Corals are identified to genus level and the life form of the colony is recorded. Coral Diversity Belts are used to document the presence of coral genera while coral recruitment is monitored using 1m² quadrats.

The GVI Marine Conservation Expedition at Cap Ternay has collected an impressive eleven years of continuous coral reef monitoring data from a total of twenty four sites, including three within the Baie Ternay Marine National Park.

GVI uses two different survey methodologies for gathering fish data. Stationary point counts require the data collector to record within a 7m radius, while 50m belt transects allow for the coverage of a larger area.

Invertebrates are surveyed using belt transects, with divers recording the presence of different invertebrate species, including the coral grazing Crown of Thorns Starfish (Acanthaster planci) and Drupella spp. Commercially targeted sea cucumber species are also recorded.

In addition to the biological data collected at each survey site, abiotic parameters are gathered such as turbidity, cloud cover and sea state. Surface and bottom sea temperatures are noted using personal dive computers.

The GVI Marine Conservation Expedition at Cap Ternay has collected an impressive eleven years of continuous coral reef monitoring data from a total of twenty four sites, including three within the Baie Ternay Marine National Park. This type of long-term coral reef monitoring data set is rare and extremely valuable when looking to compare temporal changes within fixed study sites.

The data collected by GVI staff and volunteers over the past decade has provided a unique insight into the health of the coral reef ecosystem within the Baie Ternay Marine National Park and how it has changed over time.
Baie Ternay, an example of interconnected coastal ecosystems

Baie Ternay is situated on the northwest coast of Mahé in the Republic of Seychelles. On June 11th 1979 Baie Ternay was designated a Marine National Park (MNP) under the Seychelles National Parks and Nature Conservancy Act. The boundary of the park runs from the northernmost point of Baie Ternay Bluff and continues to the western tip of the Cap Ternay Estate, including the entire bay up to the high water mark.

The bay covers an area of 25 ha and encompasses tidal flats, seagrass beds and coral reef and is located between the slopes of Cap Matoopa and the Morne Seychellois National Park. The bay is bordered on two sides by a rocky granite shoreline interspersed with small sand beaches. The tidal flats give way to a narrow strip of beach lined with coastal vegetation.

The coastal areas adjacent to Baie Ternay are currently uninhabited. GVI and SNPA are presently the only occupants at the Cap Ternay site, and have a small research facility catering for a team of 32 staff and volunteers, set back on the hillside. For several years, until it relocated in 2012, the Seychelles Dog Unit, part of the Seychelles People’s Defence Force, was based on the waterfront within the Baie Ternay Marine National Park. Prior to occupation by GVI and SNPA, Cap Ternay had been visited by occasional youth camping trips since the days of the Youth Village. The Youth Village at Cap Ternay, which formed part of the National Youth Service, was opened in 1982 and operated for over fifteen years before finally closing down in 1998. Several years before the Youth Village, a sea wall was constructed on the eastern side of the main beach where a restaurant known as ‘La Rocca’ operated between 1974 and 1981.

Coastal Ecosystems

Although there has been limited anthropogenic activity at Cap Ternay over the years, the coastal ecosystems within the bay itself have remained relatively undisturbed from development. The MNP contains a variety of marine ecosystems that continue to function effectively, providing critical habitat for numerous species.

Tidal Flats

The thin ribbon of beach that separates Cap Ternay from the Baie Ternay Marine National Park disappears at high tide, while at low tide, tidal flats comprised of sand and mud become exposed. The absence of a permanent beach, the lack of sufficient water depth for bathing, and the odious nature of the mud flats do not lend themselves to ‘traditional’ beach tourism activities.

Tidal flats are zones that are flooded at high tide and become exposed at low tide. They are located along coastlines, often in bays or estuaries where they are trapped between land and the marine environment (Miththapala 2013). They represent important feeding grounds for a variety of shore birds and seasonal migrants. The substrate is home to a high diversity of marine invertebrates and provides a rich foraging area for species of ray, including the porcupine ray (*Urogymnus asperrimus*) and the feathertail ray (*Pastinachus sephen*).

At high tide, the tidal flats and neighbouring seagrass beds act as a nursery for juvenile spotted eelgrays (*Aetobatus narinari*), which are frequently observed swimming at the surface in a few inches of water. The shallow depth provides refuge from larger predators alongside the opportunity to search for molluscs buried in the sand. At particular times of the year, sicklefin lemon sharks (*Negaprion acutidens*) enter Baie Ternay to give birth. The new born pups utilise the tidal flats at night, when they are able to hunt for food in relative safety. During the day they display refuging behaviour moving to deeper water to hide from predators and the elevated temperatures in shallow waters (MCSS 2011).

Seagrass Beds

Seagrasses are marine angiosperms with a global distribution. They exhibit high levels of productivity and create structurally complex habitats associated with diverse marine faunal communities. They perform a variety of important ecosystem services, making them economically and ecologically valuable. Seagrasses provide habitats for rich faunal assemblages and seagrass meadows are recruitment and nursery areas for fish and crustaceans (Green and Short 2003). They are stabilizers of tropical coastal habitats as they trap nutrients and sediments carried from terrestrial effluents, protecting coral reefs from turbid waters and beaches from wave erosion (Lyimo et al. 2008).

Extensive seagrass beds are found in the shallow water environment within Baie Ternay, where they account for 3% of the total area to be found around Mahé Island (UNEP 2008). The seagrass community is dominated by *Thalassia hemprichii*. However a significant proportion of the inner bay is occupied by plurispecific seagrass meadows. Species composition includes *Syringodium isoetifolium*, *Thalassia hemprichii*, *Halodule uninervis*, *Cymodocea serrulata* and *Halophila ovalis* (Dawson et
al. 2000). Sections of the seagrass beds are exposed at low tide and towards the west of the bay, the meadows are broken up by shallow depressions filled with sand and rubble.

The seagrass beds and associated algal communities within Baie Ternay provide important habitat for an array of invertebrate species. Dawson et al. (2000) identified 58 infaunal invertebrate species inhabiting seagrass beds within three study sites around Mahé (including Baie Ternay) as part of an integrated assessment of anthropogenic and climatic interactions with seagrass habitats in the Seychelles.

The ‘razor clam’ Pinna muricata is a species of bivalve, which commonly grows to 15cm in length and sits upright, lodged in the substrate with the opening of the animal’s shell visible. The species is a benthic detrital feeder and is common within the seagrass beds of the Baie Ternay MNP, where it is found in high densities in areas dominated by Thempliphii. Cowries including Cypreaa tigris, which has become depleted in other locations due to overharvesting for the marine curio trade, remain relatively abundant within the seagrass meadows.

The juveniles of several species of commercially valuable fish take refuge within the seagrass beds of the Baie Ternay Marine National Park. In the southwestern section of the bay, shallow-water colonies of the coral Pavona frondifera provide refuge to juvenile members of the family Lutjanidae, and Serranidae, highlighting the importance of the area as a nursery ground.

Coral Reef

Coral reefs are geological structures made up of the remnants of multivariate marine organisms. Simultaneously, they are complex communities of living creatures constrained by the relationship between zooxanthellate algae and their coral hosts. Hermatypic, zooxanthellate corals, which are largely responsible for reef construction, require sunlight for photosynthesis. They do not tolerate prolonged exposure to freshwater and require suitable substrate for attachment. Equally there is a clear link between ocean temperature and the formation of highly consolidated reefs (Veron 2000). With such particular tolerances, it is little wonder coral reefs occupy such a narrow margin of coastal habitat.

The coral reef within the Baie Ternay Marine National Park can be subdivided into several distinct areas. The principal section of the reef in the middle of the bay is calcium carbonate in structure, and merges into a granitic fringing reef along the boundaries of the MNP.

The back reef is situated towards the posterior of the bay, caught between the seagrass beds and the reef crest. It contains an abundance of shallow water coral colonies, many of which become exposed during spring tides. Coral genera present include Acropora, Pavona, Porites, Galaxea, Platygrya, Leptoria and Goniastrea as well as extensive areas of the leather coral Sarcophyton sp. This type of shallow water environment with a diverse, healthy coral community is now extremely rare within the inner granitic islands.

The coral cover reduces towards the southward side of the bay, giving way to seagrass meadows, sand and rubble with sparse coral outcrops. Large isolated colonies of Porites lobata have formed micro atolls, providing habitat for a multitude of organisms.

A reef crest divides the back reef from the reef slope. The reef crest is subjected to high levels of wave action and increased turbidity, particularly within the northwest monsoon. Consequently, this area of reef lacks significant coral cover, and is instead dominated by encrusting coralline algae and macroalgal stands of Turbinaria sp.

On the seaward side of the reef crest, the fore reef transforms to reef slope, which descends to around 16m depth before giving way to sand. The reef slope exhibits the highest coral diversity and percentage cover within the MNP. This section of the reef is sufficiently deep to be protected from wave action, yet remains shallow enough to support zooxanthellate coral colonies. The shallow fore reef on the eastern side of the bay contains colonies of massive Porites spp. exceeding 2m in diameter. These corals are extremely slow growing and individuals of this size are likely to be decades old, predating the bleaching event of 1998. Previous studies have shown species from these genera to be the largest surviving colonies within the inner islands (Harris et al. 2014).

The reef slope comprises a mixture of soft and hard corals, including Sarcophyton sp. and Acropora spp. beds. Massive, submassive and branching corals create a structurally complex reef environment resulting in an increase in micro-habitats, which in turn supports a wider variety of fish and invertebrate species (Carpenter et al. 1981).

Baie Ternay is home to an intricate coral reef community, including a rich diversity of coral reef fish assemblages. The high coral cover supports a variety of corallivorous Chaetodontids as well as an abundance of angelfish belonging to the genera Pomacanthus and Pygoploites. Due to the small size of the Baie
Ternay Marine National Park, it is unlikely that adequate protection is afforded to larger commercially valuable fish species whose home ranges extend beyond the MNP’s boundary. However, for smaller grouper species such as *Cephalophis miniata* and *C. argus*, which prefer structural complex reefs and possess limited home ranges (Meyer 2008; Shpigel and Fishelson 1991), population numbers remain higher within the MNP than at neighbouring unprotected sites (GVI/SNPA, unpublished data).

The Baie Ternay Marine National Park is utilised by both species of marine turtle commonly encountered within Seychelles waters. A small number of hawksbill turtles (*Eretmochelys imbricata*) continue to nest on beaches within the MNP, while resident sub-adult hawksbill and green turtles (*Chelonia mydas*) are frequently observed on the coral reef. Hawksbill turtles are associated with coral reefs, where they feed on sponges and algae. Acoustic tagging surveys have shown the back reef area within the MNP to be heavily used by sub-adult hawksbill turtles, and indicate that individuals have a specific home range within the bay (MCSS 2011).

In addition to coral reef associates, the Baie Ternay MNP receives occasional sightings of elasmobranch megafauna, including manta rays (*Manta alfredi*) and whale sharks (*Rhincodon typus*).

**Baie Ternay Marine National Park in 2015**

When GVI commenced coral reef monitoring in 2005, coral cover within the Baie Ternay MNP stood at less than 15%. While some of the older massive colonies were present, the fast-growing Acropora species were virtually absent. By 2014, mean percentage coral cover within the Baie Ternay MNP had increased significantly, and stood at over 45% (GVI 2014). Similarly, there has been a substantial increase in obligate corallivorous fishes, particularly the Chaetodontids, which rely heavily on Acropora corals as their primary food source.

The impressive recovery of the coral reef within the Baie Ternay MNP following the 1998 coral bleaching event has not been mirrored at all of the sites surveyed by GVI along the northwest coast of Mahé. The precise reasons for this are complex and as yet not fully understood, though it is possible to propose a hypothesis for the recovery within Baie Ternay by utilising GVI data and examining the presence of resilience indicators in or bordering the MNP.

Baie Ternay was designated a MNP in 1979. Despite fluctuating poaching levels over the years, the protected status is likely to have lowered fishing pressure on resident fish assemblages when compared to those outside of the MNP. The installation of mooring buoys has assisted in reducing anchor damage, helping to maintain the structural complexity of the coral reef. Furthermore, the absence of significant development surrounding the MNP has prevented sedimentation and nutrient enrichment from runoff.

Perhaps more significant than any anthropogenic interferences, are the natural dynamics of the site itself, which includes several components of ecological resilience. Baie Ternay is an outstanding example of linkages between different functioning ecosystems. The tidal flats and seagrass beds host diverse infaunal and epifaunal populations, which in turn support communities of juvenile reef fishes. They trap sediment and filter water, improving water clarity and creating an excellent environment for shallow water corals.

The presence of multiple massive *Porites spp.* colonies, which survived the 1998 bleaching event, points towards a resilient coral reef environment. Additionally, coral colonies in the shallow back reef are frequently exposed at low tide, suggesting the presence of heat resistant clades of *Symbiodinium* and the ability to tolerate elevated temperatures.

As bleaching events become more frequent as a result of rising sea temperatures, protection will need to focus on those reefs that display resilience. Baie Ternay’s high species diversity and abundance of heat tolerant corals, the absence of adjacent anthropogenic impacts and the site’s recovery from a previous bleaching event, identify the MNP as a priority site to receive continuing protection.

Despite its small size, the Baie Ternay MNP should be considered as one of the most important marine coastal ecosystems remaining on Mahé and maintaining its health is of crucial importance to the Blue Economy. Its economic value as a premier destination for diving and snorkelling tourism is well known, and these activities are directly dependent on maintaining the biological value of the site. The bay’s significance as a nursery ground for commercially valuable elasmobranch and fish species, as well as a foraging area for migratory birds, should not be overlooked. Moreover, the structurally complex coral reef features a diverse, coral-dominated, shallow back reef that is absent elsewhere within the inner islands.

**Table 1: Mean percentage coral cover within the Baie Ternay Marine National Park 2005-2014 (GVI/SNPA unpublished data).**
The Baie Ternay MNP offers a glimpse into the past of a healthy marine ecosystem with relatively few anthropogenic disturbances. Today it remains a ‘living laboratory’: diverse, vibrant and defiantly clinging to its environmental integrity. As we look to the future, the challenge ahead is how to best utilise such an extraordinary site to maximise its potential for ecotourism, education and scientific research, without compromising its unique ecological assets. There is a need to understand the limits for sustainable utilization of these resources and to adopt a precautionary approach in cases where data remains deficient. This should provide a clear demonstration of the importance of effective and policed control measures necessary to ensure the desired conservation outcomes. Such goals provide aspirational targets for the Blue economy if it is to capitalise on the vast array of marine resources available to it.

Résumé

Le parc marin national de Baie Ternay abrite un récif corallien très développé et des herbiers marins en eaux peu profondes. Les écosystèmes reliés au sein de la baie ont subi de nombreux impacts naturels et anthropogéniques au cours des années, mais ceux-ci ne sont pas comparables à l’épisode de blanchissement corallien survenu en 1998. Des efforts sur le plan de la surveillance ont été consentis dans le sillage immédiat de cet incident, et ces efforts se poursuivent à ce jour, avec des données recueillies par Global Vision International Seychelles indiquant une reprise marquante du récif corallien. Avec le rôle central que Cap Ternay est appelé à jouer dans le cadre du concept de l’économie bleue, une attention particulière devra être apportée aux écosystèmes avoisinants du site. La montée de la température de l’eau étant susceptible de causer d’autres effets néfastes en termes de blanchiment corallien, il devient de plus en plus impératif que les récifs coralliens identifiés comme étant à risque reçoivent la plus grande attention tout en étant sujets à un bouleversement minimal.
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Prawn Farming

Seychelles has a relatively long history of prawn farming, which was established on Coëtivy Island (Figure 1) in 1989 by the Island Development Company (IDC) and the Seychelles Marketing Board (SMB) and later taken over and managed by the latter. The farm comprised two hatcheries and around 200 ponds and occupied an area of around 96 ha, and when in full production had a workforce of around 350 people (mainly Thai and Sri Lankan nationals). The production of *Penaeus monodon*, better known as black tiger prawn, peaked at 1200 tonnes per annum in 2004. However, by 2007, this production output had declined to just under 400 tonnes per annum (Fig. 2). Initially, the farm imported small prawns from Madagascar and Mozambique which had been hatchery-reared and allowed to grow to market sizes in the ponds on Coëtivy. After production had established and the farm had enough capacity to develop its own hatchery, adult prawns were imported from Madagascar and Mozambique. The imported adult prawns were then bred to produce small prawns which were then taken to these large ponds and reared to market sizes. A main hatchery was built in the South and provided a steady supply of small prawns for the farm for many years, although it encountered a few challenges along the way. Since prawn farming was relatively a new activity in Seychelles when the farm started, SMB had to recruit the services of several foreign aquaculture experts to help run the prawn farm. Farm managers ranged from countries such as India, Philippines and Thailand, each with their own area of expertise, assisted by several technicians, all of whom came from East Asian countries.

The product was held in high esteem internationally and locally, due to its premium appearance and taste. A combination of factors gave the product its unique attributes, such as the commercial pellets used and a high salinity when compared to prawns that are farmed in neighboring countries such as Madagascar and Mozambique, where salinities are much lower due to the presence of large river outlets along the coast. However, for several reasons the production at the prawn farm decreased from the peak in 2004 and eventually ceased in late 2008-2009. Amongst others, these included the high operational costs due to the location of the farm, which is situated approximately 300 km away from the inner islands and the difficulty to produce sufficient numbers of post larvae for stocking into grow-out ponds and other private sector interests. Other sectors such as tourism provided more attractive opportunities to potential investors, diverting attention from aquaculture. The isolated nature of the island made it an ideal location to maintain a good biosecurity profile with very low human interaction, but meant that transport costs to and from...
the farm were quite elevated. The distance covered between Mahe and Coetivy for the farm meant a lot of money had to be spent towards transportation of feed, provisions and finished product. Prawn feed was also being produced on Mahe, with the assistance of VDS, a Belgian company which was regarded as one of the highest quality prawn feed. Hence, it was exported to Madagascar and Tanzania. For a while this venture was very profitable and indicated the potential for Seychelles to produce feed for its own consumption and export to neighbouring countries.

![Figure 2. Seychelles prawn production (1998 to 2007)](image)

The Coetivy Prawn farm was producing frozen prawns of various sizes after about five-month growth cycles, which is slightly longer than other places where the species are farmed. Dominant international prawn producers such as Thailand can produce prawns in less than 4 months and could also afford to do so at lower costs and hence sell at more competitive prices. The “Seychelles prawn” was considered a premium product and even achieved better prices on the local market with the local residents and the tourism industry. The state of the art processing plant on Coetivy was European Union (EU)-Certified and containers of prawns were exported to France and served in many restaurants. Strict certification had to be adhered to and steps taken to maintain the high operational standards in order for the products to enter the EU market. Japan was another market where the Seychelles prawn made its mark among avid seafood lovers. Frozen whole prawns were the most popular product being exported to Japan, with little effort. Seychelles has always had a big reliance on the capture fishing, aquaculture involves techniques that are similar to terrestrial farming but in the aquatic environment. Fish being in plentiful supply around the islands in the old days meant that many people did not have it as part of their culture, as do for example the Chinese, who have been farming for thousands of years. Unlike capture fishing, aquaculture involves techniques that are similar to terrestrial farming but in the aquatic environment. Fish being in plentiful supply around the islands in the old days meant that there was no real need to farm fish which could easily be caught with little effort. Seychelles has always had a big reliance on the}

**Pearl Oyster Farming**

Pearl oyster farming in Seychelles was started in 1995 and continues on Praslin in the Curieuse Marine National Park. The two main pearl oyster species that are being produced are the black lipped oyster (*Pinctada magaritifera*) and the winged Oyster (*Pteria penguin*). Round pearls are mainly produced through black lipped oyster, while half pearls are produced by winged oyster where they fetch high prices on the market. The pearls are formed from small rounded beads called “nuclei” that are imported from Japan and Australia and implanted into the live pearl oysters by foreign specialists in the workshop. The oysters are then placed at sea and allowed to grow and form the beautiful black pearls. Harvesting occurs about two years after implantation, by which time the size of the round pearls varies from 8 to 12mm. The shiny deposit that forms over the nuclei is called the “nacre” and its thickness is 1.2 – 1.5mm and the colour varies from black, greenish-black to grey, which makes each pearl unique and attractive.

The pearl farm on Praslin collects tiny oysters called “spat” from the flowing water current throughout the year on special ropes called “collectors”, although October is the most productive time. Counting on wild availability of small pearl oysters is not very reliable, because if for some reason or another they are affected, this will affect production planning. Hatcheries are beneficial for the reliability of supply compared to dependence on wild spat supply, which is the case for pearl farming on Praslin. The pearl farm covers a concession area of around 19 ha within the Curieuse Marine National Park and is unique in the sense that it is within a Marine Protected area. However, the pearl oysters (as most other bivalves) are not fed with artificial feed but rather filter-feed on microscopic algae that are present in the water. The pearl farm also produces a small number of giant clams (*Tridacna maxima*) for ornamental purposes on the farm, but originally destined for the aquarium trade in Europe.

**Challenges for Aquaculture Development in Seychelles**

The main reason why aquaculture has not developed further in Seychelles is principally because of a combination of factors and disadvantageous conditions for it to be successful (Hecht 2009). A generally poor understanding of the sector meant that many people did not know what aquaculture is and Seychellois did not have it as part of their culture, as do for example the Chinese, who have been farming for thousands of years. Unlike capture fishing, aquaculture involves techniques that are similar to terrestrial farming but in the aquatic environment. Fish being in plentiful supply around the islands in the old days meant that there was no real need to farm fish which could easily be caught with little effort. Seychelles has always had a big reliance on the artisanal capture fishery for its protein supply. However, with an increasing population, the pressure on wild capture fisheries has meant more demand and supply struggling to keep up. It is worth noting that the tourism arrivals keep on increasing every year, which means there is an ever increasing pressure on the already fragile capture fisheries to sustain this demand. With the introduction of prawn farming and pearl farming in Seychelles, the population got the chance to learn about aquaculture. However, with the prawn farm being on the outer island of Coetivy, most people never had the chance to visit and experience an aquaculture farm first hand.
Role model

Although, there had been the establishment of a prawn farm on Coetivy Island and a pearl oyster farm on Praslin, there has not been any “real” sector “champion” to make aquaculture a household name in Seychelles. Faced with multiple challenges, the Coetivy prawn farm could not withstand for long and become the success story that it deserved. Tough competition for markets with larger producers of prawns such as Thailand meant that selling the final products became more difficult (Figure 3). From all of these came a lot of lessons learned which are proving vital to the current efforts to develop the aquaculture industry in Seychelles. It highlighted the need to relook at the overall strategic development of aquaculture for Seychelles, with particular elements being more pronounced, such as target markets, species, scale of development and legislation among others. The black pearl farm on Praslin is still in operation but on a small scale and not many people are aware of its operations.

Investment climate

Another factor which has impeded aquaculture development in Seychelles is an uncompetitive investment environment when compared to our closest competitors in the region. The country went through major economic hardships after the 2008 world economic crisis and this certainly affected the chances for aquaculture to pick up, as was seen with the closure of the prawn farm. Investments were at an all-time low and it was practically impossible to attract them to invest in aquaculture in Seychelles. When compared to other countries in the region that are attracting investors, Seychelles was at a disadvantage. Its environment, social and political stability were very good, but the fiscal incentives were not as competitive as other countries. It is apparent that operational costs are more elevated in Seychelles when it comes to elements such as cost of labour, utilities and inputs as compared to countries such as Mauritius and Mozambique. When an investor looks at the potential to invest in Seychelles, all these elements play a significant role in the final decision making. Having attractive fiscal incentives vis-à-vis its competitors would make Seychelles more competitive for foreign direct investments. Although aquaculture is a capital intensive activity, the local investors are equally important in contributing to the overall GDP of the industry. Favourable fiscal incentives need to be in place to allow them to develop and grow, such as access to finance for small and medium scale enterprises.

Human Resource Capacity

There is also a lack of scientific and technical capacity that is needed to support the development of an aquaculture industry in Seychelles. There has been a general lack of trained scientific and technical capacity in aquaculture when compared to fisheries and marine conservation. Aquaculture requires several scientific disciplines such as ecology, marine biology, oceanography and microbiology that are available locally, but the capacity is scattered in various sectors. In order for aquaculture to grow as an industry, it is important to have specialists in critical fields to undertake research and development. R&D is the key to developing the sector by using existing technologies and adapting those that are not suited to local conditions. Sea cage farming for instance is not a familiar form of farming technology that has been tried in Seychelles (Figure 5). Hence, it is important that it is tested and modifications made where and if possible to make this form of farming suitable to the Seychelles conditions, as its coastline is quite exposed to wind and wave action. The level of expertise required to maintain the momentum in aquaculture development is high and usually will count significantly towards determining the success of the industry (Figure 6).
people. Alongside a transparent process, the sector development and one which responds to the current needs and aspiration of its aimed at creating a sustainable aquaculture industry for Seychelles the country. The MMP took a sector development approach and issues mentioned as well as create a new socio-economic pillar for first Seychelles Mariculture Master Plan (MMP) to address the were part of the founding reasons for developing aquaculture. were assessed had significant potential for marine aquaculture the Western Indian Ocean region. Many of the countries which activity in Seychelles, it only features in a small sub-section in the old Fisheries Act (1989), with not a lot of information about fundamental and operational aquaculture laws. The existing activities had been governed by the Fisheries Act (1989) to the best of the available guidance but this meant that it did not provide the entire necessary legal framework for it to develop to its full potential. With an ever evolving activity such as aquaculture, it is critical to have an updated set of laws which cater for every aspect of the industry to ensure it develops and operates within a modern and formal legislative framework.

**Legislative Framework**

There is an absence of a properly defined legislative and regulatory framework within which the industry can develop in a structured manner. Without a formal legislative framework it can be very difficult to establish a sound and sustainable aquaculture industry. Every aspect of the industry requires a formal structure within which it can operate, such as an application procedure, regulations, standards and operational guidelines that must be adhered to. In many cases potential investors get confused as to the procedures that are established and this has been seen to have impeded the final decision as to whether to invest in aquaculture in Seychelles or not. Even if aquaculture is not a new activity in Seychelles, it only features in a small sub-section in the old Fisheries Act (1989), with not a lot of information about fundamental and operational aquaculture laws. The existing activities had been governed by the Fisheries Act (1989) to the best of the available guidance but this meant that it did not provide the entire necessary legal framework for it to develop to its full potential. With an ever evolving activity such as aquaculture, it is critical to have an updated set of laws which cater for every aspect of the industry to ensure it develops and operates within a modern and formal legislative framework.

**Government Support and Private Sector Involvement**

The list of shortcomings is long and it reinforces the importance of strong government and private sector support if the sector is to sustain its own development. The government realised the significance of aquaculture upon receiving and considering a regional assessment which was undertaken in 2007 to assessment for marine aquaculture development in the Western Indian Ocean region. Many of the countries which were assessed had significant potential for marine aquaculture development but lacked many of the basic elements and a formal framework. Similar results were found in Seychelles and these were part of the founding reasons for developing aquaculture. Government took the decision to invest in the development of the first Seychelles Mariculture Master Plan (MMP) to address the issues mentioned as well as create a new socio-economic pillar for the country. The MMP took a sector development approach and aimed at creating a sustainable aquaculture industry for Seychelles and one which responds to the current needs and aspiration of its people. Alongside a transparent process, the sector development plan is adopting an Ecosystems Approach to Aquaculture (EAA). This approach has several definitions, but in the case of the sector development plan it refers to: the balance of diverse societal objectives, by taking account of the knowledge and uncertainties of the biotic, abiotic and human components of ecosystems including their interactions, flows and processes and applying an integrated approach within ecologically and operationally meaningful boundaries (Soto et al. 2008).

Seychelles finds itself in the fortunate position to implement EAA because the usual industrial needs and demands that would have been present if an industry already existed are absent. Hence Seychelles has the ability to develop a sector in line with its international “green” or “blue” image and this has immense marketing value.

Recent developments indicate a change in support for marine aquaculture development in Seychelles from the government, the private sector (including tourism), civil society and NGOs (Hecht 2009). With the sharp increase in global food and fuel prices in 2008 (IMF 2008), which affected many small developing countries, such as Seychelles, a new strategy needed to be devised to address emerging food security concerns. Even though the emphasis was put on increasing agricultural production, marine aquaculture was considered as one of the sectors which could potentially ensure food security and provide significant support for the socio-economic development of the country. Moreover, the decline in the tourism industry as a consequence of the global credit crunch, juxtaposed with declining tuna catches, provided further impetus for Seychelles to recognize the importance of establishing new industrial sectors. For marine aquaculture to become a player in the economy of Seychelles, this requires a proper framework in the form of a sector development plan (Master Plan) to be put in place, with the necessary guidelines, research and development, a legislative and regulatory framework and investment incentives (Figure 7). The absence of a sector development plan can have adverse consequences. For example an oyster farming project with Crassostrea gigas did not materialise because the site selection process was undertaken without consulting other resource users and residents in the vicinity (Hecht 2009). The new approach adopted by Seychelles is to involve all key stakeholders in the development of the sector development plan, right as from its beginning (Hecht 2009). Bryceson (2002) demonstrated the consequences of inadequate public consultation on the development of a large scale prawn farming venture in Tanzania in 1999/2000.
Aquaculture and the Blue Economy in Seychelles

The relevance and importance of aquaculture is becoming more and more evident in view of a global drive to further develop the “Blue Economy” following the Rio+20 conference held in Rio de Janeiro in 2012. The Blue Economy initiative is developing a world initiative pioneered by SIDS but relevant to all coastal states and countries with an interest in waters beyond national jurisdiction (BE Concept Paper). Seychelles as a SIDS has taken the leadership role in the Blue Economy initiative. Aquaculture still remains one of the fastest food-producing sectors in the world and accounts for almost 50% of the entire world’s fish used for food (FAO 2014). It addresses several elements which comprise the key areas of the Blue Economy, such as food and nutrition security, unsustainable fisheries and marine and coastal tourism. The approach taken by Seychelles to develop its aquaculture industry is very much in line with the Blue Economy initiative and many of the components in the MMP are aimed at addressing these very elements.

The Seychelles Fishing Authority (SFA) has been developing the MMP which started in 2011 with its consultant Advance Africa Management Services. The main output of the MMP has been the drafting of the first Marine Aquaculture Policy and Regulation. Though still being reviewed, it has been developed to ensure that aquaculture develops in a modern and sustainable manner, with the best management practices being adapted to the Seychelles context. The Marine Aquaculture Policy was drafted with the participation of a wide array of stakeholders representing public, private and NGOs. A working group in the form of a Steering Committee has been active since 2012 to help draft, discuss and review the Policy and associated documents. The SFA adopted such a participatory approach in view of successes seen with other projects in fisheries and other sectors. The policy was developed with close reference to the Blue Economy initiative and is, thus, very relevant to the national development strategy for Seychelles. The Marine Aquaculture Regulations have been drafted from the policy aspirations and take into consideration the best management forms from many countries around the world with good aquaculture standards. The regulations are expected to make aquaculture more relevant and updated to current levels of development and operations.

Human Resource Development is also one of the key areas that the MMP will be addressing to ensure that the aquaculture sector has a steady supply of qualified and skilled labour. A thorough capacity needs assessment in 2009 and again in 2014 gave a good overview of the manpower availability for the sector and of what needs to be done to support growth for the sector in the next five years. It is undeniable that Seychelles already has a significant amount of trained professionals in the fisheries sector. However, when it comes to aquaculture, a wider field of expertise is required and the demand becomes even more pressing for qualified people in areas such as hatchery management, nutrition, micro-biology, ecology, aquatic zoology, to name a few. The SFA has been working with the Agency for National Human Resources Development (ANHRD) to develop a new training plan to provide opportunities for local students to undertake further training in a variety of fields related to aquaculture. The training plan prioritises key areas for training and provides full scholarships for qualified candidates with the aim of building the local manpower in anticipation of the new aquaculture industry. The manpower capacity building is a strategic move to ensure that the aquaculture sector employs as many local personnel as possible, hence maximising the overall economic benefits for Seychelles. This also helps to circumvent the pressures on local amenities and services such as health care system, education and the transportation systems, when foreign labour is imported.

Aquaculture as part of the Blue Economy initiative is expected to create a multitude of socio-economic benefits for Seychelles, namely the creation of jobs, provision of fish and GDP growth. A significant amount of direct jobs such as farm management, farm technicians, etc. are expected to be created through the aquaculture industry and these will provide further diversification of the local job market to the local population. Unlike the prawn farm, where most of the workforce came from overseas, the new aquaculture industry aims at creating for Seychellois opportunities that will have a long-term impact. As one of the core elements of the Blue Economy, aquaculture is aiming at addressing the issue of food security through provision of fish and fisheries products on the local market (Figure 8). Access and supply are key factors that will be addressed under food security once aquaculture develops in Seychelles. This is because the current demand for fish, especially from the artisanal fisheries, is overwhelming the supply capacity, leading to overfishing of vulnerable stocks and shortages of supply to fish processing factories. The GDP growth that is expected from the development of aquaculture in Seychelles will be significant and this has led to strong support from government in order to ensure that all necessary elements are fully developed and established over the next five years. The potential for the industry in terms of economic growth has been well analysed and the target is set to achieve a production capacity of around 50,000 MT by 2020. This target may seem high, but the analyses undertaken over the past five years have shown that Seychelles can quite comfortably attain this with all the necessary elements and support in place.
The Ecosystems Approach to Aquaculture (EAA) taken by the aquaculture industry development in Seychelles is looking at building links with other sectors wherever possible. With the creation of the aquaculture industry a variety of support services and indirect jobs are expected to be created by the private sector, such as feed manufacturing, logistics and laboratory services. Already there has been a lot of anticipation with the possibility of establishing a fish feed manufacturing industry in Seychelles in view of the availability of existing raw materials such as fish meal from the industrial tuna fishing industry. The increase in demand for feed in the agriculture sector will further add to the justification to establish a fish feed manufacturing industry in Seychelles in the future, whereby importation of other pre-cursor raw materials such as maize meal will be more economical at bigger scales. This approach sits well with the sustainable development approach of the Blue Economy initiative and will no doubt improve on its successful implementation for Seychelles. A revamped legislative framework has led to more actors joining together to coordinate their current and future developments alongside the aquaculture industry plan, such as the investment and fiscal incentives, infrastructure development and regulatory services. A more streamlined application procedure aims at improving investments in aquaculture and at providing a more competitive set of fiscal incentives to investors in comparison with our competitors. Existing infrastructure are slowly being aligned to the future development plans and aspirations of the aquaculture industry to ensure that they respond to the actual needs, such as fresh fish handling facilities and reliable logistical chain. Alongside improved infrastructure, support services such as veterinary services and certification by the competent authority are crucial in ensuring the quality of aquaculture products are up to standards of the target markets.

The SFA has been conducting a lot of fisheries research over the past 30 years and some of these have contributed towards a lot of its management measures and regulatory framework in its current Fisheries Act (2014). Advanced research and development is expected to be undertaken by the SFA and its key partners, namely the University of Seychelles (Unisey) and the newly created Blue Economy Research Institute (BERI) to ensure that the Seychelles aquaculture industry remains up-to-date and relevant. Unisey is continuously developing graduate and post-graduate degrees and training to cater for the growing fisheries and aquaculture industries. UniSey will be a key partner of SFA along with several international research partners in undertaking advanced research and development in aquaculture. The adaptation of technologies to the Seychelles context is crucial in areas such as species development which have significant impacts on production and sale of final products. In view of the high cost of production in Seychelles, choosing the right species is vital to the survivability of the aquaculture industry as a whole. Selecting high-value candidate species is of primary importance in the first instance and continuous R&D is crucial in order to ensure that the aquaculture industry in Seychelles remains abreast of its competitors and of its local objectives. One of the main objectives of aquaculture development in Seychelles is to improve wild capture fishery stocks through re-stocking and stock enhancement trials. A tight collaboration with conservation partners will ensure that such re-stocking programmes are a success when implemented with aquaculture and will re-enforce the partnership that is being nurtured under the Blue Economy initiative. The Seychelles Maritime Academy (SMAI), formerly the MTC, is another key partner when it comes to research and development of the aquaculture industry, as it is mandated to train students up to advanced certificate and diploma level.

Aquaculture has a lot to benefit from in Seychelles in terms of marketing in view of the “sustainable label” which the country is renowned for. Currently fish from wild fisheries enjoy premium prices on international markets due to the “Seychelles brand” that exists. During the development of the MMP, the “Seychelles image” was always kept in view and respected in order to preserve the Seychelles brand and status. This has been ensured through the proposed Marine Aquaculture Regulation, with stringent laws aimed at minimising the perceived risks posed by aquaculture in Seychelles. Aquaculture aims at enhancing trade in existing and new markets with the goal of maximising revenue from its marine resources as part of the Blue Economy initiative. Currently, a detailed market study is underway to ensure that the Policy and Strategy take into consideration the market aspects and that Seychelles embarks on aquaculture based on concrete evidence and expectations. Again addressing another element under the Blue Economy initiative, aquaculture aims at improving transport and access to and from Seychelles through improved trade of aquaculture products with other countries. An increased export volume of high value products such as fresh fish is expected to improve demand for transport such as air freight and add value to the overall objective of the Blue Economy initiative.

**Conclusion**

To conclude it can be said that aquaculture presents a revolutionary opportunity for Seychelles to develop a new socio-economic pillar and add value to other national developments. The interest shown towards investing in the new industry and the level of support from government have been phenomenal, thereby addressing a lot of the gaps identified in the initial regional
assessment in 2007. This has led to a significant amount of support to Seychelles towards the development of its aquaculture industry, notably from the European Union (EU) through the Fisheries Partnership Agreement, the New Partnership for Africa’s Development (NEPAD) and the African Development Bank (AfDB). The lessons learned from past experiences and current constraints are contributing significantly towards the direction in which aquaculture is taking over the next five years. By creating one of the most robust industries in Seychelles, aquaculture could at last be making its mark into the Seychellois culture and become one of the most sustainable and respected activities if done properly. Hence, the SFA is following the already positive participatory approach and using best management practices and experiences from around the world to help accelerate the establishment of the Seychelles aquaculture industry. This new industry will inevitably help diversify the economic activities and relieve the current pressure being exerted on the wild capture fisheries. The overall expectation of establishing the aquaculture industry will be that it responds to all the expectations of the Seychellois people and offers the best opportunities for future growth and development.

Résumé

Au sens le plus simple du terme, l’aquaculture se réfère à l’élevage d’animaux et de plantes aquatiques. On estime que cette pratique a débuté entre 1000 à 2000 ans avant notre ère (Hickling, 1962) en Chine, avec l’élevage de carpes dans de simples réservoirs d’eau. Depuis ses débuts en Chine, cette pratique s’est étendue à travers le monde et a évolué pour devenir l’une des sources majeures en matière de production de protéines. En tant qu’activité high-tech, l’aquaculture peut être pratiquée dans des cours d’eau en haute montagne de même que dans des cages sophistiquées en mer. Dépendant des propriétés géographiques, l’aquaculture peut être entreprise en eau douce, ainsi que dans des zones marines et saumâtres. Compte tenu des réserves d’eau fraîche limitées aux Seychelles, l’aquaculture a été et demeurera limitée à l’environnement marin. De nouvelles avancées technologiques et scientifiques ont amené au développement d’écloseries, ce qui a amélioré la capacité de contrôle de la production entière et du cycle de vie de plusieurs espèces. Toutefois, lorsqu’elle n’est pas proprement pratiquée, l’aquaculture peut avoir des impacts environnementaux néfastes, tout en étant perçue de façon négative. Ainsi, des efforts soutenus sont requis pour trouver le juste équilibre pour développer l’industrie aquacole en tenant compte des leçons du passé.

References

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...Leading the Tourism & Construction sectors in Seychelles
Nuances of Tourism: The Case of Anse Royale

By Prof. Dennis Hardy, University of Seychelles

Abstract

The Blue Economy invites new ways of thinking about our use of the sea. Indeed, the very concept is based on doing things differently. Just because certain activities have taken place in the past is not a reason for continuing as before. Instead, the Blue Economy calls for innovation. It also calls for sustainability; practices which jeopardise the future wellbeing of the marine environment will no longer be acceptable.

To illustrate these points, this paper focuses on just one seaboard activity, namely, tourism, and on a particular case study, that of Anse Royale, a small coastal settlement on Mahé, the main island of Seychelles. The purpose is to demonstrate some of the opportunities that are presently untapped, not only in this one location but more widely. It can be seen as a microcosm of how the Blue Economy can address ongoing challenges and, in a sustainable way, open new vistas onto the oceans.

Tourism en masse

Thanks to the application of the same industrial model developed for cars, houses and consumer goods, international tourism has exploded in size since the 1960s and swept into virtually every nook and cranny of the planet... (Pollock, 2013).

Tourism is, and is likely to remain, a prominent feature of the Blue Economy. By no means is all tourist activity associated with the sea, but in terms of sheer numbers, most of it is. From the end of the nineteenth century, when industrial workers and their families in western Europe first enjoyed the novel experience of week-long holidays, the new seaside resorts drew most of the visitors. Simply being by the sea was reward enough for spending the rest of the year in grimy towns. Breathing in the salty air and taking to the waters took on an almost mystical quality.

Presently, of course, the situation is very different. We now live in an age of mass tourism. Already there are more than 1.1 billion international tourists (nearly one in six of the population of this planet) and, year on year, the number is rising. Tourism has become the world’s largest single industry. That almost goes without saying when one thinks of the sheer number of tourists buying air tickets, booking hotel rooms, eating at local restaurants, going on sightseeing trips and returning home with suitcases packed with souvenirs. The circulation of money that is generated now turns the motors of many economies. In the words of the United Nations World Tourism Organization:

Today, the business volume of tourism equals or even surpasses that of oil exports, food products or automobiles. Tourism has become one of the major players in international commerce, and represents at the same time one of the main income sources for many developing countries. This growth goes hand in hand with increasing diversification and competition among destinations.

This global spread of tourism in industrialised and developed states has produced economic and employment benefits in many related sectors - from construction to agriculture or telecommunications (UNWTO 2015a).

Most of this growth in international tourism has taken place over the past half century, a product very largely of two universal trends. One is the availability of relatively cheap air travel, which, first, enabled vacations in warmer climates just two or three hours away, and, more recently, long-haul trips to distant continents. No part of the world is now out of bounds. The rise of car ownership has also been important, encouraging journeys to different countries within respective
continents, especially in Europe and North America. A second trend that underpins modern tourism is the growth of disposable income. There are still large swathes of the world population where this is not yet evident but, for an increasing number of people, going on vacation is now a basic expectation and a regular part of the cycle of modern life.

As a result, there are few if any parts of the world which do not receive international tourists. France remains (as it has done for many years) the most popular individual destination, with its attractive menu of cities, countryside and coastline. The United States, too, continues to attract very large numbers of visitors from overseas. But for the sharpest examples of growth one has to look to south and south-east Asia especially, and also to emerging destinations in the Pacific and Africa. Even more dramatic, and a reflection of changing fortunes, is the fact that more international tourists come from China than from any other country (UNWTO 2014).

By any measure, at the heart of all these movements, the popularity of the sea remains undimmed. The most striking example is the Mediterranean, which for more than half a century has attracted more visitors than any other region in the world. At the start of the present millennium, coastal destinations around what is known as ‘the inner sea’ (largely separated from the great oceans) were receiving some 200 million visitors per year, and this figure excludes the very significant number of tourists from within the reception countries who like to enjoy their own beaches. Visitors arrive not only on charter flights but also in cars returned to the parent companies; while many visitors themselves arrive with most of their clothes and equipment already in their suitcases, with the intention of buying as little as possible locally. As well as lost revenues, another potential cost of tourism is the damage that is too often inflicted on the environment. There are all too many places around the world where the environment has been permanently degraded by overuse resulting from an excessive number of tourists. As well as the likes of forests and deserts across the world’s land surface, the natural qualities of the sea and the species within it have suffered.

Yet the essence of the Blue Economy is that all of its activities must be sustainable – including tourism, which is now ubiquitous. Realistically, the environmental costs created by large numbers of visitors cannot be removed completely but, with effective policies and political will, they can at least be minimised. There is an economic as well as ethical incentive to do so, if only because tourists will ultimately favour those locations that offer the best experience. In the following section and in the subsequent case study, we will see how this might be achieved.

Treading More Lightly

We need to discover ways in which authentic ecotourism can move from being simply a niche market in the category of nature tourism to becoming a broad set of principles and practices that transform the way we travel and the way the tourism industry functions.

In the face of mass tourism, the ultimate danger is that the very attractions that tourists come to enjoy will be lost because of visitor impact. To prevent this from happening, there are now attempts to counter unwanted effects; under the banner of ecotourism, ways are being introduced to tread more lightly on the earth.

The concept of ecotourism has evolved over little more than a quarter of century, in the wake of growing evidence
of environmental damage. In part it is a geographical concept, directed to places that are still unspoiled and where human impact should be minimised. But it also has a wider application, embracing a more comprehensive concern for the impact of tourism. For instance, hotels might be built using local, recycled materials rather than imported, industrialised products; or resort developments sometimes sponsor a conservation project to protect wildlife or a valuable wetland. But do these kinds of initiative really make a difference and, specifically, does ecotourism have a role to play in the Blue Economy?

Critics can argue that ecotourism is merely an attempt to whitewash (or, as some say, ‘greenwash’) the negative environmental effects of tourism. After all, every visitor has an impact – no matter how lightly they tread on the earth – and there is probably nothing that can be done to prevent this altogether. So can ecotourism be anything more than cosmetic in its effects? Probably not, but even if that is so, surely it is worth reducing visitor impact wherever possible. Tourism, in one form or another, is here to stay and we need to find the best ways to live with it. So, in terms of the Blue Economy, how can we make tourism more sustainable?

This is not just a question of minimising the impact on the environment. People who live in and around tourist venues can suffer too. Traditional lifestyles are threatened not only by the appropriation of land, but also by the evidence of very different income levels and contrasting forms of behaviour. Young people, especially, can be seduced by the seeming attraction of excessive drinking and late-night parties; older residents might be offended by the sight of people wearing scanty beachwear in the streets. And the many staff required to work in the hotels and restaurants are not necessarily well treated by visitors. All of which brings one to ask whether there are ways to close this kind of gulf between the two groups, so that the advantages of tourism outweigh the potential disadvantages. The answer, it seems, is to consciously develop forms of tourism that encourage visitors to find inherent enjoyment in both the natural and social environment. There is, in fact, no shortage of ways in which this can be done, as the following three examples illustrate.

One way is to provide opportunities for tourists to engage directly in conservation projects. Even (in some cases especially) if they are staying in luxury resorts, visitors will often be enthusiastic to play a direct part in helping to conserve indigenous flora and fauna. Indeed, an increasing number of resorts are themselves offering this kind of opportunity. As an example, the Four Seasons is a five-star resort on the island of Mahé, in Seychelles, which has joined an environmental organisation, WiseOceans, to restore the nearby coral reef to its original splendour. Bleaching occurred as a result of the rise in sea temperatures resulting from the global El Nino effect, but the reef is slowly recovering. To speed up the process, the project will transplant some 16,000 coral fragments from a nursery in the resort back to the sea. And residents at the resort will be actively involved: All our guests will be invited to take part in coral propagation activities, and we hope that as many as possible will join in. We will have workshops twice a week, where they can get involved in preparing coral for the nursery and learning about the process.

The success of projects like this demonstrates the fact that not all tourists are satisfied only with the traditional menu of sun, sea and sand. It is time to challenge the traditional assumption that a ‘one-size-fits-all’ approach to tourism is sufficient. Many tourists are intelligent, inquisitive and caring; so, what is on offer for them?

As well as conservation projects associated with high-end accommodation, some tourists will choose to live more simply and to devote all of their time to undertaking the kind of work that would not be possible in their own countries. Scientific recording of species in a tropical environment, treatment of injured animals in refuge centres, clean-up operations along polluted coastlines or planting new vegetation where erosion has taken place are all operations that will appeal
Another type of activity is what is known as agritourism (alternatively, agrotourism). In relation to the Blue Economy, this will take place in a coastal location, most commonly on an island where growing food is an important feature of the local economy. At one level, it simply offers visitors an opportunity to stay on a farm or visit it for a day, but it can also mean a chance for more direct participation. City-dwellers are now typically detached from the source of their daily food and agritourism is a way of reconnecting with the land. For children, who may be unaware of where the food on their table comes from, this is especially important, but it will be appealing to adults too. As an example, tourists who come from a temperate climate are invariably fascinated by the different products they see in a tropical environment. These differences include fruits that will be new to them but which grow freely in the forests: breadfruit and mangoes, papaya and passion fruit. Or something that is familiar, like the banana, may for the first time be seen in bunches on a tree; likewise for coconuts in tall palms along the edge of a beach. Plants grow rapidly and in profusion in the tropics, and the effects of heavy rainfall combined with high temperatures will be a revelation. Hotels can offer guided tours in their own grounds and will perhaps encourage indigenous fruit to be picked or herbs to be planted. For the more serious-minded, conservationists can choose to spend part of the day with like-minded people in a learning situation, and the rest of the day enjoying the beach or mountains. Providers of education tourism range from specialist travel companies and individual entrepreneurs to colleges and universities.

A further example of tourist activity with a difference is where there is an alignment with education. A winning formula is to combine opportunities to study in an attractive environment. Participants can then spend part of the day with like-minded people in a learning situation, and the rest of the day enjoying the beach or mountains. Providers of education tourism range from specialist travel companies and individual entrepreneurs to colleges and universities.

Cookery courses using locally-produced ingredients, art workshops with indigenous artists, or creative writing classes led by a well-known author, are just some of the examples that can be located in any tourist region. The idea, too, of learning a language where it is spoken everyday is also attractive. In some programmes, there are also opportunities to learn more about other aspects of a particular culture. How many visitors who spend a vacation by the sea return home with much knowledge of the people who live there? Sometimes, there is a superficial display of dancing or an exhibition of craftwork but these seldom reveal much about the origins and changes in local practices.

And, as well as classrooms and workshops, courses can be offered making direct use of the local environment. Weeks spent being coached in, say, sailing, surfing and scuba diving are already very popular, adding interest to the basic experience of being by the sea. So, too, are educational cruises, where, in addition to visiting historic or other sites, on-board experts give lectures and discuss the subject with the various participants. Mediterranean cruises where the ship calls at different classical sites offer one popular example. A very different kind of venue is for cruises in the polar regions, where visitors are introduced to the unique landscapes of the Arctic and Antarctic, and while observing evidence of melting icebergs, they can discuss pertinent issues of climate change.

The Other Side of Fairyland

We have to change, not a little, but radically. Not later, but now. Not with today’s business thinking but with a new set of skills.

Driving south-east from Victoria, the capital of Seychelles, the coastal road winds upwards to cross a heavily-wooded granite outcrop with the magical name of Fairyland. In fact, the name is derived from the former nesting ground of the fairy tern, rather than a world of make-believe, but it still has a ring about it. Snaking down the far side, one is soon rewarded by the sight of one of the island’s most popular bays, that of Anse Royale. Tourists make their way there because of its good beaches and safe waters, as well as spectacular views; a small island close to the shore must be one of the most frequently photographed landforms on Mahé. Across the bay can be seen a picturesque church with its quaint tower, nestling on the waterfront and backed by forest-clad mountain slopes. To complete the picture, waves break in advancing lines of surf across an outer coral reef.

The main road itself cuts right through the settlement, presently a small but important service centre but destined, according to the planners, for bigger things. There is a string of shops and a few restaurants along the road frontage, as well as a recently-built community hospital. Education makes its mark, too, with the main campus of the University of Seychelles, three post-secondary institutions and both a primary and secondary school. Another dominant feature is the presence of a large market garden, with kiosks nearby where fresh produce can be bought. Most of the housing is scattered inland and on the slopes above, while the keen-eyed will
spot the expanse of wetlands to the south of the main township which effectively limits new development.

For the tourist who has come to see life on a tropical island, Anse Royale offers a perfect setting. Young children in neatly-pressed uniforms make their way to the nearby schools, women wearing straw hats and clutching rolled umbrellas shop at the local stores, and each Sunday the sound of lusty singing can be heard through the open doors of the well-attended churches. What is more, the district has no shortage of small guesthouses and self-catering accommodation for holidaymakers. And yet, for all its potential, there is something missing. Especially if the weather is unsettled and the beach uninviting, what is there for visitors to do?

The essence of ecotourism is to make use of what is natural and locally sourced, and to look for alternatives to large-scale development and an unnecessary movement of goods and people. In Anse Royale this model represents a challenge that has yet to be met. But, as the rest of this section illustrates, there is undoubtedly scope to do so. The future of the settlement might lie in an ‘alternative’ set of activities, creating something of a bohemian milieu, focused around three themes – food, wellbeing and culture.

Food is an obvious starting point, based on fish caught in the coastal waters, on vegetables grown in the market gardens, and on tropical fruits gathered from the forests. Presently, these are all available in their natural state, but for each product added value can easily be created. Fish is presently sold by fishermen and middlemen from a couple of palettes laid out on the ground. Tourists love to take photos of the fresh produce, but very few are in a position to walk away with a whole fish. Instead, they can only watch local people haggling over the price before heading home to cook their purchase. Clearly, the palettes are a source of attraction in themselves and should certainly be retained (in one form or another). But more could be done to increase the revenue of the traders. Why not, for instance, build a wooden shed that could be used as a smokery? Why not sell delicacies like fish pâté and smoked fish to local shops and restaurants? Or why not introduce a wood-fired barbecue to offer cooked fish in baguettes to tourists looking for a light lunch? All of this would add considerable value to the basic product.

Likewise, the two kiosks that sell fresh vegetables and fruit from the market gardens are a popular feature and should remain part of the Anse Royale scene. But perhaps there could also be a linked café to sell juices, nutritious soups and organic snacks. Again, this would add value to the raw products. Tropical fruits are a constant source of interest to visitors and many of these grow wild in the nearby forests. Rather than only selling them in their raw state at the roadside stalls, some of these could also be processed as juices or even patisserie. Taking the possibilities a stage further, there could be a café in Anse Royale selling coffee and tea that is already grown locally; an artisanal bakery and home-made cake shop; and once a week a market with stalls selling eggs from nearby plots, jars of honey and even flowers. Existing restaurants would soon follow suit and Anse Royale could quite soon and at very little cost gain a reputation as a ‘foodies’ venue – a mecca for organic and tropical produce.

A second theme could be that of wellness. Visitors and local residents alike have an increasing interest in health therapies and Anse Royale would be well placed to offer an attractive range of activities. Encouraged by the proximity of the hospital and the potential involvement of healthcare staff, one idea is for a studio for yoga and alternative therapies, such as reiki. In line with the wellness theme, a shop could be opened to sell natural health products (many of which are already made on the island). There would also be scope for exercise, in a variety of forms. A fitness trail around the bay can be included in the beach park that is presently planned to the south of the settlement. Likewise, there are plans to improve recreation facilities on the university campus, with joint community and visitor use. There is already an exercise centre and a running track, the latter of which will be upgraded, and there are plans to add a small stadium for local and national events.

As well as food and wellness, a third feature of Anse Royale could be as a hub for the arts and culture. New initiatives could be driven by the university and the School of Visual Arts, drawing together not just local talent but the contribution of accomplished artists from across the island. One can envisage, for instance, studios for young artists making a start in
their creative careers; a cluster of galleries for established painters and sculptors; craft workshops specialising in tasteful souvenirs and objets d’art, some of which will showcase the work of young designers specializing in jewellery and fashion, homeware and pottery. To add to the cultural mix, there can be an open-air cinema and use of the university theatre to enable regular productions, including live music events. Another innovation would be education tourism, with classes, for example, in Creole cooking, fish preparation, yoga, dance, painting and drama. This could be supported by local guesthouses offering accommodation and access to the classes as a package. Drawing these three themes together, Anse Royale could offer a venue for, say, an annual festival to celebrate a distinctive brand for Creole approaches to food, wellness and culture.

Piece by piece one can see a new image taking shape, one that is quirky rather than conventional, with the rough edges of driftwood and the innate character of these moulded offcuts one finds along the beach. Imaginative urban design will be called for, perhaps combining a traditional style of Creole architecture alongside examples of bleached wood and modernity. It would offer a real boost to the local economy, suiting the scale of the many small units of accommodation and perhaps also ‘homestays’. Anse Royale in this form would complement the more urban-based future of Victoria and an existing, conventional model of tourism in the north. In order to succeed, it would need to win the support of all stakeholders. The formation of a trust would help to drive it through, over a number of years, as part of a larger strategic plan for Mahé.

**Small Island Conundrum**

*Facing a future whose only certainty is change, small island developing states are confronted with many problems and difficulties – some intrinsic and timeless, others extrinsic and new – in making progress towards sustainable living and sustainable development. However, small island societies have a record of thriving in challenging times (UNESCO 2014).*

Tourism promoters in small island states are both fortunate and unfortunate. On the one hand, they know that small islands (especially in a tropical location) rank high in the minds of potential visitors. With the right publicity, combined with good access, tourists will flock to this kind of venue. On the other hand, the fragility of an island environment, including its pristine waters, is vulnerable to the arrival of large numbers. The temptation to attract more tourists, year on year, must therefore be tempered by an appreciation of the costs as well as benefits. Strategies need to be developed to balance competing interests.

On the Indian Ocean island of Mahé, the emphasis to date has been placed on attracting more visitors. Numbers count. Around the coastline are high-end hotels and resorts, catering for a traditional diet of rest and relaxation. Undoubtedly, they meet a growing demand (more Chinese visitors, for instance, are arriving each year) but, in spite of sponsoring some worthy conservation projects, they cannot really be thought of as sustainable. It is telling that the President of Seychelles, James Michel, in his 2015 National Day speech, announced that there would be no fresh planning permissions for large-scale developments of this kind. Instead, more support will be given to guesthouses and boutique hotels owned and run by local people. The future of tourism on this particular island is, therefore, likely to be one of mixed development, large and small.

For the latter, there are niche opportunities to offer a distinctive brand of ecotourism, along the lines proposed for Anse Royale. This brand will, ideally, be closely matched to local conditions and, as a result, the most effective agents of change will themselves be local. Taking this argument a step further, it is small businesses that will assume a leading role. But to enable them to do so, there must be a more supportive business environment than is frequently the case. Below it is suggested that four initiatives will help to bring this about.

Firstly, there needs to be a more entrepreneurial culture, in which opportunities will not only be identified but also enacted. This is not something that can be conjured up overnight but will rely on the stimulus of teachers in schools, on new training programmes in tertiary education, on community meetings in the various districts, and on the leadership and encouragement of politicians. Secondly, a way must be found to respond to much-publicised concerns that credit is hard to obtain from the banks. Clearly, the banks will not want to expose themselves to undue risk, but where there are good business proposals they deserve to be supported. A third initiative could take the form of a dedicated planning policy designed to facilitate the kind of change that is envisaged. Small businesses could be assisted by experts in design and development, and through a system where their plans are approved without undue delay. Finally, there needs to be a seamless relationship with the wider community, of which small businesses are, in any case, a part. No-one knows the locality better than the people who live and work there, and the ideas and involvement of the whole community should be encouraged from the outset.

Anse Royale has been selected because it offers a good testing ground for an innovative approach to the introduction of small-scale tourism projects. A change of direction is called for and this will not be easy. It will require a change of mindset as well as the introduction of viable ventures. But small island societies are resourceful and this latest challenge cannot be ignored. In its own way, the situation at Anse Royale is no more than a microcosm of how Seychelles in particular, and small island states more generally, will have to respond if they are to prosper rather than simply survive.
Notes
1 In terms of sustainability, the Blue Economy is based on the same principles as the previously conceptualised Green Economy, but the one is directed to the sea and the other to the land.
2 For this section, on the global context of tourism in the Blue Economy and new trends in ecotourism, I have drawn on Chapter 5 in Michel (2015). President James Michel acknowledges the economic importance of tourism in the Seychelles economy, while also being acutely aware of the social and economic implications.
3 The present figure is based on the number of international tourists in 2014, which is projected to rise to 1.8 billion by 2020 (UNWTO, 2015a).
4 There are various estimates, such as the Mediterranean hosting 30% of the world’s international tourists (see, for instance, UNEP, 2008).
5 These estimates pre-dated a number of events – notably, the global recession from 2008, the financial problems affecting Greece and other southern European economies, and political instability resulting from the Arab Spring and the civil war in Syria – which, at least temporarily, altered this trajectory.
10 In discussions about a strategic plan for Mahé, Anse Royale is designated as the island’s second centre.

Résumé
L’économie bleue invite à une reconsidération de notre façon de penser par rapport à l’utilisation que nous faisons de la mer, le concept en lui-même étant basé sur une différente façon d’opérer dans le domaine. En effet, l’adoption de certaines pratiques par le passé ne constitue pas une raison valable pour le maintien de ces mêmes pratiques de nos jours. Le concept de l’économie bleue requiert comme condition la soutenabilité. Quant aux pratiques qui mettent en péril le bien-être de l’environnement marin, elles ne seront plus acceptables.

Pour illustrer ces observations, la présente communication est axée sur une activité particulière pratiquée sur le littoral, notamment le tourisme, et l’étude de cas porte sur la région d’Anse Royale, petite agglomération du littoral située à Mahé, principale île des Seychelles. L’objectif est de démontrer quelques-unes des opportunités qui demeurent pour l’heure inexploitées, non seulement dans la région, mais plus largement également. La communauté d’Anse Royale peut être perçue comme un microcosme pour discuter de la façon dont l’économie bleue peut faire face aux défis actuels de manière durable et ouvrir de nouvelles perspectives relatives à l’utilisation des océans.

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Towards Maritime Security in the Indian Ocean: The case of Seychelles

Keywords: Maritime Security, Somali Piracy; Capacity-Building; Seychelles

By Jessica Larsen

Abstract

Since 2012, the Blue Economy has become a central policy priority for coastal countries and Small Island Developing States. The aim is to promote sustainable growth of ocean-based economies. To allow for its effective implementation, maritime security plays a crucial role. However in recent years, insecurity has marred some of the world’s maritime spaces. For instance in the Western Indian Ocean, illegal fishing and piracy off the coast of Somalia have been the focus of maritime security governance actors; and more recently, drugs and human smuggling are attracting the concerned attention of the international community. In this context, the article asks: in order to provide sustainable conditions for the Blue Economy, which security governance mechanisms may effectively deal with maritime crime? Based on the example of counter-piracy off the coast of Somalia, the article explores how maritime security governance is approached in the Western Indian Ocean. It focuses on the role of the Small Island Developing State of Seychelles to document which steps were required for one of the Blue Economy’s central stakeholders to participate in maritime security governance. In particular, it describes and discusses Seychelles’ efforts of piracy prosecution, as Seychelles was the main country to do so. Since little published work exists on the subject, the aim is to provide preliminary documentation of some of the legal and practical issues encountered in a recent example of maritime security law enforcement. This may inform the development of more permanent security governance structures concerning maritime crime in the Indian Ocean and beyond.

Framing maritime security within the Blue Economy agenda

Based on the premise that maritime security governance is a crucial field of priority for the success of the Blue Economy agenda, this article explores some recent lessons learned from law enforcement of the sea. The Blue Economy is an emerging development agenda (UNCSD 2012, p. 4) which is being devised in national and international settings to facilitate the sustainable growth of ocean-based economies. It speaks particularly to coastal countries and Small Island Developing States (SIDS) wishing to explore marine resources with environmentally friendly and socially inclusive means. As such, the Blue Economy is an important maritime supplement to current global development agendas like the Green Economy principles established at the Rio+20 Summit (UNCSD 2012a) and the post-2015 United Nations Sustainable Development Goals (UNGA 2015). These development agendas all overlap in their efforts to ensure food security, create sustainable livelihoods, restore the health of the environment and mitigate climate change.

For coastal states and SIDS to effectively implement their Blue Economy policies, maritime security is “of utmost importance,” as Seychelles’ President James Michel stressed at the 70th UN General Assembly in September 2015 (Michel 2015a). Within policies related to the Blue Economy agenda, this is increasingly being acknowledged. For instance, the African Union has recently devised a comprehensive Integrated Maritime Strategy (AU 2012) in which maritime security plays an important role; and the European Union (EU) has recently launched a dedicated Maritime Security Strategy (European Council 2014) concerning the sustainable development and governance of the oceans, not least in collaboration with developing states. And nationally in SIDS like Seychelles, a Blue Economy roadmap is being developed (SEY 2014; see also Purvis this issue), in which maritime security is treated as a component.

Yet in recent years, insecurity has marred some of the world’s maritime spaces. In the Western Indian Ocean for instance, piracy off the coast of Somalia rose dramatically in the mid-2000s. At its height in 2011, Somali piracy accounted for 327 attacks and 28 hijackings in the Indian Ocean (OBP 2012, p. 8). It put at risk the safe transit of cargo vessels, fishing boats and private yachts and thus affected international trade, local economies in the region and general maritime security. Consequently, it was a major international policy priority, which was addressed through comprehensive security governance mechanisms – and with great success: since May 2012, no successful attack has been reported (NATO 2015). Another maritime security issue in the Western Indian Ocean is illegal fishing (UNODC 2014a, p. 3), which is yet largely left unchecked. And increasingly, drugs...
and arms smuggling, poaching and human trafficking are some of the maritime crimes in the Indian Ocean that are now attracting the concerned attention of international policy-makers (UNODC 2013, pp. 4-5).

Taking as its premise that maritime security is a major, yet not sufficiently addressed in practice, precondition for the Blue Economy’s ability to flourish, this article takes the opportunity to ask: which governance mechanisms may effectively deal with maritime crime? The question is addressed by examining one recent example of maritime security governance to illuminate what is required to combat threats to maritime security. The article takes its empirical point of departure in the Western Indian Ocean, using as its case the international fight against maritime piracy off the coast of Somalia since the mid-2000s. Here, the article speaks from the assumption that the actors involved in counter-piracy have a common understanding of what the threat is, namely maritime piracy on the high seas, as outlined in international law (UNCLOS 1982, Art. 101), and a common understanding of maritime security as a basic absence of risk or threat to human or economic security, although other definitions may be applied (see Bueger 2015).1

Counter-piracy serves as a particularly rich example of maritime security governance, as it was addressed comprehensively by the international community: in its basic form, counter-piracy brought together a host of navies patrolling the Indian Ocean for piracy incidents (primarily the EU and NATO member states and a US-led coalition of individual states) and a row of domestic jurisdictions (in particular Kenya, Mauritius and Seychelles) in the region around Somalia to try the apprehended piracy suspects. Around this law enforcement set-up were multiple policy forums in which international and regional actors discussed and disseminated knowledge on legal and operational issues connected to counter-piracy. And finally, the private sector established a row of security measures on their vessels, including armed security guards, for self-protection.

To narrow the scope, the article focuses specifically on how the prosecution of piracy suspects was undertaken by regional states and specifically uses the involvement of the SIDS of Seychelles as the prism through which efforts of maritime security governance are examined.2 Focusing on piracy prosecution in Seychelles is firstly of general relevance because little has been published on it, and secondly because piracy prosecution in Seychelles enjoyed a unique platform on which to test the practice of global security governance: a seafaring nation with a vast 1.37 million km² Exclusive Economic Zone adjacent to Somalia, Seychelles stood particularly exposed to the risk of piracy attacks. Seychelles therefore took the regional lead in combating maritime piracy and collaborated extensively with the international community on setting up a Piracy Prosecution Model, which required wide-ranging capacity-building of its law enforcement agencies. Looking at piracy prosecution in the case of Seychelles thus enables the illumination of some of the legal and practical details required for one of the Blue Economy’s central stakeholders to participate in international governance mechanisms concerning maritime security. As such, the article serves as a debut repository of lessons learned, which may inform the development of more permanent security governance structures concerning maritime crime in the Indian Ocean and beyond.

The article draws on diverse sources of data, namely applicable international and domestic law governing counter-piracy; academic literature on counter-piracy; legal capacity-building programmes in Seychelles undertaken by international donors; Seychelles’ piracy case law; and ethnographic interviews and observations conducted by the author in 2014-15 with national and international law enforcement actors working in Seychelles and in Denmark – even interviews with Somali piracy prisoners serving time in Seychelles.3 On the basis of this data, the article first describes the international policy response to Somali piracy and the preparatory steps that Seychelles needed to perform in order to participate in this response. It then describes the Piracy Prosecution Model as practiced in Seychelles, before turning to brief examples of the Model’s contributions, and some challenges the practice of this Model gave rise to. Finally, some brief conclusions are made.

A case of maritime insecurity: Somali piracy and the international response

Piracy on the high seas is an ancient crime (Rubin 1998) but in its modern form, as practiced off the coast of Somalia – for instance in the famous case of the Maersk Alabama, which Hollywood made into the movie ‘Captain Phillips’ – a group of typically 5-10 young men launch a vessel from the Somali beaches and sail into international waters to attempt the hijacking of a local fishing boat (dhow), typically with crew on board from Iran or Pakistan. The young men use the dhow as a so-called mother ship to reach further out to sea. Here, they wait for a cargo vessel to pass and launch a fast dinghy (skiff) for the actual attack. If they do not succeed, for instance if armed security guards are on board and manage to scare off the skiff, the attack is aborted and the skiff returns to the mothership, where they await a new cargo vessel. If they do succeed, the cargo vessel is navigated back towards the coast of Somalia and months of negotiation for a ransom ensue.4

Due to the heinousness of the crime, ‘the pirate’ has for centuries been considered an enemy of all mankind (hostis humani generis) as a matter of customary international law. The crime of piracy has fallen under universal jurisdiction, meaning that any state may intercept piracy suspects on the high seas, whether that state has a national link to the incident or not (Kontorovich and Art 2010, pp. 251-52). Universal jurisdiction over the crime
of piracy on the high seas has even been codified in international law (UNCLOS 1982, Art. 105).

However, code does not necessarily reflect conduct, and when Somali piracy incidents increased in the mid-2000s, they were largely left unchecked. The Somali state was not able to carry out the task of maritime law enforcement off its coast due to decades of instability and poverty. Indeed, Somali piracy is often explained as a consequence thereof. Where few other income possibilities seem to exist, hijacking vessels for ransom is one lucrative, albeit very dangerous way to make a living (Klein 2013; Roach 2010, p. 408). As Somali authorities were unable to lift the task of suppressing, let alone preventing piracy through law enforcement, piracy incidents grew exponentially in the mid-2000s, and no other state seemed to take maritime law enforcement upon itself to curb piracy in the Indian Ocean.

By 2008, however, the problem of Somali piracy seemed to have reached such proportions that the United Nations Security Council (UNSC) unanimously adopted the first of many resolutions in direct response to Somali piracy (UNSC 2008). The resolution urged all states to cooperate around the suppression of piracy off the coast of Somalia. It further decided that – with prior approval by the Somali government – states may enter into the territorial waters of Somalia and use “all necessary means” to repress acts of piracy and armed robbery in accordance with international law (ibid, para 7(b)).

With this resolution, naval fleets from NATO, the EU, a US-led international coalition and a row of independent countries launched counter-piracy missions with willing states deploying their warships to patrol piracy-prone areas of the Gulf of Aden and the Western Indian Ocean. But as the warships began capturing piracy suspects, challenges arose as to what to actually do with them. Despite universal jurisdiction, states deploying warships in the Indian Ocean were often legally unable to carry out prosecution due to insufficient domestic legislation, or their governments lacked political will to undertake the task. Of concern were the costs that prosecution and incarceration entailed and that piracy suspects would claim asylum once they reached the territory of the prosecuting country.

Looking to the international legal framework governing counter-piracy provided little help. The 1982 UN Convention on the Law of the Sea (UNCLOS) obliges states to cooperate around the suppression of piracy on the high seas (UNCLOS 1982, Art. 100) but, importantly, only authorizes the prosecution of piracy suspects (ibid, Art. 105). And the 1988 Convention for the Suppression of Unlawful Acts against the Safety of Maritime Navigation (SUA) obliges states to prosecute or extradite piracy suspects (SUA 1988, Art. 10) but requires some jurisdictional link to the offender (ibid, Art. 6 (1) and (2)). This is most often not the case in counter-piracy off the coast of Somalia, where the naval forces primarily come from NATO and EU Member States – not from Somalia. Lastly, no international legal body existed with a mandate to conduct piracy trials.

Looking to the international legal framework governing counter-piracy provided little help

The lack of legal obligation to prosecute piracy led to the so-called ‘catch and release’ procedure (Guilfoyle 2010, p. 141), whereby warships simply disarmed piracy suspects and delivered them onto the shores of Somalia. Thus until 2011, 90% of piracy suspects apprehended in the Gulf of Aden were released without trial (UNSC 2011, para. 14). Recognising the galloping impunity – not to mention the wasted resources of deploying navy ships if no suspects were brought to trial – the UNSC passed a new resolution in December 2008. This resolution urged the international community to establish a “cooperation mechanism” among states, regional and international organisations “on all aspects of combating piracy and armed robbery at sea off Somalia’s coast” (UNSC 2008a, para. 4). This was effectively acted upon and one month later, the Contact Group for Piracy off the Coast of Somalia (CGPCS) was established by more than 50 willing countries and organisations. The CGPCS facilitated discussions on counter-piracy, coordinated actions and offered recommendations on legal and operational issues that were disseminated to the parties involved in counter-piracy. Among the discussions in the CGPCS was how to deal legally and practically with the prosecution of piracy suspects.

Ensuring a piracy prosecution mechanism: regional involvement in maritime security

There were initially two schools of thought on how to facilitate piracy prosecution. The first school stressed the necessity for special piracy courts (UNSC 2011). However, this was considered to require significant funding in regards to its establishment (Andersen et al. 2009, p. 12) and – considering the urgency for a means of prosecuting to avoid the catch and release procedure – too much time to set up. Thus, no consensus was reached on establishing a new or ad hoc tribunal.

The second school of thought preferred to prosecute piracy nationally, as stipulated in international law (UNCLOS Art. 105) and, more specifically, to prosecute in the national jurisdictions of the countries around Somalia. This would minimise the logistical challenges of transferring suspects and evidence far away from the crime scene and, in consideration of human rights, keep suspects closer to their region of origin. This option was assessed to be less expensive (UNSC 2010, para. 56) and to provide a relatively instant justice mechanism, as the judiciaries already existed. Regional piracy prosecution was further considered more sustainable in terms of building on human rights knowledge and existing judiciaries, the function of which would not discontinue once piracy died down.

The latter option of regional piracy prosecution was ultimately implemented. First Kenya and Seychelles got involved...
in 2009 by signing agreements with naval states patrolling the Indian Ocean regarding the transfer of piracy suspects for prosecution in their national courts; then Mauritius in 2010 and later Tanzania followed by signing similar transfer agreements.\(^{12}\)

Focusing on Seychelles, its decision to participate in counter-piracy was based on the serious effects of Somali piracy on the island state’s economy. According to the Seychelles government, the risk of piracy firstly drove up the price of fish (Michel 2015, p. 168), which had a negative impact on food security and the Seychelles’ major fishing industry. Second, the risk of piracy affected Seychelles’ tourism, which reportedly dropped by 22\% from 2008-2010 (ibid, p. 172). And last, but not least, piracy wreaked human havoc as Seychelles suffered numerous attacks on its seafarers and vessels (Fernando 2015, p. 2-3). With this, the Seychelles government argued that it had to react\(^{13}\), and the common law jurisdiction of Seychelles quickly became the main premises in the region for piracy prosecution.\(^{14}\)

**Seychelles’ preparation for prosecution of Somali piracy**

In order to facilitate piracy prosecution, Seychelles needed to undertake a series of legislative and practical steps. These were supported by the UN Office on Drugs and Crime (UNODC), which provided technical and financial support to the Seychelles Judiciary and Penitentiary through its Maritime Crime Programme (UNODC 2014); and by the EU, which set up a civilian capacity-building mission (EU CAP Nestor 2015) to conduct training of and provide equipment for the Seychelles Police, Judiciary, Air Force and Coast Guard under the umbrella of enhancing maritime security capabilities. Below, the principal preparatory steps that Seychelles undertook are described in their approximate chronological order and some comments are made on their function.

First, Seychelles set up a High-Level Committee on Piracy in 2009.\(^{15}\) The Committee brought together the Minister of Foreign Affairs, Minister for Home Affairs, the Commissioner of Police, the Attorney General (AG), and representatives from the Defence Force and Coast Guard to coordinate actions and brief one another on counter-piracy issues domestically and abroad.

Second, Seychelles entered into transfer agreements with the EU, US, UK and Denmark among other naval authorities patrolling the Indian Ocean for piracy incidents (Murdoch and Guilfoyle 2013, p. 149). The transfer agreements spell out the nature of the transfer, the treatment of piracy suspects and the parties’ collaboration around piracy trials. Importantly, the agreements also provide the Seychelles’ Government with the option to reject piracy cases (Sterio 2012, p. 115). This grants the Seychelles Government the power to control the intake of cases, for instance if national resources do not allow the undertaking of a trial, or if political priorities change. Generally, the value of the transfer agreements is that they serve as an instrument of standardisation and thus simplify the procedure of ensuring due process once piracy suspects are apprehended at sea, rather than having to rely on diplomatic advancements in each case between the apprehending and prosecuting nation.

Third, the Seychelles Penal Code was revised in 2010. The existing section 65, which criminalised piracy, did not define piracy – nor did it provide Seychelles with jurisdiction to try piracy suspects apprehended on the high seas.\(^{16}\) Even though piracy trials did take place under this law (SC Cr Side 51/09; SC Cr Side 14/10), Seychelles – as was also the case in Kenya and Mauritius – revised its Penal Code to better facilitate the prosecution of piracy suspects. The new section 65 established universal jurisdiction for the Seychelles Supreme Court to prosecute piracy suspects apprehended on the high seas by the navies of other states and defined piracy as a criminal offence in Seychelles with wording mirroring that of the internationally endorsed definition in UNCLOS. In fact, section 65 is even more comprehensive than the corresponding UNCLOS articles in terms of the acts included as an offence.\(^{17}\)

Fourth, Seychelles received support for conducting piracy trials via the UK Crown Prosecution Service, funded by the UNODC (UNODC 2014, p. 2). From the piracy case law undertaken in Seychelles Supreme Court,\(^{18}\) the first piracy cases in the Supreme Court conducted in 2009-10 were led by the Seychelles Attorney-General himself. Subsequent cases were undertaken by UK-trained prosecutors, who worked alongside a Seychelles counterpart. The UK prosecutors were operating in the office of the AG until March 2015 as part of capacity-building to transfer knowledge within the common law system. This facilitated spill-over effects outside of counter-piracy to more general capacity-building of state prosecution, for instance updating case management systems and internal Court procedures.

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**Seychelles signed transfer agreements with the Somali government and the administrative regions of Puntland and Somaliland**

The fifth step that Seychelles undertook in order to participate in counter-piracy, was the creation of a special prison wing for the piracy convicts (Laraia 2012, p. 132). Located in the Montagne Posee Prison on the main island of Mahe, the prison wing was built by the UNODC (UNODC 2014). It has the capacity to hold 60 prisoners and features enhanced security and surveillance. The prison wing, however, is no longer inhabited by Somali prisoners convicted of piracy but by high risk inmates from the Seychelles’ own prison population.\(^{19}\) This expresses another positive spill-over effect of counter-piracy capacity-building, where resources are adjusted to the context and are flexible enough to be put to use in the most appropriate way.

Sixth, under the guidance of the CGPCS, Seychelles signed transfer agreements with the Somali government and the administrative regions of Puntland and Somaliland (Laraia 2012, p. 132). These agreements provide for Somali
piracy convicts to transfer – upon their own consent – from Seychelles to UN-built prisons in their region of origin. The agreements state that the facilities for and treatment of prisoners once transferred to Somalia must live up to international human rights standards; this is ensured by the UNODC (ibid). On the positive side, the option of transfer firstly facilitates that space and resources are liberated in the Seychelles’ prison, which is taking on the incarceration of Somali prisoners over and above their own prison population. Secondly, it allows the Somali prisoners to serve their sentences closer to their social, religious and cultural context. On the potentially negative side, if the convicts opt for a transfer, they sign a waiver whereby they lose their right to appeal; this will be addressed below.

Seventh, Seychelles revised additional legislation in 2013, after some years of experience with piracy prosecution, it proved a challenge to secure the participation of certain witnesses – whether military officers intercepting the piracy vessel or civilian fishermen being attacked, their livelihood often requires them to be deployed at sea and a trip to Seychelles to give evidence, as is required in common law jurisdictions, can be disruptive to their work schedule. Thus, a legislative amendment allowed for witnesses giving evidence via live television link in situations where it is ‘not reasonably practicable’ for witnesses to be brought physically before the Court. This had three benefits: it allowed minimal interference with witnesses’ professional obligations; it relieved prosecution of a major logistical burden of coordinating the simultaneous presence of multiple witnesses from all over the world; and it reduced the costs associated with flying in witnesses and accommodating their stay for piracy trials in Seychelles.

Eighth, the UNODC built an annex to the Seychelles Supreme Court – which, in turn, was donated in 2013 by China – to specifically handle prosecution of piracy and other maritime crime (Vannier and Uranie 2015). Opening in April 2015, the annex has two court rooms, judges’ chambers and meeting facilities. Construction was initiated when piracy was at its peak. However, upon completion, only one piracy trial was outstanding in Seychelles and as of September 2015, no new transfers of piracy suspects to Seychelles have taken place. Nonetheless, the annex may serve as the premises in which to undertake trials related to other maritime crime and provides welcome spill-over effect of freeing up resources in the court rooms needed to tend to Seychelles’ own caseload.

Finally, related to counter-piracy but not to the Piracy Prosecution Model per se, it should be mentioned that Seychelles hosts the Regional Fusion and Law Enforcement Centre for the Safety and Security at Sea (Reflecs3 2015). Funded by donors such as the UK and Netherlands, it is to function as a transnational organised crime unit and information sharing centre. Also, Seychelles hosts the Indian Ocean Commission’s Anti-Piracy Unit (IOC-APU). The IOC-APU houses technical expertise in maritime crime and safety and is tasked with implementing parts of the EU-funded Maritime Security Programme, which targets piracy and other maritime crime through legal and operational capacity-building in the region (EEAS 2015). Seychelles is also set to take over the chairmanship of the CGPCS from January 2016.

Establishing a maritime security governance mechanism: the Piracy Prosecution Model

The preparatory steps sketched above range from necessary, to advisable and helpful for Seychelles to facilitate piracy prosecution. Since Seychelles was, in effect, executing universal jurisdiction on behalf of the world community – the crime of piracy affects not only Seychelles, but potentially all nations – resources were injected by foreign donors, primarily the mentioned UNODC and EU, for Seychelles’ involvement. The result was a Piracy Prosecution Model, which can be divided into five general procedural phases. Starting after the naval interception of piracy suspects, these phases are:

1. Request for transfer

The flag state of the warships that has captured the piracy suspects and signed a transfer agreement with Seychelles, approaches Seychelles authorities to formally request the transfer of the piracy suspects for prosecution at the Seychelles Supreme Court. The request is processed by the AG based on available resources in the Judiciary and Penitentiary at the time of the request.

2. Handover of piracy suspects

If the AG grants the transfer request, the warship sails to Port Victoria, where the handover takes place. Here, the Seychelles Police Authority receives the evidence package compiled by the navy. The package includes, inter alia, original copies of witness statements, detainee records, photographs and any physical evidence. As the suspects leave the warship and reach the dock, the Seychelles Police arrest the piracy suspects and take them into custody.

3. Preparation of case

Upon the formal arrest, the piracy suspects and evidence are transferred from the dock of Port Victoria to the police station and supplementary investigations are conducted by the Seychelles Police to complement the navy’s evidence package, for instance interviews with the piracy suspects, age assessment and forensic examinations of the physical evidence. Together with the evidence from the navy, this forms the basis for prosecution.

4. Trial

When the prosecution has built its case, the suspects are formally charged and informed of the options for their defence: in all cases, they have ultimately chosen legal aid, which is funded by the UNODC. Criminal procedures begin at Seychelles Supreme Court, and prosecution strives to gather all witness hearings within a two-week period to minimise the protraction of the case. However, with witness attendance from all over the world and many of them – military and civilians alike – being deployed on ships at different times, this is necessarily a goal more than a strict procedure. The attendance of civilian
witnesses, such as hostages and expert witnesses, is funded by the UNODC, whereas military witnesses are paid for by the involved navies themselves. During hearings, Somali-English interpretation and other needed translation (e.g. French or Spanish) is facilitated by the UNODC.

5. Incarceration or repatriation

When the trial is finished and Court has delivered its decision, incarceration of the piracy convicts takes place in Seychelles. The convicts have access to an interpreter in prison and are allowed a ten-minute phone call each month. They may also receive medical treatment as per standard in the prison. The convicted have the option of transferring to a prison in their region of origin through Seychelles’ transfer agreements with Somali authorities. The transfer is facilitated by the UNODC. The convicted may also appeal their case to the Court of Appeal, in which case they cannot return to Somalia but must wait out the appeal process in Seychelles. If the accused are acquitted, they are repatriated to their home region, again facilitated by the UNODC.

The Piracy Prosecution Model in Seychelles: some outcomes

Based on the above implementation of the Piracy Prosecution Model, Seychelles has provided an important means of bringing justice in piracy cases. The Supreme Court has completed 16 trials on Somali piracy, which have involved a total of 142 accused. Of the 142 accused, the 16 trials have led to 138 individual convictions of piracy, whereas the remaining four were acquitted due to claims of being minors. Of the 138 Somalis that were convicted of piracy, 96 have been transferred from Seychelles to Somali territory. As of September 2015, there are 31 Somali prisoners incarcerated in Montagne Posee. Eighteen of these are serving their sentence, while five are on remand and eight are awaiting repatriation after their convictions were recently quashed in the Seychelles Court of Appeal. In all, the Seychelles Court of Appeal has quashed the convictions of 13 Somalis in four different appeal cases.

Seychelles has provided an important means of bringing justice in piracy cases

With the Piracy Prosecution Model, Seychelles has provided a number of valuable contributions and lessons learnt. For instance, ‘pure’ universal jurisdiction (enabled by the revised Penal Code) is exercised by Seychelles in that most of the piracy cases undertaken by Supreme Court have no national nexus to the incident. This practice is rare: apart from Seychelles, Kenya and Mauritius, states have generally only prosecuted piracy suspects when there is a national link to the offence, such as the attacked vessel or victim being from the prosecuting country. Seychelles’ legislation on – and choice to exercise – universal jurisdiction is valuable, as it sends an important political signal to the international community of an ideal willingness to undertake national prosecution of international crime. It conveys a sense of duty to assume a great share of responsibility beyond a limited national focus for the security of the oceans. This sense of responsibility is mirrored in Seychelles taking over the chairmanship of the CGPCS, as well as hosting the mentioned Reflecs3 and IOG-APU.

A related type of contribution from Seychelles’ involvement in counter-piracy is that Seychelles’ willingness to prosecute piracy suspects has satisfied the international community’s wish for regional prosecution with the logistical and financial benefits this was assessed to have. As a positive spill-over, Seychelles, in turn, received resources through capacity-building initiatives that were undertaken in connection with counter-piracy. Its Police, Judiciary, Air Force and Coast Guard received training and equipment from the UNODC, EU and other donors. This strengthens Seychelles’ institutional knowledge and technical capacity, which reaches beyond piracy-related matters of law enforcement and can be applied in other forms of maritime security governance.

Further, Seychelles has engaged in piracy litigation on an issue where little modern case law existed. The Seychelles Supreme Court has thus provided a valuable contribution to the development of precedent in piracy prosecution. Through piracy trials, the Court has applied section 65 of the Seychelles Penal Code – which, as mentioned, is formulated closely to that of UNCLOS. In its case law, the Court has thus tested the usability of the language of international law – and exercised national application of international law. It has, in this regard, suggested revisions of piracy law. One such suggestion concerns the incorporation of the so-called ‘equipment article’ from slavery law. Referring to the international legal scholar Eugene Kontorovich, the Court argued in one case (SC Cr Side 53/11, para. 58) that the equipment clause would criminalise the possession of equipment associated with piracy, such as hooked ladders, weapons, skiffs with powerful outboard engines (that are typically used for piracy attacks) and excessive amounts of fuel compared to the normal pattern of life in the Western Indian Ocean. Incorporating the equipment article could support proof of operating a pirate vessel without evidence of an actual attack, which some of Seychelles’ case law revolves around (e.g. Cr Side 53/11). Similarly, the Seychelles Court of Appeal has suggested legislative revision concerning the issue of presumption (SCA 22/12, para. 24). This would criminalise cruising on the high seas with piratical equipment, as that mentioned above, on presumption of the suspects being involved in piracy. Whereas the focus of this article does not allow an assessment of the legal implications, Seychelles’ piracy case law is arguably of relevance, both nationally and internationally, to other states willing to criminalise piracy and undertake trials domestically. Seychelles’ case law could thus be dispersed internationally and potentially drawn upon, if and when further suspects of piracy are brought to trial across other (common law) jurisdictions.
Learning from Seychelles: Challenges ahead for addressing maritime crime

There have also been challenges pertaining to the Piracy Prosecution Model. Whereas the Model is well established by now – with revised legislation, standardised transfer agreements and renovated prison facilities – several complicating issues have come up during Seychelles’ piracy prosecution since 2009. Below, some issues are sketched that should be granted separate attention, if the Model is to be replicated for further transnational law enforcement of other maritime crimes that are currently taking place in the Indian Ocean and beyond.

While Seychelles law enforcement agencies have hopefully benefitted from capacity-building, piracy prosecution is largely financed by international donors. Some expenses are one-time costs, for instance equipment and construction of courts and prisons. But donors are also providing continual support. The UNODC pays for training of law enforcement staff, legal aid and transcription, technical experts, language interpretation, travel expenses for witnesses, prisoner welfare items, transfer and repatriation (UNODC 2014). This lacks sustainability in the long-run.

Further, because of the comprehensive international attention paid to Somali piracy and the resulting resources that donors have provided to facilitate regional prosecution, piracy cases in Seychelles were given priority over own domestic criminal cases. This created some backlog in the Judiciary with negative impact on due process for Seychelles’ own litigants. Such an effect is neither sustainable, nor acceptable if individual states in the future are to exercise universal jurisdiction on behalf of the international community.

Another challenge pertaining to the Piracy Prosecution Model is the condition in the transfer agreements of the loss of the right to appeal, if Somalis convicted or piracy return to Somalia to serve their sentence. To understand why, it must be explained that Seychelles Supreme Court has been displaying zero tolerance towards Somali piracy: sentences are relatively high and the conviction rate is near 100%, with no cases of acquittal, save some of the accused who claimed to be minors (e.g. Cr Side 16/12). The Supreme Court’s convictions have recently resulted in a wave of appeals in 2014-15. In all cases but one, this led to the Court of Appeal quashing the Supreme Court’s decisions (SCA 07/2013, SCA 2/2011, SCA 22/2012, SCA 31-37/2014); in the last appeal case, the sentence was halved from 24 to 12 years (SCA 19/2013). This raises issues regarding which other convictions might be quashed upon review; but with the majority of Somali convicts already transferred to serve their sentences in Somalia – thus losing their right to appeal according to the transfer agreement – this question is left unanswered. The implications of this on the constitutional and human rights of the piracy convicts are serious issues to be addressed, as the Prosecution Model gains experience and is potentially replicated in other transnational governance collaboration initiatives around maritime crime.

A further issue is how to ensure the principle of legality, when multiple jurisdictions are involved. Since maritime security governance, as practiced in counter-piracy, is transnational in nature, the responsibility for the rights of the piracy suspects, due procedure etc, fall on different states at different times. For instance with the mentioned transfer agreements, the salience of evidence collected by one state is suddenly evaluated in the courts of another; the responsibility for the treatment of the piracy suspects during the same case shifts from one jurisdiction to another; legal aid and thus the piracy suspects’ access to their lawyer is paid by one actor (UNODC member states) but ensured by another (Seychelles). Such issues of legality need further exploration and the development of a central oversight mechanism of cross-jurisdictional maritime security governance practices seems a relevant consideration in this regard.

A final issue is one of global scope, namely how to ensure that all states carry their weight in efforts to keep the oceans secure. Thus far, what has driven counter-piracy is a reliance on a select number of states, such as Seychelles, willing to punch above their weight and carry responsibility for all states. A more equitable set-up of exercising universal jurisdiction seems necessary, if the burden is not to be put on developing countries that agree to receive capacity-building in exchange for judicial availability. In this regard, a shift from ad hoc maritime governance mechanisms to a more permanent transnational law enforcement structure regarding maritime security governance must be ensured. This entails addressing issues of funding to ensure the sustainability of a security governance mechanism, division of labour and cross-jurisdictional legal oversight to ensure the principle of legality in processes of transnational law enforcement. This is also important for maritime crime more generally, as only piracy grants universal jurisdiction; other maritime law enforcement still needs the establishment of a mandate. Whether such issues are addressed within the framework of international conventions, such as strengthening UNCLOS to oblige states more clearly to manage maritime security, or via bilateral diplomatic efforts to ensure permanent agreements – or under the auspices of the Blue Economy, in which maritime security is a precondition – remains to be discussed.

Concluding remarks

Acknowledging the detrimental effects of Somali piracy on international trade and maritime security in general, and on the citizens and economy of Seychelles in particular, the Small Island Developing State of Seychelles has since 2009 taken a regional lead in the international fight against Somali piracy. As some of the preparatory steps to do so, Seychelles collaborated with the UN, the EU and other donors to build the capacity of its law enforcement agencies. It revised its Penal Code, renovated its main prison, signed transfer agreements with naval states and Somali authorities.
Following the massive international attention paid to counter-piracy, piratical attacks off the coast of Somalia are finally waning. This is a welcome development, not least for Seychelles, its economy and population – and for its efforts of reaching its Blue Economy goals, where maritime security is a key component to its success. However, the world is seeing increased criminal activity in the Indian Ocean. Human smuggling, poaching, arms and drugs trafficking via maritime routes are new challenges that the international community must address after Somali piracy. Here, the policy and practical ‘infrastructure’ from counter-piracy is potentially already set up and can be moulded to fit the legal and practical specificities of other maritime crimes. As the Blue Economy agenda continues to take shape, much can be learned from the case of maritime security governance in Seychelles. This article has provided an introduction to some of the issues around the Seychelles’ Piracy Prosecution Model, but dedicated studies are needed to extract the full extent of the lessons learned for replication in other issue areas of maritime security.

As a final note of conclusion, counter-piracy serves only as suppression. For sustainable solutions to piracy and other maritime crimes, efforts to prevent these from happening in the first place also need urgent address. Here, the Blue Economy agenda itself holds great potential. The investments and technical knowledge transfer it can facilitate, as well as the job opportunities it can develop could be used to empower the citizens of volatile states with low governance mechanisms, for instance along the coast of Somalia, from where Indian Ocean-based piracy stems. In this way, the Blue Economy can contribute directly to the promotion of alternative livelihoods to piracy and other maritime crime at the same time as it, in turn, benefits from the conditions that maritime security provides.

Résumé

Seychelles law (accessed at www.seylii.org)
Seychelles Penal Code (Amendment) Act 2010
Evidence (Amendment) Act 2013

Piracy court cases (accessed at www.seylii.org)
SC Cr Side 51/09 Republic v. Dahir and 10 others
SC Cr Side 14/10 Republic v. Ali and 10 others
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SC Cr Side 53/11 Republic v. Jama and 6 others
SC Cr Side 16/12 Republic v. Jama and 14 others
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- Ocampo, L. 2013, ‘Piracy and armed robbery against ships in and around the high risk area off the coast of Somalia’, 10th December 2013.
- Uranie, R. 2015, ‘Seychelles highest court acquits 8 Somalis including minor in piracy-related appeal case’, Seychelles News Agency, 2 June 2015, accessed 04.08.2015: http://www.seychellesnewsagency.com/articles/3853/Seychelles+highest+court+acquits++Somalis+including+min or+in+piracy-related+appeal+cases
This said, it is not a given how the threat (of piracy) is defined and who defines it. However, such a discussion goes beyond the scope and errand of this article and will therefore not be addressed here.

For a global analysis of what lessons may be learned from counter-piracy on issues of maritime security governance, see Bueger 2015a.

Some interviewees have opted to remain anonymous. While the names and identities of these interviewees are known by the author, only their general professional function will be referred to in this article.

As such, Somali piracy differs in methodology from piracy currently practiced elsewhere in the world, e.g. Nigerian piracy (see Murphy 2013) and piracy in South East Asia (Beckman 2013).

See Murphy (2011) and Mengisteab (2014) for overviews of the recent political and religious history of struggle in Somalia and the Horn of Africa respectively.

It should be added, however, that Somalis who identify themselves as pirates, have explained to the media that their activities are not piracy but rather concern the reclaiming of their waters which, lacking law enforcement, they assert have been subjected to illegal and over-fishing by international trawlers; see Bueger (2013a) for an analysis of the narratives of Somali pirates, and Way (2014) for a discussion of the media-generated discourses on Somali piracy. Recent research further proposes that Somali piracy stems from the little known cultural practice of social and economic protection linked to a history of trade, plunder and profit that is endemic to the region (Dua 2013). Some Somali piracy convicts, with whom this author has spoken in the Motagne Posee Prison of Seychelles, likewise point to the protection that a piracy group provides (interviews with Somali piracy convicts at Motagne Posee Prison, Mahe, Seychelles, July-August 2014; the identities of interviewees are withheld for security reasons.)

1 See Dutton (2012) for a global comparison of (the lack of) national incorporation of universal jurisdiction in domestic legislation to facilitate piracy prosecution.

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7 See Dutton (2012) for a global comparison of (the lack of) national incorporation of universal jurisdiction in domestic legislation to facilitate piracy prosecution.

8 Such sentiments were explicitly encountered during interviews that the author conducted in August 2015 with government officials in Denmark, one of the countries participating in counter-piracy in the Indian Ocean under NATO mandate.

9 See Andersen et al (2009) for a discussion of the options of prosecuting piracy at international courts.

10 The CGPCS became the main policy and technical network in which law enforcement and military actors, technical experts, legal advisors and executive-level politicians could meet on a regular basis. The CGPCS, however, is but one counter-piracy network active on the issue of counter-piracy off Somalia; the CGPCS is highlighted in this article due to the uniqueness of its global reach. But for an overview of other significant fora pertaining to Somali piracy, see Roach (2010) and Bueger (2012).

11 For a comparison between the two schools of thought, see Andersen et al. (2009).


13 Such was the opinion encountered during interviews with Seychelles government officials, August 2014 and European counter-piracy actors in Seychelles, June 2015.

14 While Tanzania has so far received zero cases and Maunius has received one case, Seychelles has completed 16 piracy trials. Kenya has completed 12 cases and then decided to discontinue piracy prosecution due to political tensions (Laraia 2012, p. 137).

15 Interview with Seychelles government official, May 2015; the Committee is transitioning to the High-Level Committee on Maritime Security and Safety but as of September 2015 it is without an officially publicised mandate.

16 Decisions by the Seychelles Court of Appeal can be accessed at www.seylii.org.

17 Since little has yet been published on Seychelles participation in counter-piracy, this section draws on knowledge gained during the course of fieldwork among counter-piracy law enforcement actors in Seychelles from July-September 2014 and email correspondence with UNODC Programme Officer Shanaka Jayasekara, 19.08.2015 (on file with the author).

18 Numbers in this paragraph are from UNODC Programme Officer Shanaka Jayasekara, email correspondence 30.09.2015 (on file with the author) and Uranie (2015).

19 As observed by the author during fieldwork visits to Montagne Posee Prison, May 2015; the Committee is transitioning to the High-Level Committee on Maritime Security and Safety but as of September 2015 it is without an officially publicised mandate.

20 Namely the Evidence (Amendment) Act 2013, in which a new section 11 (c) was inserted on giving evidence via video link.

21 Since little has yet been published on Seychelles participation in counter-piracy, this section draws on knowledge gained during the course of fieldwork among counter-piracy law enforcement actors in Seychelles from July-September 2014 and email correspondence with UNODC Programme Officer Shanaka Jayasekara, 19.08.2015 (on file with the author).

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23 Numbers in this paragraph are from UNODC Programme Officer Shanaka Jayasekara, email correspondence 30.09.2015 (on file with the author) and Uranie (2015).

24 See Kontorovich and Art (2010, p. 272-274) for an examination of the jurisdictional basis for national piracy prosecution; although necessarily basing their analyses on data from before publication in 2010, the tendency remains to not exercise universal jurisdiction, not least seen by Seychelles receiving the piracy suspects which the counter-piracy naval missions of the EU and NATO have apprehended, thus being a consistent partner to the international community in exercising universal jurisdiction.

25 Such was the opinion encountered during interviews with Seychelles government officials, August 2014 and European counter-piracy actors in Seychelles, June 2015.

26 Interview with Judiciary staff, August 2014.

27 For instance in Cr Side 19/10, the accused were sentenced to 22 years on three counts. Eight of the convicted decided to return to Somalia to serve time. The ninth convicted appealed his case. The conviction of the appellant was quashed, while the remainder of his group is presumably serving their sentences in Somalia.
Best practices for the development of the Blue Economy: Engaging stakeholders in ocean planning

Keywords: Protected Area Network, Marine Spatial Planning, Blue Economy, Stakeholder Involvement, Community Engagement, Resilience

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Abstract
Ocean health is being subjected to natural and anthropogenic factors. Marine Protected Areas (MPAs) are used in the conservation of biodiversity and ecosystems. When not properly planned, MPAs can result in poor performance. Good MPA planning is required to fit into the Blue Economy concept so that maximum benefit is achieved. Such planning is being included in the Marine Spatial Planning (MSP) process. In MSP processes, planning for ocean development is done in a way that encourages input from stakeholders to ensure that MPAs are properly set up to provide ecosystem resilience. Such a practice is critical in the development of the Blue Economy.

Introduction
Mankind has depended on the ocean for centuries. The ocean provides us with many benefits, such as food and essential services. Ocean health is affected by numerous anthropogenic factors, such as poorly-planned development, over-exploitation of the biodiversity and marine resources, as well as pollution. This is complemented by natural factors, such as climate change, ocean acidification, and atmospheric aerosol loading, that threaten the ocean. Often, global efforts to remedy the situation have failed and the planet has been put at risk (Jackson et. al 2001). Protection of the ocean space is critical for our survival.

Prior to the 1990’s, the general sentiment was that the ocean was resilient, vast and homogenous, and therefore limitless. As this proved untrue, modern conservation efforts have concentrated on the setting up of Protected Areas, which include national parks, nature reserves and multi-use conservation areas (Hannah et. al 2007). Marine Protected Areas (MPAs) aim to protect habitats, ecosystem structures and functions, ecosystem integrity, species diversity, richness, size, abundance and density. These benefits are more visible where there are no-take zones (Bennett & Dearden 2014). It has been proven that MPAs can be an effective tool to prevent over-exploitation of marine resources and help to protect existing habitats for future generations. MPAs have become increasingly popular for conservation and management (Thomassin et.al 2010).

The Seychelles is adopting this global practice in the development of its Blue Economy. It has embarked on a Marine Spatial Planning (MSP) process. This short article describes the importance of establishing Protected Areas, their roles in the Marine Spatial Planning initiatives, as well as the roles of communities and stakeholders in planning for marine resource development.

MPA establishment
Within the context of the Blue economy, the establishment and effective management of protected areas are important. MPAs are set up to (i) ‘protect rare and vulnerable habitats and species (ii) conserve a set of habitats that are representative throughout the system (iii) maintain and restore ecological functions (iv) promote research and education (v) act as ‘harvest refugia’ (vi) control tourism and recreation (vii) promote integrated coastal management (viii) maintain aesthetic values (ix) maintain traditional uses (e.g. subsistence fishing) (x) act as cultural symbolic value set-aside areas’ [derived from the idea that it is ‘morally right’ to preserve natural areas (Jones 2010)]. MPAs need to be of the right size to protect habitats and home range of the species intended for conservation, meet the ecological requirements of their species throughout their life history stages, while also providing connectivity with other MPAs (Agardy et al. 2011).

For an MPA to be effective, good design is required. Users who rely on these resources, whether directly or indirectly, must be involved in the process and their views must be taken into consideration to achieve compliance (Gleason et. al 2010). Failure to engage the users could result in unsuccessful MPAs, as was the case in the 70s and early 80s. These failures were also attributed to improper implementation and poor management. Other factors, such as lack of scientific data, also contributed to the poor performance of these MPAs (McClanahan 1999). Proper planning is required in the establishment of MPAs.

Planning for and implementation of individual MPAs constitute a common and a well-established practice. Some MPAs are set up through community or government efforts. The challenge though is the establishment of MPA networks on a regional scale. Nonetheless, these should be ecologically connected and managed as a system (Gleason et al 2010). Key to this is proper advice and inputs from stakeholders.
that help in the development of guiding principles for design, including inputs by the general public on both socioeconomic and biophysical aspects of PAs (Gleason et. al 2010). It is important that a framework is established for ‘site’-specific planning, with SMART goals and objectives to guide the process. In the early stage of planning, appropriate location and management of MPA are defined and correct information is made available to all stakeholders, scientists and policy makers involved in the planning and implementation process. Scientific information that is more readily available should be used (Gleason et. al 2010).

**Networks and ecosystem resilience**

Current concerns in PAs focus on issues relating to the changing climate. To increase resilience and thus reduce vulnerability of the blue economy, stakeholders and other bodies working on setting up PAs need to concentrate on design methodologies that result in creating a network of MPAs. MPA networks have a role in maintaining species diversity and ecosystem, functions, and thus bring resilience to the ecosystem to maintain ecological processes and reduce environmental disturbances. The management of these networks should then address most stresses that impact the blue economy, such as overfishing, pollution and coastal development (McLeod et al. 2009). It is indeed important to maintain species and genetic diversity in the application of the blue economy, long term population viability and ecosystem functions, and such protection could be provided by MPAs.

MPAs are paramount in protecting genetic diversity while giving priority to conservation efforts and increasing the potentials of a population to adapt to changes (Kahilainen et al. 2014). Hence, the establishment of an MPA network in the blue economy strategy is vital to enable connectivity which influences individual dispersal between different localities and increases species diversity (Kahilainen et al. 2014; Stein et al. 2014).

**Marine Spatial Planning has recently become crucial in ocean resource management**

The Government of Seychelles understands the need for review and assessing how sufficient the current Protected Area network or system is, in order to find priority gaps that have the potential to direct future expansions of the national network. To achieve this, some activities were carried out under the ‘Strengthening Seychelles Protected Area System through NGO Management modalities’. These complement the Seychelles Sustainable Development Strategy (SSDS) aimed at improving sustainable development management in Seychelles and the National Biodiversity Strategies and Action Plan (NBSAP), which focus on mainstreaming biodiversity and development in order to build resilience and effect biodiversity strategies in Seychelles. This, coupled with the Marine Spatial Planning, should influence decisions pertaining to the development of processes that use environmental resources, improve the outcome of biodiversity and resources, and achieve sustainable use.

**Marine Spatial Planning process**

Consequently, Marine Spatial Planning (MSP) has recently become crucial in ocean resource management. The basic idea is to conserve nature, especially Ecologically and Biologically Significant Areas (EBSAs) even as these areas are used for a number of different purposes. MPAs have contributed to ocean space allocation, but their planning has usually been carried out in isolation, neglecting other activities that impact on the ocean system. Coupled with conflicts among users and impacts of user activities on marine resources, particularly given the fact that resources are limited, MSPs have indeed become an essential tool for planning (Douvere 2008).

Hence, MSP is required in order to provide additional support for MPAs, especially where these are poorly planned and no time is spent on gathering the opinion of all stakeholders. The impacts of this poor planning are observed in ecologically insufficient MPAs, MPAs that are not properly managed, MPAs that undergo degradation without proper conservation and where there is no protection. MSP allows for Integrated Marine Protected Area planning in order to avoid these shortcomings (Agardy et. al. 2011). It is a process whereby activities planned in the ocean are spatially distributed in such a way that current activities are maintained, while new ones are started. It ensures healthy ecosystems, meaning that services provided are sustained for the benefit of future generations (Foley et. al. 2010). Current activities and needs of coastal communities, and especially islands, mean that the possibility of declining marine ecosystem health is prevalent. Thus, a strategy that ensures the maintaining of the ability of ecosystems to continue functioning without destruction to their health and without loss of services is required. Such a strategy is the MSP, as it has the potential to replace the complex and often uncoordinated rules and regulations that currently govern ocean use across the world (Foley et al. 2010).

In addition, marine ecosystems need to function sustainably even as economic activities are undertaken. Since resources are limited both in terms of space and time, economic development can negatively impact the places and resources, leading to destruction and overuse. Conflict between users over these resources will be imminent. MSP aims to do away with all these issues and engage all stakeholders in the planning of marine and ocean activities. It embodies the ecosystem-based approach to management and thus enables assessment of biodiversity and ecosystem service use and responses (Douvere 2008). MSP provides a framework for discussion and finding solutions to these issues (Douvere & Ehler 2009).
Community engagement and science

Networks of MPAs and Marine Spatial Planning will not be successful without working with people and communities. It should be recognised that people are at the centre of MSP and subsequently MPA planning. It is argued that humans have changed ecosystems faster, and to a greater extent, in the last 50 years, than they ever have (Douvere 2008). In spite of this, it is sometimes difficult to link changes in the biological system to human activities. This is because it is difficult to establish natural benchmarks against which to assess changes in the natural environment and also to differentiate between natural and anthropogenic impacts on marine biodiversity. An example currently relevant to Seychelles is that of the Crown of Thorns Starfish (Acanthaster planci) outbreak. These starfish can devastate huge areas of corals, as experienced in the North of Mahe Island. While it is known that anthropogenic impacts exacerbate the extent of these outbreaks, through reduction of the population of species that naturally prey on these starfish (e.g. triggerfish) and also through increased production as runoff of nutrients from land augment, this is difficult to establish (Jones 2002).

Thus, the focus should not only be on MPA or MSP. The 2005 Millennium Ecosystem Assessment (MEA) recognized that people are at the core of sustainable use. There has been an increasing demand for food, energy and trade, and these are a result of continual population growth, technological improvements and increased trade. These have led to more demand on coastal and marine resources, which – depending on how these demands are met – can impact positively or negatively on conservation of biodiversity and marine populations (Douvere & Ehler 2009).

It is up to the ‘designers’ and management of the PA to ensure that concerned stakeholders and users of areas where PAs will be set up are made to understand the benefits that they can derive from the designing of PAs, so that there are more positive than negative impacts. An example is fishing interest, where fishers do not always agree to additional closures as they feel the immediate effects through lost fishing opportunities and increased set of laws. Yet, long-term benefits for fishers include increased marine life populations and stock sizes outside of MPAs (Gleason et al., 2010). While it is expected that fishing efforts will be displaced to open areas, once PAs are established, the opposite is sometimes true. Whenever there are conflicts and non-involvement on the part of fishers from the beginning, in a lot of cases poaching takes place, with fishing activities being carried out inside PAs (Kritzker 2004).

Thus, we can no longer adopt styles of management that were used decades ago, especially when conserving coral reef ecosystems (Sade et al. 2014). Instead, integrated approaches should be used, through new governance regimes, to properly manage marine resources and ecosystems. Alongside Ecosystem-Based Management (EBM), that looks into the social and ecological dimensions of resource management, the focus should also be on interaction between the human and the environment, including community-based arrangements for marine resource management (CBRM), essential for transforming marine resources towards more sustainable trajectories (Abernethy 2014). For this to become a success, there needs to be a shift of focus in perceptions and meaning. This shift should include defining roles and responsibilities of all stakeholders and gaining community support, forming a pattern of interactions among stakeholders, establishing leadership and power relations, and making organisational and institutional arrangements for effective use of CBRM. Everything should be done to ensure a movement towards sustainable livelihood, whereby ecosystem services for community needs are generated through communities learning, responding and properly managing ecological feedbacks (Abernethy 2014).

There needs to be substantial changes at policy level for this to be achieved. Changes should ensure good governance as the norm and also that legitimacy, transparency, accountability, fairness (equity), coordination, capability, adaptability and inclusiveness (participation) are achieved. Needless to state the need for outreach and public education, which should lead to establishment of good relationships built on trust, through coordination with other management institutions and integration of traditional knowledge and scientific knowledge in management (Bennet & Dearden 2014). Seychelles is making a move towards CBRM approach to MPA management, especially under projects funded by United Nations Development Programme – Global Environment Fund (UNDP-GEF) grant. Engaging all the relevant partners is critical in the process.

Citizen Science

In relation to the Blue Economy, the concept can be further expanded to include what is described as citizen science. Citizen or community science, also referred to as public participation in scientific research, was started in the 1900s and is growing as a movement that involves the public in scientific discoveries, monitoring and experimentation across various disciplines (Cohn 2008; Theobald et al. 2015). Citizen scientists provide manpower for monitoring species of animals and plants or other environmental parameters, without receiving payment and without being necessarily scientists themselves. They assist research because of their love for the environment and conservation and see it as a way of contributing to conservation. These citizens (or ‘volunteers’, as they are sometimes referred to) can be members of the local communities or tourists visiting the area, and they do not participate in data analyses or scientific writing, but are important in the gathering of information (Cohn 2008). There are a number of methods which can be used to engage the local citizens and develop their competencies so they can successfully contribute to remove some of the pressure on the government when working with shrinking financial resources (Dobos & Jenei 2013).
Biodiversity-related citizen science is especially important for specific species, like rare corals, which are data deficient and which have the potential to be scattered over a large area, thereby making it difficult for proper monitoring and data collection by small groups of scientists (Theobald et. al. 2015). For such purposes, volunteers allow scientists to collect crucial data over large geographic scales for a longer time than possible with what is termed ‘traditional scientific methods’. However, training needs to be provided to ensure collection of accurate and usable data, and it is the role of scientists designing research projects to take citizen science into account when writing projects, so that reliable data is collected to ensure availability of scientific information that encompass all the features of the Blue Economy concept (Cohn 2008). This can be achieved by government and ministries moving away from the traditional involvement of communities (i.e. through stakeholder meetings, workshops and forums only), to provide conditions that allow communities to engage in the conservation of species and ecosystems.

The proper techniques and methods that can be used differ in terms of region and locality, and will only be understood through dialogue and interaction with and between local people as well as other stakeholders. Government has to delegate responsibility to citizens and engage in exchange of information, instead of simply informing, as well as provide long-term initiatives and motivations. On their part, citizens need to be willing to cooperate, make suggestions and take on responsibilities assigned (Svara & Denhard 2000). This method of citizen engagement can also be described as interaction and a mutual form of exchange between government and members of a community (Klein, 2000).

Currently, there is no recorded use of citizen science in Seychelles although there are past and current projects that seek to engage local communities.

Citizen science in biodiversity management is at present providing valuable resource for research that can, and does, lead to global changes. Citizen scientists locally collect fine-grain data which can impact on regional and even global conservation work. These data are of good quality and can be compared to those collected by professional scientists. However, there is a need to acknowledge citizen scientific data as a source of information, and scientists have to be aware of, and have access to these data. Citizen science may present local solutions to large-scale problems experienced globally (Theobald et al. 2015). Currently, there is no recorded use of citizen science in Seychelles although there are past and current projects that seek to engage local communities. In order to improve coral reef management and for the success of the development of our Blue Economy, Seychellois citizens have to be properly engaged and made to understand their role, as well as the benefits for them as individuals and/or businesses.

Conclusion
In spite of the establishment of PAs, world oceans can still be affected by pollution, agricultural runoff, industrial runoff, coastal development and climate change, among others (Jackson et al. 2001). PAs need to be properly planned and should concentrate on different biomes, as indicated by the scientific knowledge acquired about species that are under conservation (Agardy et al., 2011). It should be noted that scientists and policymakers have grown in their understanding of the benefits of designing MPAs as networks, instead of as individual PAs, in a bid to sustain and restore marine populations. It is important that for Seychelles, this concept becomes better understood so that PAs that are currently being set up or that will be set up in the future function as a network. Still, these networks need to be well managed so as to offer ecosystem protection, fisheries management and research and education outcomes that provide protection and maintain populations. Additionally, networks afford more resilience in the face of climate change and other catastrophic occurrence (Gleason et. al. 2010).

The marine environment is fundamental for long term sustainability and for sustaining our survival. Activities that use marine resources can continue, but conservation processes should be developed in such a way so as to ensure that the integrity of resources is maintained. Thus, MSP should be an important factor in developing the Blue Economy, so that planning for development is carried out in a sustainable manner. As stakeholders and local communities get involved in the process, the probability for understanding the importance of these concepts is increased and sustainable use achieved (Douvere 2008; Agardy et. al. 2011).

Résumé
L’état des océans étant vulnérable aux facteurs naturels et anthropogéniques, les zones de protection marine (ZPM) représentent un moyen de conservation pour la biodiversité et les écosystèmes. Toutefois, lorsque les initiatives ne jouissent pas d’une bonne planification, les ZPM fonctionnent de façon déiciente. Pour optimiser les bénéfices, le planning des ZPM doit s’effectuer selon les provisions de l’économie bleue, tout en étant intégré dans le processus de planification de l’espace marin. A travers ce processus, le planning du développement océanique s’effectue de sorte à encourager la contribution des partenaires en vue d’assurer que les ZPM soient proprement établies pour que la résilience des écosystèmes devienne réalité. Une telle pratique est fondamentale pour le développement de l’économie bleue.

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The Blue Economy in Seychelles: How political leadership can convert an island into the Switzerland of the Indian Ocean

An Interview with Professor Gunter Pauli

Abstract
Gunter Pauli is the quintessential global citizen. Born in Belgium, he now lives in Japan but also spends time in Colombia and South Africa. There can be few countries he has not visited in his constant quest for new ideas and applications. Best of all he is known for coining the term ‘Blue Economy’. For Pauli, the Blue Economy is primarily about creating new business opportunities that enhance rather than diminish the natural environment and which bring social and economic benefits to local communities. True to his word, he has initiated and supported numerous projects across the world based on local financing and yielding new jobs. Kelly Hoareau is Director of the Blue Economy Research Institute at the University of Seychelles. In an issue devoted to exploring the different aspects of the Blue Economy, it is only fitting that she should catch up with the instigator of the term. The following records an interview where she learns about some of Pauli’s ideas and experience.

KH: The Blue Economy seems to have emerged very rapidly onto the world agenda and, perhaps inevitably in this embryonic phase, it still means different things to different people. Given your own contribution in introducing the term, let us start by asking what it means to you.

GP: The Blue Economy goes beyond the green economy and definitely goes beyond the millennium development goals. At the local level, in a community or region, it is possible to create the conditions that meet the basic needs of everyone without exploiting the ecosystem with which we share a particular space. The goal is to generate value, much more value. It is against this background that I can identify a number of new opportunities for an island nation like Seychelles, based on what we know, based on what works, and based on what has been successfully implemented. Whenever an island is constrained in terms of resources and scale of operations, development cannot be based on a conventional economic model that is constantly trying to drive down costs. Instead, I believe that the only economic growth strategy that can work is the generation of more value. This is what Switzerland has done with great success, and this is exactly what Seychelles as a newly designated high-income nation with limited space and resources could emulate.

My version of the Blue Economy is based on an inherently positive approach: it seeks to do better and to achieve this within realistic time frames. It calls for a combination of pragmatism, acceleration and entrepreneurship. Over the years, we have found that it is not always easy to encourage entrepreneurs to work on the frontiers of knowledge and development; even entrepreneurs are sometimes risk-averse. That is why the Blue Economy combines the design of clusters of projects (never one at the time) with learning initiatives that will, ideally, start at the level of the kindergarten. The logic is simple: the nearly 200 breakthrough projects with which I have been involved sometimes seemed like fantasy for many of the engineers, economists and policy-makers. But children, especially the younger ones, never distinguish between fantasy and reality and are therefore open to embrace the kind of creative innovations that I have championed.

KH: It is known that you have travelled far and wide, but how is it that you know so much about the small nation of Seychelles?

GP: I first visited Seychelles in 1987. My initial impression was of a group of islands formed of granite, each offering a unique pattern of biodiversity. After a brief stay in Victoria I moved to the island of Praslin, where I was determined to observe the Black Parrot and the vanilla orchid, both of which could be found close to the natural palm forest that later became a World Heritage site. Then I ventured to La Digue to look for the Paradise Flycatcher; this, unfortunately, proved to be elusive but I could console myself with the presence of the giant tortoises for which Seychelles is famed.

While the granite islands were under no immediate threat of rising sea levels, we did agree that the World Heritage Site of Aldabra, this unique atoll where the British once wanted to establish a military presence, required special protection. Human presence and activities should be strictly limited and any change would need to meet the highest standards of sustainability. My scheduled visit could not take place at the time but it is gratifying to see how much progress has been made by the Seychelles Government to protect this exceptional site.

KH: Yan have also taken an interest in coral restoration, something which is of enormous importance to us.

GP: Not only is it of interest to me because of the value of coral itself, but it also illustrates the need for a new approach to environmental issues. Coral restoration has always been viewed as a cost, for which either the government or generous people provide funds. Based on our experience that permits us to convert costs into assets and revenues, my Blue
Economy team worked on the Caribbean island of Bonaire with the tourist industry and local fishermen to find a financial model that would make coral restoration pay. We estimated that it would take only 20 years and €500 million to regenerate the coral reefs around the main islands. With the cooperation of the diving industry, a specialist course in coral reef rehabilitation was designed and aligned with the organization of special scuba diving tours that offer families the chance to spend a vacation actively contributing to coral reef rehabilitation. The response from the Netherlands, in particular, was impressive and soon there were insufficient corals for sale. This triggered the creation of an economic development plan that not only included the planting of corals but also the preservation of the existing species. The third commercial coral nursery was inaugurated earlier this year (2015).

Every single component of the exercise was converted into a business opportunity, generating value whereby, traditionally, conservationists would see only costs and subsidies or charity. Seychelles has unique conditions for rehabilitating coral reefs, and the absence of labour can be replaced by the dedication of tourists to participate in this historic turnaround, which leads to a customer loyalty that encourages repeat visits. Whereas the conditions are always unique, and local traditions and conditions need to be considered, the key is to ensure that this fits into the economic tissue that needs to be woven, and create higher value for all involved, including the ecosystems.

KH: Your longstanding interest in biodiversity, and why you were attracted to Seychelles in the first place can be understood. But you have also explored ways of improving the environmental sustainability of business practice in Seychelles...

GP: That is true. I returned to Seychelles nearly ten years later, in 1996, for a very different purpose. This time I came at the invitation of two international companies, Brauhaase (Hamburg) and Diageo (UK), which shared a commercial interest in the popular local brand, SeyBrew. I was asked to suggest ways in which their brewing operation in Seychelles could be made more sustainable. Accompanying me then was Professor George Chan, a Mauritian with whom I had previously designed integrated biosystems that could be applied to breweries. We were encouraged by the fact that government officials were keen to see SeyBrew cut water consumption, while also generating more jobs and introducing sustainable technologies. In spite of this support, and although our proposals had been successfully adopted elsewhere, we encountered resistance amongst the local engineers, who seemed content at that stage to simply measure water consumption and were more focused on the cost of importing carbonic acid.

KH: Islands are an obvious source of fascination for you, presumably not least of all because they offer relatively discrete laboratories for your ideas. As well as Seychelles, what other experience of islands have you had?

GP: Let me tell you about another island experience, also off the coast of Africa although in this case to the west of the continent. El Hierro is a remote outpost of the Spanish-controlled Canary Islands, and it proved to be, as you say, a wonderful testing ground for some of my ideas. Always I want to find new means to bring together business and environment so that they are not in conflict.

This particular project started in Tokyo, at the United Nations University, where in 1994 I formed the Zero Emissions Research and Initiative (ZERI), with a strong network of scientists and an emerging group of entrepreneurs. The philosophy of zero emissions — which can be explained as waste nothing and use everything you have — emerged with a series of initiatives at the World Expo 2000 in Germany. This gave rise to my version of the Blue Economy, which is the ZERI philosophy in action. As you will see, it can be applied to marine situations but, unlike the wider use of the term, it is equally applicable on land.

Always I want to find new means to bring together business and environment so that they are not in conflict

We were always looking for live projects and responded positively to the opportunity to work on El Hierro. The background in this case was that it had been earmarked for the establishment of a radar base, which was refused by the local farmers and fishermen. So what should take its place? While the expression of what was not welcome was clear, the islanders themselves formulated a plan for what they did want: self-sufficiency in water and power, as a tool to generate a viable agriculture, animal husbandry and a flourishing fisheries industry. It seemed a dream at the time, but we committed to support this venture and in 2014 the island inaugurated the hydro-wind facility that produces all the power for the island, and which also secures double the amount of water at half the cost.

Once water became abundant on land that had always suffered from water scarcity, then agriculture and industry started to thrive: organic bananas, pineapples, yoghurt, cheese, ice cream, freshly processed goat meat and more, leading to the lowest unemployment rates on Spanish territory. It is interesting that the Spanish Ambassador to Seychelles organized a visit for a delegation to observe this €83 million investment that will be paid back over a decade through the saving in petroleum imports.

KH: This sounds like a real success story. To what extent were other nations encouraged to do the same?

GP: Although this experience did not have the international impact we would have hoped for, there were certainly some encouraging responses. Notably, the Hon. Sarwono Kusumaatmadja, the former Minister of Environment of Indonesia and the first Minister of Marine Affairs and Fisheries, embraced the ideas proposed...
and engaged in a direct exchange on how Indonesia could convert itself from a mining nation and a tourist destination into a maritime nation.

Additionally, HE Ratu Mara, the President of Fiji who had witnessed the creation of coastal integration biofarms outside Suva, the capital, even came to Indonesia to discuss the breakthroughs achieved, the training offered and the projects implemented.

**KH:** One of the remarkable aspects of your CV is the sheer number and wide range of innovative activities you have been involved with. Can you give us an example of, say, just one of these?

**GP:** Well, there are certainly plenty to choose from. Let me tell you about a project that shows how coffee production can contribute to wider goals of food security. The starting point is the fact that the extraction of coffee concentrate for instant coffee or coffee liquors only gives value to well below one percent of the green coffee bean (0.2% to be exact). The rest is considered waste. Now, if the coffee farmer is only appreciated for the tiny faction that is entering the world market, he can never expect to earn a living. The industry from Nestlé to Kahlua is keenly aware that coffee waste left to rot generates methane gas through fermentation, contributing to millions of tons of greenhouse gas. Unfortunately, attempts to reduce this impact only lead to other problems. Thus, the extraction companies burn the left-overs, generating some power but also converting methane to CO₂.

An alternative business model would study a locally abundant resource, which often seems to be without value. The coffee beans are rich in fibres, protein, and a cocktail of complex molecules that often seems to be without value. The coffee beans are rich in fibres, protein, and a cocktail of complex molecules that often seems to be without value.

The coffee beans are rich in fibres, protein, and a cocktail of complex molecules that often seems to be without value.

This model could easily be applied to Seychelles, where most of its coffee supply is imported. It would surely take no time to start mushroom farming using coffee grounds from cafes and restaurants. This would support the growth of a healthy and fresh product, generate jobs and reduce methane emissions from rotting coffee waste. Mushrooms are amongst the highest-valued food commodities and therefore offer a unique business opportunity.

**KH:** This is fascinating, not least of all because it seems to be easily within reach. Can you offer another example?

**GP:** My next example is, perhaps, less straightforward because at first it might seem, what shall we say, unappetizing. It’s about finding a productive use for the contents of diapers rather than seeing this simply as waste.

Diapers are a product of modernity. Invented in Sweden nearly 60 years ago, they are universally considered indispensable in a family with babies. While everyone is acutely aware of the massive waste it generates, the super absorbent diaper offers comfort that cannot be traded. While it is expensive, it also represents one of the most destructive product designs, requiring massive tree planting with often genetically modified tree species, chemical processing, multiple layers of plastics, odour controls and a disposal system, none of which is itself sustainable. The idea of creating an ecological diaper is as old as the diaper itself, but as long as the super absorbent model creates a dry contact with the skin, one never succeeds in replacing it with a 100 per cent compostable product. The moment one substitutes the super absorbent one, the diapers must be changed more often, creating more waste along the whole process.

However, some alleviation of the problem can be found in the contents of the diaper itself, namely, by converting the fresh excrement from babies through blending it in an ingenious way with charcoal to form black earth, also known as terra preta. Black earth is not compost. It is humus, full of nutrition for micro-organisms that make plants and trees thrive, offering rich carbon in a world were top soil is destroyed through industrial farming. The sheer volume a single baby produces per year is a staggering 1,000 kg of black earth, sufficient soil to grow one thousand fruit trees to maturity. This implies that a family has the opportunity not just to buy and plant one tree to celebrate the arrival of a new member of the family, the family can plant a thousand fruit trees! If one hundred families in a neighborhood collect the richly filled diapers and turn these into black earth, and then start planting trees over a period of one year, one hundred thousand trees will grow. This, in turn, over a few generations will yield fifty kilograms of apples per year. But if, instead of just one hundred families, the process is spread across thousands of families, the output can only be imagined.

The key to this kind of increased food production is to change the business model. Diapers could be offered free, stimulating parents to use more per day, which is required to secure the better health of babies since urinary diseases are correlated to the introduction of diapers, especially amongst girls. If the diapers are offered free, and the trees are sold for 5 euros per each (about half of the ongoing price on the market for a two-year old) then one hundred families generate one million euros per year and fruit trees will now
adorn the outskirts of the city. Berlin, a city with an estimated 100,000 babies with diapers, would be able to re-green the city and its outskirts with millions of trees per year, adding in a generation, possibly, 2.5 billion fruit trees, providing fresh fruit for all of its people. This is democracy from the ‘bottom up’!

Seychelles, on the other hand, currently imports its diapers and the waste stream contributes to landfill and incineration problems. Used diapers pose a serious environmental impact: floating diapers in the ocean is amongst the worst experiences sports fishermen or scuba divers undergo. Diapers degrade slowly as a sheet, but the worst are the super absorbent ones, which never degrade and are eaten by fish, causing havoc in their digestive track.

The key once more is to recycle all of the contents produced by the thousand and more babies born in Seychelles each year. For the parents, this would produce a top soil in the form of the kind of black earth that the farmland urgently needs. Good quality soil is recognized as the basis for a healthy, small-scale, highly productive model of local agriculture.

KH: Food security is certainly a major issue for Seychelles and your above example illustrates an imaginative way of approaching this. But one of the twin pillars of the economy is fishing. Clearly, many people worry about its long-term sustainability. What are your thoughts about that?

GP: Fish stocks around the world have been driven to exhaustion. Nearly 90 per cent of all reserves are stressed or over-stressed. However, the problem is not simply fishing quotas, or fishing techniques; the main challenge is that we have a culture of catching females with eggs without discriminating these from other fish. How can one ever expect to have sustainable fishing when we kill the pregnant females with thousands of eggs in their belly? Worse, we even sell the eggs as a delicacy. Here, ethics must come to the forefront. We would never permit a cattle farmer to take those of his cows expecting a calf to the abattoir, and if he does he would be considered a barbarian. The problem with our business models is that they run on ‘autopilot’. In the case of fishing, they do not even take notice of totally unethical fishing techniques. But public opinion can change. Protesting against the catching of whales is one example, but tolerating the broad killing of female fishes shows how far we still have to go – although it seems that there is widespread support to prevent this when people are made aware of the practice.

An alternative business model would study a locally abundant resource, which often seems to be without value.

As long as one does not know the facts, unethical actions are seen as an unintended consequence and one’s inaction is equated with innocence. The moment one knows, it becomes collateral damage and one shares full responsibility. Not only is one aware of the obvious annihilation of fish by killing females with eggs, the massive pollution dumped in the seas exacerbates the challenges. We seem unprepared to learn from others on how to design a fishing technique and fish-farming processes that do not destroy habitat and species. The concept of ‘air curtain’ fishing allows the catch to be brought into the fishing boat without causing damage. Then the live fish can be checked for eggs and each pregnant female can be released back into the sea. While this makes sense to everybody, authorities like the European Union are so focused on ever-lowering fishing quotas that they have not only lost interest in new business models, but are also unaware of the fact that new ethical standards could actually create new opportunities for the industry.

Good techniques can make all the difference. A fishing boat that does not pull nets, nor require compressors to freeze fish can reduce energy consumption by 80 per cent, making it perfectly possible to design a catamaran that releases bubbles underneath the boat, selects the fish and only processes the non-pregnant ones on the boat to sell as different products. With the complete redesign of the boats, the fishermen can triple their income and yet remain at sea during the day only. The new boat can remove the need for 250,000 litres of often heavily-subsidized fuel per year; extend the home stays of the fishermen, and reduce risks. It also eliminates the consumption of fresh water on shore, since the container on the boat only brings ready-to-sell filets, rich in Omega-3, as well as smoked fish and processed animal feed. Perhaps most important, this permits the overhaul of complete fleets of fishing boats that have not benefited from any investments for decades. There are some exemplary projects to be seen in Portugal and Morocco and opportunities for others to follow suit. Seychelles has a wealth of pelagic fish, which is ideally suited for this innovative approach that is based on a catamaran structure.

KH: You’ve described various examples of your ideas in action. But can we probe a little more into what is behind the scene? What kinds of methodologies do you use to develop new business models?

GP: This is a good question. The key behind the proposals I have described is to be found in mathematical models, which provide the means to enhance the capacity to implement and speed up the roll-out. Since the Blue Economy opts for transformative and radical change of the existing model, the project teams need to ensure that the initiatives are facilitating action on the ground, and that the concept of learning by doing in multi-disciplinary teams speeds up the translation into a business that can outpace existing models. This means that the implementation teams cannot formulate their action plans on the same basis as traditional business plans. It is not enough to rely on a traditional package of market analyses, financial spreadsheets, technology audits and competitive analyses focusing on cost-efficient choices that are centered around
core business activities built on core competences which are protected by patents. Such an approach, with the logic of the existing business practice that is typically taught on MBA courses, would asphyxiate the creative models to steer business towards sustainability, capable of responding to people's needs with locally available resources, while putting nature back on its evolutionary path.

This does not mean that there is no planning! On the contrary, since my notion of the Blue Economy is inspired by non-linear models that prevail in nature, we use the Participatory System Dynamics Model as a tool to design, support and implement the innovative business models that characterise us. Mathematical modelling supports this development concept; it allows us to accelerate and broaden the opportunities for implementation while determining the natural limitations. This modelling also permits the quantification of the feedback loops and the multiplier effects, facilitating a clear understanding of the synergies of the cluster approach through the different principles I have already outlined. And if anyone has any doubt about any proposal, then we suggest a visit to the sites around the world where these initiatives have already been implemented.

Professor Jay Forrester at MIT (Massachusetts Institute of Technology) built the prototype of this computer tool as early as 1964, as an urban development model. Inspired by the description of the world's problems by Aurelio Peccei, a former top executive of FIAT and Olivetti, it was later adjusted into a global model that served as the basis for the Club of Rome report ‘Limits to Growth’. A simplified version of this is now widely available, permitting its use even amongst beginners in maths, but committed to understanding and operating the dynamics of the Blue Economy. Mathematics and modelling are the heart and soul of the projects that we implement. We could consider it the reversal of the modern-day obsession of business plans and strategy developments which have a linear approach, neglecting a multitude of opportunities and putting the maximum profit and market share as the ultimate goal.

The key to Participatory System Dynamics Modelling is that we do not simply wish people to discuss the final result; we want to ensure that a diverse group of participants gain insights into the structure and the behaviour of the system they design and are part of. Participation and collaboration are an efficient way to share and increase knowledge, to improve the formulation of a common vision and to strengthen the decisions required to implement it. This collaboration makes it easier to solve the technicalities of these proposals, and highlights how projects can be adapted to ensure implementation. A multidisciplinary approach helps create the interdependency which builds shared understanding of the issues and a common striving to optimise the results from all perspectives. It creates consensus through a dynamic exchange between economic, social and ecological systems, integrating stakeholders’ interest with scientific analysis and fostering relationships that accommodate changing information and changing conditions.

KH: One thing that the above tells us is your approach is as novel as the outcomes. But, whatever the approach, I’m sure that any project must be financially viable. Is the system of accounting as novel as the rest of the methodology?

GP: The design of the model relies on a wealth of insights into the various clusters and sub-systems, substantiated by systems that incorporate feedback loops and multipliers. There has to be a consensus on where to start and how to proceed, with the successful implementation and continuous support (often against all odds) requiring one ultimate step and translation: whatever is and will be unfolding will reconfirm decisions based on the shift in the financial accounts. It is not because the Blue Economy prioritises non-linear system-dynamic models that we cannot translate our programmes and progress into annual or even quarterly reflections in traditional accounting tools. This unique capacity of the Blue Economy provides the link from the wide range of opportunities, to the narrow definition of how these initiatives and proposals can positively impact the traditional tools for measuring the health and performance of a company.

My Blue Economy projects navigate through the maze of finance and generate surprising results that can be expressed in simple accounting. A few examples will clarify this approach. The business model design sometimes allows costs to be capitalised, as is the case with ‘stone paper’. This type of paper is recyclable forever, unlike regular tree-based paper that can only be recycled three or four times because the fibres are too short. Therefore, the cost of stone paper can be considered like a deposit, just like drinks companies put aluminium as an asset on the balance sheet, often even charging a deposit, which also strengthens the balance sheet. The recycling of stone paper would remove ongoing costs. Publishing companies could offer a reduction in subscriptions if the old magazines are returned, creating a closed-loop of stone paper at low recovery cost, which can be recycled without the use of water. The cutting of the subscription cost will increase circulation, improve advertising rates and put more stone paper on the balance sheet.

So-called negative and stranded assets (which are covered through provisions) can be converted into investments and even cash-generating instruments. For instance, the removal of tailings from mine waste dumps, for which provisions were made and ongoing costs borne by the mining company, can now be converted into raw materials for paper, thus turning a waste disposal into a cash flow. Over the years this negative asset will provide a positive cash flow, permitting the re-evaluation of the tailing dams from a negative to a positive figure. Considering that mining companies have millions of tons, this could become a major capital gain if the company so desires. The key in the process is that companies which have been over-leveraged can now strengthen their balance sheet, not through asset stripping, fire sales, closures or divestments, but through putting real
value on what had in the eyes of the traditional business model been treated as having no value.

Stranded assets could also have a fresh start, even fully depreciated. As we know, any industrial site that is more than forty years runs the risk of massive clean-up costs. If these sites with a well maintained infrastructure are cleaned up over the years through newly found cash flows, like the case of the petrochemical refinery in Sardinia, then this offers an opportunity to create a major capital gain over subsequent decades, thus eliminating the need for a full provision on the day of the announcement of closure. These opportunities that can be quantified case by case through the basic tools of accounting, at the same time increase the buying power of the local population, speed up the circulation of cash in the local economy, securing a multiplier effect and feedback loops that generate, thanks to a faster circulation of cash in the local economy, securing a multiplier effect and feedback loops that ultimately explain why double-digit growth is not only possible, but has been done elsewhere.

Perhaps the time has come for Seychelles to create a Blue Economy report containing scenarios for the future economy. In 1965, when Seychelles was still a crown colony and plantations were extensive, the then Governor-General commissioned a futurist (Donald Prell) to study the cinnamon, vanilla and copra industries. He added frozen and canned fishery products and tourism, which now represent the greatest source of local employment. Some half a century later, it is time to create new scenarios and the question is not if the Seychelles will embrace the Blue Economy but how fast will it happen? On the basis of our existing record of 200-odd projects and $4 billion of investments, with the millions of jobs generated, we could join forces and succeed in turning the Seychelles, the smallest nation of Africa, into the one that shows the way forward. The political will is there; now it is up to the entrepreneurs and the NGOs to translate the opportunities into responsible action that benefits all. I am looking forward to my next visit so that I can see how much the country has grown since the last time I was there.

KH: Thank you Prof. Pauli

Résumé
Gunter Pauli représente la quintessence du citoyen global. Né en Belgique, il vit présentement au Japon, mais passe également du temps en Colombie et en Afrique du Sud. Compte tenu de sa quête perpétuelle pour des idées et autres applications novatrices, il n’existe que très peu de pays sur terre qu’Il n’a jusqu’ici pas visités. De façon plus significative, il est celui qui a créé le terme « économie bleue ». Selon Pauli, ce concept concerne en premier lieu la création de nouvelles opportunités de commerce qui promeuvent au lieu de dégrader l’environnement naturel. Ces opportunités ont aussi pour but de générer des bénéfices sociaux et économiques pour les communautés locales. Fidèle à sa parole, il a initié et soutenu plusieurs projets de par le monde basés sur le financement local et générant de nouveaux jobs.

Kelly Hoareau est la directrice de l’Institut de Recherche sur l’Economie Bleue à l’Université des Seychelles. Dans le cadre d’une édition spéciale portant sur les différents aspects liés à l’économie bleue, il est des plus opportuns de solliciter la personne qui a précisément inventé cette expression. Dans l’entretien qui suit, Gunter Pauli parle à Kelly Hoareau de son expérience et de certaines de ses idées par rapport à l’économie bleue.
Sylvanna Antha has worked as a Research Officer for the last seven years. She holds a degree in Environment studies and Geography from James Cook University in Australia and is currently undertaking a Masters Degree at Cambridge.

Dr Ashton Berry is Head of Postgraduate Programmes, Research and Consultancy (Environmental Science) and Senior Lecturer in Climate Change Resilience at the University of Seychelles. As an active researcher investigating the resilience of coastal ecosystems to climate change, Ashton has contributed a number of articles to peer-reviewed journals. He is also developing UnSey's first Masters Programme titled Integrated Coastal and Marine Management.

Professor John G. Day obtained his PhD in 1987 from the University of Dundee and has over 30 years of experience working on applied algal projects. His interests include the conservation of micro-algal cultures, their biotechnological exploitation and the development of the Blue Economy. He was awarded a personal chair in 2014 by the University of the Highlands and Islands (UHI) for his work in the field, having published more than 100 scientific articles, papers and book chapters.

Lucy Greenhill is currently a Research Fellow at the Scottish Association of Marine Science (SAMS), where her primary interests lie in the development of effective governance to ensure the resilience of socio-ecological systems in the face of increasing demands on marine resources. Her current research activities focus on marine spatial planning as a tool to guide transitions to the integrated management of marine activities and progress towards sustainable development. Lucy has also worked extensively at the science policy interface on the development of marine policy, legislation and management practices, particularly relating to offshore renewable energy.

Professor Dennis Hardy’s first degrees were in geography, prior to training as urban planner at University College London. His doctoral thesis on planning history was awarded through the London School of Economics. He is the author of books on a variety of subjects, including utopian communities, social history and different aspects of planning. His latest book is set on Mediterranean cities. His contribution to this edition of Island Studies is based on a belief that places should be exciting and reflect the inherent features of their surroundings. Dennis is currently the Vice-Chancellor of the University of Seychelles.

Dr Adam Hughes is a researcher and senior lecturer in sustainable aquaculture focusing on the development of economically and environmentally sustainable production systems for marine animals and plants. He is a marine ecologist with over 20 years of experience in the field. He is the coordinator of the ‘Increasing Industrial Efficiency in European Mariculture’ project. He also sits on a number of ministerial working groups for the development of sustainable aquaculture, and on the Marine Alliance for Science and Technology Scotland (MASTS) steering committee for sustainable aquaculture. He is an editor for the journal ‘Aquaculture Environment Interactions’ and leads the Centre for Aquaculture at the Scottish Association for Marine Science.

Jessica Larsen is an anthropologist by training and she is currently pursuing her PhD at the Danish Institute for International Studies and the Faculty of Law at Copenhagen University. The PhD project combines law and anthropology. It examines the role of law in global governance and takes as its empirical point of departure the practices of counter-piracy law enforcement off Somalia. Jessica Larsen’s background is in international development in Sub-Saharan Africa, and she has previously worked, lived and researched in East Africa.

Aubrey Lesperance is the Principal Aquaculture Officer at the Seychelles Fishing Authority (SFA). He graduated in 2007 with a bachelor’s degree in Aquaculture from the University of Tasmania, Australia. He joined the SFA in 2008 as Development Officer, where he started working on assessing the potential for aquaculture development in Seychelles. He works on aquaculture policies and strategy. Aubrey has been involved with the development of the first Seychelles Mariculture Master Plan since 2009. His main areas of focus include aquaculture sector development, policy and governance in Seychelles.

Christophe Mason-Parker is originally from the UK. He came to Seychelles in 2009 and currently works for Global Vision International Seychelles as Country Director. He oversees the running of the Marine Conservation Expedition at Cap Ternay and the Island Conservation Expedition on Curieuse Island.

Denis Matatiken has been working in the Environment Sector for the past 17 years. He has a Master’s Degree from the University of Plymouth. He was previously a Policy Analyst, CEO of SNPA, and, now the Special Advisor to the Minister of Environment, Energy and Climate Change.

Gunter Pauli is the author of the 2009 Report to the Club of Rome ‘Blue Economy: 100 innovations – 10 years – 100 million jobs’, which was followed by the ‘Blue Economy 2.0: 200 projects implemented – 4 billion dollars invested – 3 million jobs created’. He contributed to the COP3 in Kyoto through the design of a new business model and economic growth system that would entail no waste and no emissions. In 1996 he created with UNDP the ZERI Foundation in Switzerland.

Dr Marie Therese Purvis is an independent consultant based in Seychelles. It is in this capacity that she has carried out a number of assignments for the Blue Economy Department since May 2015. She was previously Principal Education Officer and Director of the National Institute of Education. She has over twenty five years of experience working in the area of education. Her other interests include sustainable development and the promotion of social justice and democracy. She is a member of two environment NGOs, a board member of Seychelles’ Citizens Engagement Platform and a member of Seychelles Electoral Commission.

Dr Michele Stanley has over 22 years of research experience in the area of biochemistry and molecular biology. She has worked on applied phycology projects for more than 18 years. Over the last eight years, she has initiated and led research investigating marine biomass, both macro- and micro-algal, as forms of biofuels at SAMS and is also developing other areas of applied research investigating the biotechnological application of algae. Her other main role at SAMS is exercised in her capacity as Centre Lead for Blue Biotechnology.
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