



Theme 1

MARINE BIODIVERSITY AND FOOD SECURITY

**Tuesday 6th November
(Parallel Session - morning)**

Chair: Leonard Sonnenschein
Rapporteur: Lennart Nyman Junior



'Biodiversity – An Issue of Governance'

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Abstract

The planet's loss of biological diversity is occurring at an unprecedented and accelerating rate. The serious deterioration of the health of the ocean and coasts and the horrendous, irreversible damage already done to its biodiversity, in terms of variability of living organisms in marine and other aquatic ecosystems and the impact on genetic diversity, species and ecosystems, is unforgivable. That damage comes from many sources of what can only be described as lawlessness on land and ocean. While poverty is the source of all evil, greed, political expediency, ignorance and incoherent policies are cumulatively strangling life in our oceans and coasts, despite decades of efforts to evolve an adequate governance regime. It has become evident that the scientific and technological advances that facilitated the large-scale exploitation of ocean resources have also contributed to the emergence of destructive practices and inherent dangers. It is therefore essential to understand the delicate balance between the health of the oceans and their resource use and imperative to strike a balance between sustainable practices and the health of the ocean. That balance can only be achieved if an enabling environment is created through the application of enforceable governance, appropriate technology use, advocacy, and capacity building.

However, having conventions, international rules, guidelines, and protocols does not guarantee implementation or compliance. There is no automatic relationship between goals and action. The essential ingredients are the political will of policy makers to act on commitments and the will of humans in general to behave rationally and comply with obligations.

The reality of the situation is that despite the entire complex and multi-faceted governance architecture that exists, our oceans' biodiversity is in deep trouble. This author argues that, to correct the current distortion, there is a need for a mindset change, as the governance architecture has failed to protect the ocean and its resources. Governance of ocean and coasts is a complex web of inter-related, interdependent, converging, conflicting and competing demands and interests. There is no silver bullet as there is no "one size fits all" solution. Also, national and regional ocean policies have proved inadequate for the simple reason that current policies produce incoherent sectoral solutions that are irreconcilable and hence ineffective, as evidenced by current fisheries policies. The contradiction and disconnection between environmental, fisheries and maritime policies of some of the most developed countries is one glaring example.

An Ocean in Trouble

The ocean is the provider of the essential services for the fabric of life. It is the provider of oxygen (half of the oxygen in the atmosphere is generated by the ocean) and is the modulator of the weather. It further drives planetary temperature and chemistry, absorbs CO² and is host to most of the biodiversity on the planet, the same diversity of marine life that balances the oceans resilience and ecosystem.

Sylvia Earle poignantly stated that changes are occurring as consequences of what humans are putting into the ocean and removing from the mantle of living systems:

We have learned the hard way that the ocean is not infinite in its capacity to accommodate what we put in and take out. The human imprint on the ocean has led to destruction of habitat with annual removal of millions of tons of ocean life and addition of millions of tons of noxious waste.¹

In addition to the traditional human uses of the ocean such as shipping, resource extraction and waste disposal the value of the marine ecosystem goods and services are approximately 63 percent of the total value of all systems on earth.

As no market value is ever put on the original source of these goods and services, consequently it results in failure to place limits on their use and invariably leads to their degradation. The body of water seems to be assumed as a neutral entity: ships cross it; fish are caught in it; energy extracted from it; and two-thirds of the human population lives from it and on its shores. But that

¹ Sylvia Earle, *Defying Ocean's End*. Island Press (2004) USA.



body of water does not figure in the human sustainable development calculations. For example, the special interdependent relationship between humankind and the ocean was not part of the logical framework for the elaboration of the Millennium Development Goals (MDGs.)

The ocean is the primary provider of economic and social services to humankind. The combined value of all ocean ecosystems of goods and services are conservatively estimated to reach US\$32 trillion per year; this estimate covers such uses as, *inter alia*, exploitation of living and non-living resources, transportation, communication, recreation, energy production, and waste disposal.²

The ocean covers almost three-quarters of the Earth's surface and by 2025 about 75 percent of the world's population could be living within 100 km of its coasts. While the total economic and social value of the ocean can never be fully or accurately estimated, humankind has an economic and social dependency on the goods, services, and uses provided by the ocean. It is the largest source of protein for humankind. More than 90 percent of the planet's biomass is found in the ocean.

Moreover, 90 percent of the ocean is unexplored.³ Given this fact, and the fact that the ocean (particularly deep-sea ecosystems) is home to biodiversity unparalleled on land, it is quite likely that the ocean contains as-yet undiscovered secrets, which could, like many of its resources, be used for the common good of humankind. An example is that of marine genetic resources, more specifically the fact that most cancer treatment medicines are derived from living species of the ocean such as sponges.

Humans, however, have failed to live with the ocean and from the ocean in a sustainable relationship. The economic and social welfare of humankind depends to a large degree on the oceans' productive sectors and services. The manner in which humans exploit those resources and services has been anything but humane. Over-exploitation and depletion of living resources, compounded by land-based and seaborne pollution, have resulted in the current scarcity of affordable protein and is making a mockery of attempts to achieve MDG goals relating to health and poverty eradication.

Regrettably, however, the human impact on the ocean through use and exploitation has been destructive and unconscionable because humans have taken for granted the sustainability of the ocean. In so doing, and despite decades of efforts to evolve a global and comprehensive governance regime, the ocean's fragile ecosystem is being systematically destroyed. It has become evident that the scientific and technological advances that facilitated the large-scale exploitation of ocean resources have also contributed to the emergence of destructive practices and inherent dangers. It is, therefore, essential to address the delicate balance between the health of the oceans and resource use. That balance can only be achieved if an enabling environment is created through the application of enforceable governance, appropriate technology use, advocacy, and capacity building.⁴

The combination of existing hard and soft laws in the form of conventions, international rules, guidelines, protocols, etc. does not guarantee implementation. There is no automatic relationship between goals and action, particularly in the absence of political will from policy makers to act on commitments and ensure that their nationals behave rationally. Despite the entire complex and many faceted of governance architecture that has existed for more than half a century, our oceans are in deep trouble.⁵

² Ocean Source of Life, UNCLOS 20th Anniversary Publication, United Nations, Division for Ocean Affairs and the Law of the Sea. (2002) United Nations, NY; see also: Constanza, The Value of the World Ecosystem Services and Natural Capital, Ecological Economic Research and Application Inc. 1997.

³ See IUCN, Critical Ocean Issues: Ecosystems and Biodiversity in Deep Waters and High Seas, UNEP 2005 available online www.iucn.org

⁴ See: Behnam, A., *The IOI and the MDGs: a stakeholder contribution to achieving the Millennium Development Goals*. Ocean Yearbook Vol. 22, PP. 19-31. Martinus Nijhoff (2008)

⁵ Ibid.



Reality Check

In the last 42 years, capture of wild marine fish increased from 20 million to 84.5 million tons with more than 40 percent entering international trade. Global discarded bycatch amounts to 20 million tons a year, approximately 25 percent of fish caught. Over half of the global fish stock is fully exploited and 24 percent over exploited in 2002. 73 to 75 percent of world major fisheries are over exploited, fully exploited or recovering from depletion.

The world value of Illegal Unreported Unregulated Fishing (IUU) catches is estimated at 10.0 billion US dollars. Each year, illegal long-line fishing kills over 400,000 birds and albatrosses.

Worldwide populations of large fish with high commercial value, such as tuna, cod, swordfish and marlin, have declined by 90 percent. In the past century, over 100 million sharks and related species were caught for their fins with North Atlantic sharks crashing by 80 percent in 10 years. In the South Tasman Rise trawl nets brought 1.6 tons of coral per hour as bycatch. 19 out of 20 albatross species are under threat of extinction.

In 2000 more than 200,000 loggerhead sea turtles and 50,000 leatherneck were accidentally caught in fishing gear worldwide. The populations of both species have fallen by 90 percent over the past decade. We all know the WTO ruling on turtle exclusion devices and dolphin safe tuna. Most cold-water coral reefs in the North East Atlantic show signs of or have been destroyed by bottom trawling.

Each year ten billion of ballast water is transferred around the globe and released in foreign waters. Wastes created per day amount to 4400Kg. One third of the waste of cruise ships visiting the Caribbean is deliberately dumped at sea. Total marine litter input into the ocean is 6.4 million tonnes per year, 5.6 million of which is from merchant shipping. Some 8 million items of marine litter enter the sea every day, about 5 million of which have been thrown overboard or lost from ships.

Over 46,000 pieces of plastic are floating on every square mile of ocean today; in the Central Pacific there are up to 6 pound of marine litter to every pound of plankton. Plastic waste kills up to 1 million seabirds and 100,00 mammals and countless fish each year.

The Gulf Stream flow has declined 30 percent in the last half century.

Source: IUCN Ecosystem and Biodiversity in Deep Waters and High Seas, UNEP Regional Report, No. 178, 2006

The greatest source of pollution to the ocean originates on land, and includes, *inter alia*, toxic waste, nutrient pollution, untreated sewage, industrial production waste. In many cases, all have resulted in irreversible damage to the health of the ocean: destroying its biodiversity and bleaching the coral habitat for the species. The bottom line is that the cost of the damage to the ocean from the productive sector that leads to exchange of goods and services is not internalised.

Fisheries: an example of human mismanagement

In spite of a plethora of ocean governance tools, the fishing fleets have grown to such overcapacity through accessible financing and Government subsidies. A dangerous nexus has developed between IUU fishing subsidies, unfair access agreements and flags of convenience.

The horrendous damage that humankind has inflicted on the ocean's biodiversity and ecosystem is unconscionable. That damage comes from many sources of what can only be described as lawlessness on land and ocean. While poverty is the source of all evil, greed, political expediency, ignorance and incoherent policies are cumulatively strangling life on our planet.



One glaring example is the abuse of the natural resources of the ocean, namely a destructive and unsustainable fishing practice, where not only fish stocks are being depleted but at the same time the total ecosystems are at risk of being wiped out.

One of the most destructive fishing practices is bottom and seamount trawling. IOI has joined with other organisations of good will and responsible States in calling for an immediate moratorium in order to stop this form of annihilation of all of life and ecosystems on the seabed and seamounts.⁶ However, a moratorium alone will not be durable in the long term, for the simple reason that once again the international community is addressing only the symptoms and not the root causes. Compliance with the will of the international community will not be secured, because at the root of such a practice is evil nexus between IUU fishing, fisheries flags of convenience, fisheries subsidies and, as a consequence, a governance deficit in enforcement and compliance.

IUU fishing, a modern day piracy, has amounted to more than 30 percent of total fish catch (approximately 20 billion US\$). As an example, 60 percent of some 2,400 vessels off the West Coast of Africa are engaged in IUU fishing. What makes this abhorrent phenomenon possible is the spread of a cancerous system of flags of convenience to fishing vessels. Flags of convenience put their unscrupulous owners beyond the rule of law. IUU fishing combined with destructive fishing technology such as intensive bottom trawling is converting the rich seabed and seamounts into a barren and scared desert, devoid of its ecosystem and any form of life. IUU fishing approximates a 10 billion dollar robbery in the high seas and territorial waters.

What fuels IUU fishing, is the gaping governance deficit that allows flags of convenience vessels to operate with impunity and disregard of laws, ethics or morals of decent and sustainable behaviour. While all countries are adversely impacted, developing countries tend to suffer most as they do not have the capacity to protect their waters and on the high sea there is no authority to ensure compliance. Unfortunately, on the high seas, international law left compliance with flag States. In the case of flags of convenience, it is tantamount to leaving the fire brigade in the hand of the arsonists.⁷

The governance deficit is implicit in this year's report of the United Nations Secretary-General (A/60/63/Add.1); he recalls that the water column on the high seas falls under the regime of the freedom of the high seas and any obligation to protect, conserve, and manage diving resources and the marine environment fall under the duties of the flag States.

For more than forty years the international community has turned a blind eye to the fact that Flags of convenience States are neither willing nor capable of exercising any form of jurisdiction or control over vessels flying their flag. The less reputable ones do not even know of the existence of vessels flying their flag. There are over 2,900 such fishing vessels plundering the sea and conducting IUU fishing. It has become evident that Port State control, unlike in maritime trade, does not work because in fishing the act is the problem and not the condition of the ship. Furthermore, such vessels resort to fish laundering on the high seas. The absence of a mandatory and defined genuine link in UNCLOS, and fruitless efforts since, has allowed this situation to develop.⁸

However, there is the other link that directly or indirectly encouraged the proliferation of flags of convenience fishing vessels. That is fishing subsidies extended by Governments. Fisheries subsidies have reached US\$15 billion annually; almost 20 percent of the fisheries industry revenue.⁹ Subsidies distort production and create unmanageable overcapacity supporting 30-35 percent of all fish production.¹⁰ This compounds already existing unsustainable overfishing conditions, together with the increase in bycatch and related destructive practices. The vicious

⁶ Statement by Behnam, A., President of IOI at PIM 31, 32 and statements at UN/ICP 2006, 2007.

⁷ See: Behnam, A. & Faust, P., *Twilight of flag State control*. Ocean Yearbook Vol. 17, PP. 167-192. University of Chicago Press (2003), and Behnam, A... *The unfulfilled promise of the seventies: shipping and developing countries*. Ocean Yearbook Vol. 18, PP. 453-487. University of Chicago Press. (2004)

⁸ Fisheries, International Trade and Sustainable Development, ICTSD, 2006

⁹ WWF, *Turning the Tide on Fishing Subsidies*, 2002.

¹⁰ There is a clear and compelling link between IUU fishing on the high seas and fishing vessels flagged to what are commonly called open registries. Typical high seas IUU operations involve vessels flagged to open registries such as Bolivia, Belize, Panama, Uruguay and Togo. Closing the Net, HSTF, March 2006, www.high-seas.org



circle leads to IUU fishing and depletion of stocks. Subsidies are also extended to fisheries infrastructure and management that increase incentives to fish.

Cathy A. Roheim¹¹ concludes that: impacts of trade liberalization on the welfare of the nations are critically dependent on the fisheries management systems of the producing countries. Open access, which is the management regime in many developing countries, leads to overfishing. Fisheries management is not successful if there is little enforcement. Any event creating rises in prices for fish from exporting (developing) countries creates incentives to fish even more, exacerbating overfishing, and leads in the longer run to stock collapse. Even trade liberalization in the aquaculture industries worldwide is not immune from the effects of fisheries management regimes if the feed for that production is itself from a poorly managed capture fishery.

A related grey form of subsidies is unfair and inequitable fisheries access agreements that impact particularly on the access granting developing countries. While access agreements are considered as a component of North-South relations, most developing countries do not have the capacity to monitor or effectively negotiate such agreements.¹² As stocks in developed countries have declined, their fleets have gone elsewhere to capture fish. The EU, for example, has paid several developing countries for access rights to their fishing territories. While the developing nations gain access fees, enforcement of fish management policies to limit the catches of the foreign fleets are minimal, generally resulting in an overfishing of these fish stocks.¹³

Thus, while there is a short-term monetary gain for developing countries allowing foreign fleets to fish in their waters, in the long-run that value disappears along with the resource and perhaps the ecosystem. When the average return to the granting country is no more than 3-6 percent of the value of the catch (in the case of Guinea Bissau less than 1 percent), it becomes nothing more than a marginalisation of the coastal communities and a net income loss to local fishermen at the expense of the depletion of their resource by industrial and unsustainable practices with the involvement of flags of convenience vessels.

Rubens Ricupero, then Secretary General of UNCTAD, once described cotton subsidies as weapons of mass destruction. In this case, the nexus of IUU fishing, subsidized and unfettered unfair access agreements combined with flags of convenience are weapons of mass annihilation; they do not only hurt people but also destroy the biodiversity and the fragile ecosystem of the ocean.

While the IOI is committed to the elimination of IUU fishing, advocates a moratorium on deep sea and seamount trawling and is strongly in favour of the use of area-based management tools for management and conservation, it is convinced that the international community must address the root causes of the ocean governance deficit as a priority.¹⁴

Maritime Transport and its Impact on Climate Change

Maritime transport services are an example of the interdependent relationship between trade, sustainable development and climate change. Currently, 90 percent of all world trade is seaborne trade and 60 percent of all oil transported moves by tankers on the high seas. The world's shipping freight bill in 2004 reached US\$280 billion and the bill developing countries pay for shipping their seaborne trade amounted to US\$185 billion. African and most developing countries pay foreign operators for the maritime transport of their trade - a debilitating outflow of scarce foreign exchange. One can easily discern the interdependent relationship among poverty eradication, financial resources, and the uses and services of the ocean.

World sea-borne trade in 2005 reached a record high of 7.11 billion tons, and total maritime activity measured in ton-miles increased to 29,045 billion ton miles. World seaborne trade

¹¹ Roheim, Cathy, Trade Liberalization in Fish Products: Impacts on Sustainability of International Markets and Fish Resources, University of Rhode Island, 2004, crw@uri.edu.

¹² Roheim, Cathy, Ibid.

¹³ *Op. cit.*

¹⁴ See also: Closing the Net, Stopping IUU fishing on the high seas HSTF, High Seas Task Force, March 2006, www.high-seas.org; WWF/ITF Changing Nature of High Seas Fishing, October 2005; Fisheries, International Trade and Sustainable Development, October 2006, ICTSD, Geneva.



accounts for 90% of world trade. In 2006, the world merchant fleet reached 960 million tons (dwt), 72% of this fleet is composed of oil tankers and bulk carriers. The average age of that tonnage is 12.2 years, with fuel cargo vessels reaching 17.5 years. The productivity of the world fleet is estimated to be 30,000 tons miles per dwt, the highest productivity rate since 1990. Half of the world fleet is registered in open-registry countries. In (2006) the figure increased by 6.9 percent.¹⁵

It is evident that, compared with other transport industries, shipping is highly productive. However, the most recent studies show that carbon dioxide emissions from shipping are twice as much as airlines and may rise by 75% in the next 15 years as seaborne trade expands.¹⁶ The current annual emissions from shipping range between 600 and 800 million tons of CO₂. The Institute for Physical Atmosphere in Wessling, Germany suggests it is up to 5% of the global total, which is nearly double Britain's total emissions and more than that of all African countries combined. The world fleet consumed approximately 280 million metric tons of fuel in 2001, and the merchant fleet consumption is expected to grow to 350 tons by 2020¹⁷.

The reality of the current situation is that the Kyoto Agreement does not cover maritime emissions, and there is no international emission strategy for shipping in place.

V. Eyring, H.W. Köhler and *et al* wrote in the Journal of Geographical Research, while shipping contributes only 16% of the total fuel consumption of all traffic related sources, the ocean fleet produces 9.2 times more NO_x emissions than aviation, 80 times more SO_x emissions and 1,200 times more particulate matter than aviation.¹⁸ This clearly indicated the need for the shipping industry to incorporate environmental considerations into their designated development.

While the EU has a commitment to identify and take action to reduce greenhouse gas emissions from shipping, IMO has focused also on improving vessel efficiency. However, there is no international accord as to how to allocate emissions from ships whether to countries of registry or otherwise, because the beneficial owners have no relation with the flag State.

There are two issues that confront the international community: the first being how to use and incorporate technology solutions to reduce emissions from ships, particularly NO_x, SO_x and CO₂ emissions by total fuel consumptions, cleaner fuels, exhaust gas treatment technology and replacement of residual fuel by marine diesel oil, and alternative energies and fuels; the second issue emanates from the nature of shipping as a competitive international industry and the existence of flags of convenience which undermines governance, jurisdiction control and compliance in the shipping and maritime trade.

The heart of the problem is that international organizations such as IMO cannot enforce compliance with their conventions and guidelines should, for example, an emission cap be agreed upon for CO₂ emission from ships. It is up to the flag State to ensure compliance through enforcement measures.

The April 2007 Report on Aviation and Maritime Transport in a post-2012 climate policy regime, confirms that there is no agreement on actions in IMO to ensure effective implementation and mitigation policies to reduce greenhouse emissions for international shipping.¹⁹ One of the stumbling blocks is the issue of allocation of responsibility for emissions.

At least in one sector of the shipping industry, the liner trade, which is the sector with the least engagement in flags of convenience, has made its voice heard as to the shipping "culture of procrastination and opting for the legal minimum which has spawned a welter of competing and often conflicting visions on reducing pollution from ships". In supporting the US proposal for a

¹⁵ Review of Maritime Transport, 2006, UNCTAD.

¹⁶ Vidal, John, environment editor, The Guardian, March 03, 2007.

¹⁷ Journal of Geophysical Research, Vol. 110, D17305, 2005, Emissions for International Shipping: The last 50 years. See also: Journal of Geophysical Research, Vol. 108, 2003, D20, 4650 Updated Emissions from Ocean Shipping.

¹⁸ *Op. Cit.* Vol.110, D17306, Impact of Future Technologies on Scenarios until 2050.

¹⁹ See Report, Corbett and Koehler, (06.7153.59) Aviation and Maritime Transport in a post 2012 Climate Policy Regime. April 2007, Report 500102008 (CE report 06.7153.59) Netherlands Environmental Assessment Agency, Bilthoven.



revision of MARPOL, liner companies have supported sulphur free fuels. Shipping must not be allowed to hide behind the slogan “little pollution for a lot of movement”.²⁰

There are indications that the EU may be contemplating what the Environment Commission called as most effective cost options, namely, inclusion of maritime transport in EU emissions trading schemes and incentives, such as differential harbor dues based on environmental performance of vessels and mandatory CO² index limits for ships calling at EU ports.

The shipping industry is a conservative one and as such changes in behavior do not come easily. It is evident that the allocation of emission responsibility is so difficult. However, ultimately it is the flag State that should be responsible for monitoring and compliance to any agreed measures or solutions. But, in half of the world shipping the flag State is absent and in the other half it is placed under an unfair competitive position because of the international character of shipping. The absence of mandatory genuine link between flag State and vessels renders flag States incompetent in exercising jurisdiction and control. Thus, the difficulty faced by an international agency such as IMO in implementing such principles as the UNFCCC of common but differentiated responsibilities for developed and developing countries where developed countries own the ships under the flags of developing countries.

The EU green paper has clearly recognized the nexus of ocean and climate change. However, it states that CO₂ induced acidification is inevitable. The shipping sector remains a major source of pollution in Europe with emissions of 157 million tons in 2000, more than aviation emissions in EU space. In EU seas NO^x emissions are projected higher than all land-based sources by 2020. The solution the EU will seek is not in capping but in technologies. The question that arises is will that technology be affordable or available to developing and least developed countries?

Addressing the Lacuna in Ocean Governance: A call for coherence

“The health of the ocean is a profound distortion of humanities purpose on earth.”²¹

To correct that distortion there is a need for a mind-set change, as the governance architecture has failed to protect the ocean and its resources. Governance of the ocean is a complex web of inter-related, interdependent, converging, conflicting and competing demands and interests. There is no silver bullet as there is not a one size fit all solution. National and regional ocean policies have proved inadequate for the simple reason that current policies produce incoherent sectoral solutions that are irreconcilable to be effective as is evidenced in current fisheries policies. The contradiction and disconnect between environment and fisheries policies of some of the most developed countries is profoundly perplexing.

At the international level there is an urgent need to balance the ecological, social, cultural, economic, legal and technical parameters of policy perspectives in the management of the ocean. Ocean governance at the international level is a vast collection of binding and non binding rules, protocols and all other forms of hard and soft agreements. These are diffused among a myriad of sectoral, international and regional organisations that have the responsibility for monitoring implementation, but lack the means and authority to ensure compliance and enforcement.

Calls for coordination and cooperation among all relevant parties and stakeholders are frequently sounded. In the context of the UN System, UN-OCEANS was established for such a purpose. The problem is that coordination and cooperation do not address the root cause but the symptoms. In most cases, the root cause is compliance and enforcement and the absence of mechanisms that ensure compliance and are capable of enforcement has contributed to the current unacceptable situation.

It is not the absence of an enabling legal environment that is the problem. Having a constitution does not automatically result in compliance or coherence of policies. Institutional coherence in implementation is evidently lacking. The environment, uses, health and resources of the ocean are fragmented among numerous bureaucracies. The international institutional governance

²⁰ Lloyds List, Rajesh Joshi. Lines Back Radical US Emissions Cuts. 28 and 29 June 2007; and Shipping Urged to Step a Gear on Green Issues. Julian Macqueen, 20 June 2007.

²¹ Behnam, A., IOI Annual Report, 2005. www.ioinst.org



architecture lacks the capacity of a single overarching entity that can create a holistic paradigm for ocean governance.

There is no doubt that the complex nature of the oceans and divergent sectoral interest and demands of all actors make coherence a difficult goal to achieve. But the side effects can be to a large extent mitigated by policies and measures that promote partnerships among stakeholders and an inclusive environment for the interaction of civil society – the advocacy, the business community, the scientific community and policy makers. A culture of partnership of all stakeholders may contribute to a more coherent implementation of policies at national and international levels, and promote mutual appreciation of each others' interests.

IOI has called for the appointment of a Special Representative of the United Nations Secretary General for the ocean, albeit, a goodwill ambassador or ombudsman. The establishment of such a high office in the UN may provide solutions to many areas where contradictory policies are either formulated or implemented. Such a Representative would have authority to make direct representation to those with the power to effect change at the same time giving a voice for the civil society.

The participation in this process of civil society, and particularly non-governmental organizations such as the IOI, is indispensable: civil society brings community groups to the centre of the decision-making process, provides facts and information, monitors compliance with, and implementation of, decisions, and consequently safeguards grassroots collective interests. The Informal Consultative Process of the UN General Assembly (IPC) which the late founder of IOI, Elisabeth Mann Borgese, was instrumental in creating, has provided a unique opportunity for the civil society not only to have a voice in multilateral dialogue on ocean affairs, but also to ensure empowerment and stakeholder by-in.

In conclusion, protecting the biodiversity of the ocean is a collective as well as individual responsibility. There is no dearth of governance tools to comply with, what appears to be lacking is the political will and commitment at all levels to ensure implementation and compliance and, above all, a voice for the ocean.



Status of Critical Marine Ecosystems in the South Western Indian Ocean

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Abstract

The Western Indian Ocean (WIO) region comprises the western extremity of the tropical Indo-West Pacific, the world's largest marine biogeographic province. The region is endowed with critical habitats including coral reefs, sea grass beds, mangroves, and terrestrial forests. Although the WIO region is still one of the least ecologically disturbed oceans relative to other regions in the world, it is increasingly threatened by natural- and human-induced stresses such as over-exploitation of living resources, modification of habitats, pollution, invasive species and climate change. This paper provides a transboundary analysis of the main problems related to physical alterations and destruction of critical marine and critical marine habitats in WIO, their main causes as well as environmental impacts and socioeconomic consequences.

Introduction

The Western Indian Ocean (WIO) region extends from latitudes 12°N to 30°S and longitudes 30° to 80°E. The region encompasses five riparian states (Somalia, Kenya, Tanzania, Mozambique and South Africa) and five island states (Mauritius, Comoros, Seychelles, Reunion-France, and Madagascar) – Fig.1. The coastal areas of WIO countries are characterized by a diversity of critical habitats including, coral reefs, seagrass beds, mangroves, and terrestrial coastal forests.

Coral reefs in WIO cover a surface area of approximately 12,913 km². They are one of the most productive and diverse ecosystem in the world with more than 300 coral species known in WIO region (Spalding et al., 2001). Coral reefs play an important role in the socio-economic well-being of the people of WIO as many are dependent on them for work and subsistence.

The total area of mangrove forests in WIO is estimated to be 10,000 km² (Spalding *et al.*, 1997) representing about 5.0 % of the total global mangrove coverage. Nine species of mangroves are encountered in WIO, the dominant species being *Rhizophora mucronata* and *Ceriops tagal* (Kairo, 2001; see Table 1). The best developed mangroves in the region are found in the estuaries of River Rufiji (Tanzania), the Tana River Delta (Kenya), the Zambezi and Limpopo river deltas (Mozambique) and along the west coast of Madagascar at Mahajanga, Nosy be and Hahavavy (Spalding et al., 1997).

Twelve seagrass species, comprising about a fifth of the world's total occur in the WIO region (Bandeira and Bjork 2001; Gulström *et al.*, 2002). The highest diversity of seagrasses in the region is found in Kenya, Tanzania and Mozambique (Table 2). Unlike mangroves and coral reefs, area of seagrass beds in the region is not known for most of the countries.



Fig. 1: Map of WIO region

Table 1: Distribution of mangroves in the WIO

Country	Area (ha) ¹	Species	Main mangrove areas
Mozambique	390,500	9	Zambezi delta
Madagascar	314,000	9	West coast at Mahajanga bay, Nosy Be, and Hahavavy
Tanzania	164,200	9	Rufiji delta, Tanga, Kilwa , Pangani.
Kenya	51,600	9	Lamu archipelago, Tana delta
Seychelles	1,900	7	Aldabra atoll
South Africa	667	6	St Lucia
Comoros	670	5	Grande Comoro, Moheli
Mauritius	7	2	Mathurin bay, Rodrigues
Somali	9,100	6	Juba/Shebele Estuary

(Data source: FAO, 2002, Beentje and Bandeira 2007; Spalding *et al.*, 1997)

Table 2: Seagrasses species in WIO countries

Species	Somalia	Kenya	Tanzania	Mozambique	South Africa	Mauritius	Madagascar	Comoros	Seychelles
<i>Zostera capensis</i>		√	√	√	√				
<i>Thalassia hemprichii</i>	√	√	√	√	√		√	√	√
<i>Thalassodendron ciliatum</i>		√	√	√		√	√	√	√
<i>Syringodim isoetifolium</i>	√	√	√	√		√		√	√
<i>Halodule wrightii</i>	√	√	√	√		√	√	√	
<i>Halodule uninervis</i>	√	√	√	√		√	√	√	√
<i>Halphila stipulacea</i>	√	√	√	√		√	√	√	√
<i>Halphila minor</i>		√	√	√					
<i>Halophila ovalis</i>	√	√	√	√	√	√	√	√	
<i>Enhalus acoroides</i>		√	√	√					√
<i>Cymodocea serrulata</i>	√	√	√	√	√	√	√	√	√
<i>Cymodocea rotundata</i>	√	√	√	√	√		√	√	√
<i>Ruppia maritime</i>					√				



Transboundary problems affecting critical habitats in WIO

Coastal and marine habitats around the world have been extensively modified with a consequential reduction in biodiversity and an alteration of ecological community structures (UNEP, 2006). In the WIO region, analysis of Land Based Sources and Activities (LBSA) affecting coastal and marine habitats identifies three problem clusters.

1. Pollution from land-based sources and consequent degeneration of water quality;
2. Physical alteration and destruction of habitats (PADH); and
3. Alteration in fresh water flows and sediment loads from rivers.

The major transboundary problem discussed in this paper is that of loss and transformation of habitats, commonly referred to as Physical Alteration and Destruction of Habitats (PADH). These transformations have been physical, as in the dredging of waterways, deforestation, diversion of fresh water flows, and construction of ports and jetties, tourist resorts, and housing developments; and they have been biological, as has occurred with over-exploitation of living resources from terrestrial forests, mangroves, sea grass beds and coral reefs. In addition, global climate change, which is a crosscutting concern attributed to human activities has led to abnormal rainfall patterns, droughts, floods, and sea level changes. The cumulative impacts of these problems have been significant physical and ecological changes in the region and an overall decline in many ecosystem services. The three categories of PADH discussed in this paper are:

1. Degradation of mangrove forests
2. Degradation of seagrass beds
3. Degradation of coral reefs

Mangrove degradation in WIO

The underlying root causes of the loss and modification of mangroves in WIO are associated with the population pressure, poor governance, economic pressure in the rural and urban centres, poverty status of local communities, and unequal distribution of resources. In addition, climate change related factors such as sea level rise and increased sedimentation have affected the fringing mangroves in Kenya, Tanzania and Mozambique (Semesi, 1998; Kitheka et al., 2002; 2003; Hogue et al., 2002).

According to the recent assessment of global mangrove forests, the WIO lost about 3000 ha/year of mangrove area from 1980 – 2005 (FAO, 2007; Table 3). While causes of mangrove degradation may vary from one country to another, the major causes seem to be over-exploitation of wood products, conversion of mangrove areas to other land uses, and pollution. Increased awareness of the value of mangrove forests have led to successful small scale mangrove reforestation initiatives in Mauritius, Kenya, Mozambique and Tanzania (Kairo et al., 2001).



Table 3: Loss of mangrove area in WIO (1980 – 2005)

Country	1980	2005	Annual change (1980 -2005)	
			Ha	%
Mozambique	402,500	390,200	-492	-0.1
Madagascar	330,000	300,000	-1200	-0.4
Tanzania	152,000	125,000	-1080	-0.7
Kenya	54,700	50,000	-188	-0.3
Seychelles	2,500	2,500	0	0.0
South Africa	3,500	3,000	-20	-0.6
Comoros	125	115	-0.4	-0.3
Mauritius	45	120	3	6.7
	945,370	870,935	-2977.4	-0.3

Source: FAO, (2007)

Degradation of Seagrass Beds

Seagrass degradation in the WIO region is generally evidenced by continued destruction and/or reduction of seagrass habitats in shallow intertidal and subtidal areas. This degradation is usually as a result of dragging of fishing nets, pollution, or by climate change through increased discharge of sediment laden low salinity water derived from flooded river systems (Short and Neckles 1999, Bandeira & Gell 2003).

Degradation of seagrass beds leads to loss of ecological services provided by them such as edible invertebrates and fisheries resources. Immediate impacts of seagrass degradation are reduced water quality (in particular increased turbidity of water due to sediment re-mobilization) and biodiversity impacts such as reduction or disappearance of fauna (see e.g. Daby 2003). These impacts in turn directly or indirectly affect the sustainability of coastal fisheries and tourism, leading to loss of livelihood and poverty. Existing examples are the effects of floods (Bandeira & Gell 2003) and possible intensive collection of bivalves in Maputo Bay that caused a reduction in clams sold in local restaurants, ultimately impacting on people's revenues.

Degradation of Coral Reef Ecosystem

Coral reef ecosystems face various levels of impact throughout the WIO region. Threats to coral reefs include climate change which has led to coral bleaching and El Niño Southern Oscillation that damaged the coral reefs throughout the WIO region (Sheppard, 2003; McClanahan et al., 2005; Obura, 2005; Graham et al., 2006). Poverty and socioeconomic drivers are associated with the use of destructive fisheries practices that leads to the degradation of coral reef ecosystems (Edinger et al., 1998). In the recent past, it has also been shown that lack of effective governance such as lack of effective policies, laws and regulations including inadequate institutional capacity for coral reef management, have led to increased degradation of the coral reef ecosystems in the WIO region. The continuous degradation and resultant diminishment of coral reef biodiversity ultimately impacts on socioeconomic wellbeing of coastal communities. This is due to the fact that destruction of the coral reef ecosystems leads to reduction in coastal marine fisheries productivity that eventually impacts on the livelihood and incomes of coastal communities (Souter and Lindén, 2000; Sheppard et al., 2005). These indirect impacts ultimately lead to increased poverty levels among the coastal communities.

The underlying root causes of coral reef degradation in the region can be grouped in four broad categories that include: a) global climate change and natural phenomenon; b) poverty and inequality factors; c) lack of alternative livelihood systems; and d) inappropriate governance. In



most cases, more than one of these drivers is responsible for any observed degradation on coral reefs thus making the determination of root causes a complex issue.

Conclusion

The WIO region is endowed with a variety of resources (both living and non-living) that support livelihood and economic development in addition to maintaining the health and functioning of marine and coastal ecosystems. Critical habitats in the coastal and marine areas of WIO are coral reefs, seagrass beds, mangroves and coastal forests. The rapid population growth as well as increased growth in the various economic sectors in the WIO has exerted considerable pressure on these habitats thus resulting in over-exploitation, degradation of environment, and resource use conflicts.

The pressure of coastal and marine living resources in WIO have been identified as overexploitation, loss and modification of habitat, destructive fishing practices, urban and tourism development, human settlement, and the effects of climate change. These factors cumulatively impact negatively on the community and countries at large; as indicated by: shortages of firewood and building materials, increased coastal erosion, and reduction in coastal fishery.

A number of root causes of loss and degradation of critical habitats in WIO have been identified in the paper. These include poverty and inequality in resource allocation and distribution, gender disparity, lack of alternative livelihoods, declining respect for traditional resource management systems, climate change, inadequate legislative and policy frameworks, and inadequate institutional and financial capital for enforcement of regulations and surveillance. Furthermore, rapid population growth in the coastal areas leads to increased demands of coastal and marine resources, land reclamation, diversion of fresh water flow, and pollution effects due to poor land and water use practices in the watershed areas.

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The Caribbean Large Marine Ecosystem (CLME) Project: Governance framework and key challenges

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Abstract

The Wider Caribbean is one of the most geopolitically complex regions in the world. Its countries range from among the largest to the smallest, richest to poorest and the most developed to the least developed. This complexity must be accommodated in any attempt to pursue governance of the living marine resources of the Wider Caribbean. A large marine ecosystem (LME) governance framework designed to address the sustainable management of the shared living marine resources of the Caribbean, has been developed to guide the implementation of targeted interventions. The LME governance framework comprises complete policy cycles at multiple jurisdictional levels that are networked through both vertical and lateral linkages. The framework takes account of factors such as context, purpose, jurisdictional scale, capacity and complexity. It accommodates the diversity of policy cycles arrangements and linkage types that are likely to be required for comprehensive governance and is sufficiently flexible to incorporate the diversity of ecosystem-based management (EBM) approaches that currently exist. The framework provides a means to identify critical areas for intervention, the goal of which would be to establish and enhance cycles and linkages that are context specific and appropriate to purpose, capacity and complexity. Substantial challenges can be expected in dealing with this complex framework. Among others, these are likely to be: engaging the suite of critical stakeholders; building capacity; rationalizing and adjusting roles and responsibilities of existing institutions at all levels; overcoming language barriers; and compilation and sharing of data and information among framework entities.

Introduction

The Wider Caribbean Region extends from the mouth of the Amazon River, Brazil, in the south, through the insular Caribbean, Central America, the Gulf of Mexico and north along the east coast of North America to Cape Hatteras. Within this area there are three large marine ecosystems (LMEs): The Gulf of Mexico LME, the Caribbean Sea LME, and the North Brazil Current LME (Figure 1). These ecosystems are closely linked, particularly the latter two, as the oceanography of the Caribbean Sea is strongly influenced by the highly productive upstream Brazil-Guianas Shelf LME. The Gulf of Mexico LME is most influenced by inputs from the Mississippi and other North American rivers.

The region includes 26 countries and 19 dependent territories of 4 other countries (see Section 3). These countries range from among the largest (e.g. Brazil, USA) to among the smallest (e.g. Barbados, St. Kitts and Nevis) in the world, and from the most developed to the least developed. Consequently, there is an extremely wide range in their capacities for living marine resource management. Throughout the region, the majority of the population inhabits the coastal zone, and there is a very high dependence on marine resources for livelihoods from fishing and tourism, particularly among the small island developing states (SIDS), of which there are 16. In addition, 18 of the 19 dependent territories are SIDS. The region is characterized by a diversity of national and regional governance and institution arrangements, stemming primarily from the governance structures established by the countries that colonized the region.



Fig. 1: The Caribbean and adjacent Large Marine Ecosystems

The Caribbean Sea has been severely impacted by human uses: overexploitation of most coastal and offshore living marine resources; destruction of coastal habitats by tourism, industrial and urban development; and degradation of the marine environment by pollution from land and ship-based sources. Caribbean coastal states, especially SIDS, are highly dependent on the marine environment for their economic, nutritional and cultural wellbeing. Fisheries play a major role in Caribbean countries. Small-scale fisheries are particularly important, but are often undervalued. As nearshore resources have become depleted, and also in response to increasing demand for fish products, attention has turned to offshore resources, which are inevitably shared and already fully exploited by the major fishing nations (Mahon and McConney 2004).

At the scale of the LME, living marine resource management issues in the Caribbean include:

- Migratory resources (mainly large pelagics, but also some coastal pelagics);
- Resources with transboundary distribution as adults (various demersal fishes);
- Resources with transboundary larval dispersal (lobster, conch, reef organisms);
- Dispersal of pathogens, pollutants and invasive species;
- Resources with transboundary trophic linkages.

Governance Context: Legal, Policy and Institutional

The need for attention to the management of shared marine resources in the Wider Caribbean Region is well documented. From the early 1980s, it has been a main subject for discussion (Mahon 1987, FAO 1999). These issues have been discussed and agreement reached on the need for a coordinated regional effort on shared resources at many other fora.

A number of regional and global agreements exist which seek to address the social, economic and governance issues related to shared marine resource management. These include UNCLOS, the UN Fish Stocks Agreement, the FAO Compliance Agreement and the FAO Code of Conduct for Responsible Fisheries (United Nations 1983, United Nations 1995, FAO 1995a, 1995b). The national level implications of several of these are being explored by the countries of the Caribbean region. These implications include: (a) the need for capacity building at the national level to take part in international and regional level management of shared resources; and (b) the need for strengthening and expanding the scope of regional institutions to undertake this function.



Institutional arrangements for the management of transboundary living marine resources in the Caribbean region have been emerging, de facto, from the ongoing efforts of various institutions. These reflect the fact that the Caribbean does not have any major fish stocks attracting large commercial fleets, revenues from which can be expected to support a fisheries management institution. In other parts of the world, large valuable tuna or clupeid stocks have provided the incentive to establish management regimes to protect indigenous rights and to extract rents from nonindigenous fleets. The emerging approach in the Caribbean is more suited to the large diversity of resources that are already mostly exploited by indigenous fleets, so that the issues relate primarily to conservation, optimization and intraregional equity.

In response to the above situation, the emerging arrangements are flexible and involve networking and adaptation of existing institutions. The arrangements involve a number of fledgling initiatives for various types of resources. For example, in the case of conch, the Caribbean Fishery Management Council has taken the lead in approaching regional management. However, some countries have difficulty taking part to the extent required for successful management.

The reality of Caribbean ocean governance is a diversity of networks of actors serving various purposes that seldom intersect effectively (Chakalall et al., 2007). Notably absent in most cases are interactions at the critical stage of communicating analysis and advice to shape coordinated decision making. Thus the importance of having a framework that focuses on critical nodes for effective LME governance and on strengthening linkages across multiple levels became increasingly evident. Most countries also lack capacity, and there is seldom a clear mandate by any national, subregional or regional level institution for management policies that address integration among sectors.

A Large Marine Ecosystem Governance Framework

Much has been written on theory, effectiveness and recommendations for enhancement of governance, defined as the ability to get things done without necessarily having the legal competence to command that they be done (Ostrom 1990, Czempiel 1992, Kooiman et al., 2005, Olsen et al., 2006). However, little guidance has been provided on how actors might practically bring about beneficial change and, as noted by Sherman et al. (2005), development of this module in the five-module indicator-based LME approach has lagged behind the others (Sherman et al., 2005).

Rather than being one of the five modules to be undertaken in LME management, governance in the Caribbean context is seen as overarching. This perspective also provides the opportunity to separate the 'governing system' from the 'system to be governed' (Jentoft, 2007). Further elaboration provided below draws on a more in-depth description of the framework published by the authors (Fanning et al., 2007).

The framework provides for the processes and linkages at the multiple geographic and organizational scales that prevail in the Caribbean. It provides all actors, including the youth and women, with the opportunity to see how their actions can affect the sustainable management of the shared living marine resources of the Caribbean LME. It also provides guidance on the identification of critical areas and timing for interventions and for assessing the success of such interventions. It comprises two well-known components of LME governance: the process by which decisions are made in any governance regime, i.e. the policy cycle, and the multi-scale nature inherent in LMEs, be it jurisdictional, spatial, temporal or ecological. It is based on standard principles and values for governance: transparency, accountability, equity, sustainability and participation.



The policy cycle component

The foundation for the framework is a generic policy cycle; an iterative process that should lead to incremental improvement in management (Olsen et al., 2006). The different stages in the cycle – data and information, synthesis and provision of advice, decision making, implementation and review and evaluation – all require different inputs and actors, although there is overlap.

The 'data and information' stage is where much of the science and technical input takes place. This information ought to be interdisciplinary and may range from highly technical, science-based to local/traditional knowledge provided by stakeholders either informally or formally.

The 'analysis and provision of advice' stage is likely to be closely related to the 'data and information' stage in terms of actors involved and also draws on technical expertise. Its purpose is to provide specific policy and management options and recommendations to decision-makers in the next stage.

The 'implementation' stage may be the least directly connected to the previous stages and will involve the full range of tools and activities that are familiar to natural resource managers for achieving compliance, either voluntary or enforced, as appropriate to the particular situation. These include legislation, monitoring, control and surveillance (MCS), incentives and capacity building. The 'review and evaluation' stage completes the cycle and mainly feeds back into 'data and information' needs, but can also provide direct inputs across the cycle into 'analysis and advice' if policy changes are called for.

Clearly, this is a simplified depiction of the cycle, of which there are many variations. The various stages often overlap in function as actors play roles in more than one stage. There may also be cross-links that bypass various stages for some parts of the process. We do not perceive these variations as compromising the cycle. What we consider to be important is that the cycle be complete and iterative.

The multi-scale multi-level component

For effective governance of LMEs, the policy cycle described above must be operational at several scales and levels, e.g. local, national, regional (LME region) and international, in which jurisdictional and geographical scales are correlated (Figure 2).

Different kinds of interactions are likely in each direction. For example, there is likely to be a downward flow of information on analysis, rationale and decisions from each level to the level below. However, flows in the other direction are equally important. They can provide information on what is desired and feasible. These flows can lead to cross-scale relationships that are mutually sustaining in the long term, being neither exploitative from above nor parasitic from below. We see these upward and downward linkages in the multi-scale system are an integral component of a functioning LME governance framework.

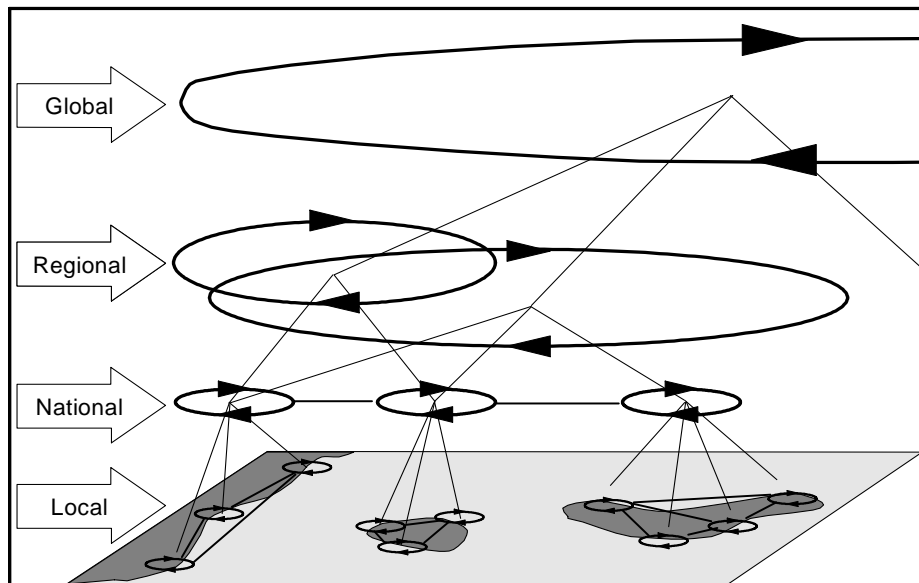


Fig. 2 The multi-scale component of the proposed governance framework with vertical and horizontal linkages among the different policy cycles. The multi-level linkages do not necessarily imply a controlling function. (Source: Fanning et al., 2007)

Linkages can take place at any point in a policy cycle at any level and will differ accordingly. Technical linkages amongst scientists and technologists in the data and information stages will differ substantially from linkages amongst actors in the implementation stages – trainers and enforcers. There may be imbalances also. Technical linkages may be strong among the actors in the data and information stages through the literature, internet and technical conferences, yet weak at other stages. It appears likely that when linkages, especially vertical ones, are absent between cycles at the ‘analysis and advice’ and ‘decision making’ stages, integration of governance at higher levels is ineffective.

Key Challenges

The full implementation of the LME governance framework in the Wider Caribbean can be expected to take several decades and to be a highly dynamic process requiring regular review and adaptation. It will require that existing organizations be willing to rationalize their current mandates and roles in the context of the framework, often expanding to take on the new responsibilities that will be essential for transboundary governance in the Wider Caribbean. For example, intergovernmental organizations will need to incorporate processes for review of and decision-making on Caribbean Sea issues. This will at least require additional time in current processes and will incur additional costs to ensure fully functional policy cycles are developed and appropriately linked horizontally and vertically.

Communications and networking will be key elements of implementing the framework. Electronic means now make this easier than ever, but care must be taken to ensure that access to technology, and capacity to use it, do not introduce disabling inequities, especially at national and lower levels.

Differences in size and capacity among the countries of the region present particular challenges in many areas. To engage effectively, smaller countries often require subregional organizations to provide technical support and collective representation. This can lead to issues of sovereignty that must be considered in strengthening policy cycles at subregional levels. At the technical level, data and expertise are highly aggregated in a few of the larger countries. The capacity to



access and use the data, and to interact with the expertise are likely to be key challenges in building an equitable framework.

The cultural diversity in the region that enriches it also presents challenges. The development of shared principles and values, appreciation of the diversity of approaches that may be culture-based and the ability to communicate across language barriers are challenges that face all aspects of regional development and will be present in Caribbean Sea LME governance.

The socioeconomic dependence of the countries in the Wider Caribbean, particularly SIDS, on the living and nonliving resources provided by the Caribbean LME presents a considerable challenge for the implementation of the framework. Sectoral decision making at the governmental level that seeks to enhance economic gain in one sector can oftentimes conflict with the achievement of economic and social goals set in other sectors. At the same time, many key stakeholders from the private sector, including resource users, and civil society whose actions can support or undermine governmental level policy decisions, are not fully engaged in the policy cycle process. The reasons for this may include lack of capacity, lack of institutional structures by some of these stakeholders, for example fisherfolk organizations, lack of resources to participate and existing governance mechanisms that ignore the contributions these stakeholders can make to the policy process.

Conclusion

The majority of countries of the Caribbean LME are either small island developing states (SIDs) or developing countries with an overwhelming lack of capacity at the national level. Nonetheless, countries are generally dependent on their limited natural resource endowments, especially coastal and marine resources, for their economic wellbeing. As such, hierarchical authority may not be needed and is unlikely to be feasible in the Caribbean. A great deal may be accomplished by a mechanism that focuses on networking and linkages among lower level policy cycles. The inherent inclusiveness of the governance framework provides for such decentralization of authority and encourages comanagement arrangements that draw on the strengths of all, including the youth and women in the Caribbean.

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Reflections on Marine Biodiversity and Food Security

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Abstract

We are entering a significant phase of a global food crisis on our planet. For years the majority of the earth's population subsisted on food grown or harvested primarily from land resources, yet in the later half of the 1900s, for reasons of abundance and later health, the demand from the ocean has risen to unsustainable levels. With the inescapable exhaustion of the wild resources, aquaculture has been developed as a new frontier for meeting the supply and demand equation. At this point a majority of the planet is affected by the vicissitudes of this seafood equation. Fisheries input has been traditionally part of the lower end of the economic chain of custody and youth and women are more likely to directly participate in the harvesting, preparing and distributing of these goods as commodities. As demand rises, costs to the consumer have risen because of a number of factors. However, at the production end of the equation many of these suppliers are working at a barely economically sustainable level. Obviously, conservation and education become erudite at this level and it is only through consumer demand and payments that this equation can be reversed, not only to the good of those in the chain of custody, but also to the benefit to the environment directly and indirectly.

Issues explored in this talk will define the core issues and also include opportunity for discussion about biodiversity, marine protection, education, fisheries inputs, agricultural effects on nutrient balances, aide to the poor, and the effects of pollution and global warming on the future production. Specifically examples taken from the World Aquarium's Conservation for the Oceans Foundation will be discussed to provide information about the effectiveness of small grant programs for: research, education and promotion of sustainable uses of marine and freshwater resources; promotion of responsible aquaculture; consumer education; and promotion of products and services based on these equities, with focus on finding regionalized approaches which involve multi-stakeholder input and public awareness as components of actions taken. Currently millions of people are directly impacted by these active efforts and further motivated by information distributed from local, regional and global sources such as the World Ocean Network and others.

Introduction to the Problem

We can all agree that humankind is exceeding the productivity of Earth through its consumptive efforts (7). The mathematician who explained Malthusian proportions of consumption as ever expanding well understood what later Garret Hardin identified as the Tragedy of the Commons (3). Indeed we are continuously taking from the common domain for our sufficiency, but that process has not only the negative connotation of production not meeting the demands of use, but also the downstream effects of the over-consumption which affects not only the soil, air and water, but indeed our atmosphere and climate within. During PIM-32, I had the fortunate opportunity to preside over the Biodiversity and Food Security Session and the presenters all spoke on their regional studies which demonstrated the demise of ecosystems, effects on human populations, but also spoke with some hope towards designing ways to communicate and live more sustainably. It is clear that water provides both living abundance and economic sustainability along with aesthetic and legal providence.

Crisis in our Planet

As our society has evolved into the industrial age, resources have become more and more limited due to population needs and limited production by ecosystems and farmed products. We are no longer able to survive off of the resources provided by the land portion of the planet and since 1950 the resources of the oceans have been tapped towards being unsustainable as well. These processes along with pollution effects have significantly affected the biodiversity on the planet (6).

Biodiversity equals Productivity

Recent Studies have shown that the biodiversity of ocean ecosystems is linked to their overall productivity (7). This productivity also directly relates to the ability for the access to sufficient, safe and nutritious food, by definition, Food Security (6).



Marine Protection improves Productivity

Marine protection increases biodiversity and productivity equaling improved economics (5).

Particularly important to recognize is that over 70% of all seafood for human consumption comes from developing countries, many areas of which could benefit from protection (2). Protection could not only preserve future productivity, but would also provide for poverty reduction along with conservation.

Education insures the Future

Allowing the members along the chain of custody, information about the link to ecosystem health and economic prosperity, contributes to food security (4). At the farmer level ecosystems are being stressed for improved productivity, however, with poor water conditions, stressors provided by the need to overproduce and the rising costs of fuel affecting transportation costs, feed and labor affect the bottom line (8).

Conclusion

Throughout the PIM-32 conference it was echoed that the damages to the coral reefs and ocean's fisheries productivity have skyrocketed over the past 40 years since the establishment of the UN Law of the Sea doctrine, but that there is still a general lack of knowledge of the ocean amongst the general population. Statistical evaluation of the general public surveyed in 2007 at an aquarium, reinforced the idea that there is a need for more information about the state of the ocean and that institutions are the best used resources for this information. On the other hand, based on a survey of PIM-32 participants, institutions are more disparate at the table when it comes to receiving the information, being consulted in its dissemination or in the science of its derivation and much less in the scientific processes for protection, preservation or even exploration. Developments such as community Rotary International Sustainable-living Experiences (R.I.S.E.), Conservation For The Oceans Foundation and World Ocean Network are action based communication platforms that will help communities across the planet take more control of living more sustainably, and other necessary actions to curb the trend of ecosystem demise that Rachel Carson (1) predicted more than 50 years ago for our webs of life in the water and inextricably connected to the land for which we are all responsible for in terms of stewardship for the future.



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Fishes Feed Us: An Art-Science Youth Project

Cynthia Pannucci

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Abstract

The presentation will provide an overview of the development of three art-science projects designed to lead with the heart, capture the imagination, and become a model for delivering marine science and ocean conservation concepts and messages in dramatically expressive ways:

- “Beneath-the-SEE” is a multi-component, art-science project designed to travel around the world as an emissary for the restoration of healthy ocean ecosystems and wildlife.
- An “Art-Science Teen/College Ocean Literacy Project” that utilizes the artform of “mime” as a fun and creative way for youth to directly assess the dismal lack of public ocean literacy which, via multimedia and Internet research, empowers them to build their knowledge-base and practice critical thinking so they can become skillful leaders.
- “Fishes Feed Us” is a low cost, easily replicable educational, public performative action by and for youth about the human consequences of the collapse of our ocean fisheries. Text from a KidsFishesBlog became spoken monologues in the premiere performance that took place on the United Nations Plaza in New York City on June 5, 2007 as part of their World Environment Day celebration.
- Biodiversity is the fundament on which all human cultures base their existence. Genetic diversity is essential to biological production at large, terrestrial and aquatic, but species diversity and ecosystem function are equally essential to long-term food security. Some of the root causes of poverty have a cultural and political base, but access to natural resources and vulnerability to environmental degradation are also very important factors. Among the latter, poor quality water, poor soil quality, soil erosion, clear-cutting practices and lack of productive forests all lead to a downward trend of environmental stress and degradation, biodiversity loss, and overexploitation of renewable natural resources.

All these trends must be reversed to help alleviate poverty, in particular among the rural poor. The segment of the rural poor normally most severely affected by environmental degradation contains the small-scale coastal fisherfolk of Third World countries. Needless to say, women and children of those communities suffer most from this environmental degradation, which also means that reversing the negative trends will most strongly benefit women and children.

The most important remedies to help alleviate poverty among those communities encompass adoption of the basic principles of sustainable use of natural resources and conservation and restoration of local biodiversity. This in turn requires that both coastal terrestrial and aquatic ecosystems be restored and protected. On the terrestrial side protection of water catchments and coastal forests have top priority; on the aquatic marine side creation of protected marine areas (MPAs) and no-fishing zones are equally important remedies. Creation of MPAs contributes to poverty alleviation by helping protect biodiversity-rich areas, improving resource management and by promoting sustainable development. In addition, there will be indirect financial benefits from increased small-scale ecotourism and direct benefits for the fisheries sector. As a consequence of the globalization of the use of marine resources, such measures must be based on international cooperation, improved legislation, and promotion of methods that reverse the trends of overexploitation in general, and fish resources in particular. To date there is only one such player on a global scale – the Marine Stewardship Council (MSC). It is vital that both private enterprises and international aid programs address the need to financially help poor small-scale fishing communities explore the possibility of MSC certification. Certified fisheries will increasingly have an edge on uncertified fisheries in the global market, and this will in turn benefit the local community.



First of all, I would like to thank IOI for inviting me to speak and for finding the sponsorship for my trip so that I could visit Malta and participate in this 32nd PIM conference. I wish that I could have met Elisabeth Mann Borghese and thanked her for her forward vision, however, I am sure she is here in spirit as we celebrate and attempt to carry forward her legacy. She and her cohort, Arvid Pardo seemed, above all else, to be working towards a change of consciousness regarding the relationship between man and nature [the sea]. Without a fundamental knowledge about and respect for nature and how we are utterly dependent upon its ecological gifts, all of our best efforts at policy-making to protect and nurture our ocean and ocean life will not be sustainable.

I believe that we must approach our ocean problems both from the "top-down" of influencing government policy-makers, but just as vigilantly from the "bottom-up" through both formal and informal education of our youth. They are inheriting this mess, they need to know the truth (about current environmental degradation), and they need to recognize their inherent power: the power to influence their parents, aunts and uncles, grandparents and teachers, who can sign online petitions to let lawmakers know their views on ocean policies, be encouraged not to eat endangered seafood species, create pressure on local schools to add environmental and ocean literacy curriculums, participate in beach clean-ups, and much more. This is the very old concept of "intergenerational learning," which "word-of-mouth" promotion is to the advertising industry, a cost-effective model that has withstood the test of time.

My name is Cynthia Pannucci, and I have been an artist all of my adult life. My artwork has been exhibited at museums in New York City and elsewhere; I have made silkscreen quilts, painted fabrics for a Broadway play, designed and made one-of-a-kind, hand-painted dresses; and conducted art workshops for children and families at children's museums; as well as created art projects with pregnant teens and homeless youth in New York City.

Twenty years ago I founded a nonprofit organization based in New York City called Art & Science Collaborations, Inc. (ASCI). During the early 1990's, we were instrumental in reinvigorating the art and technology movement in the USA and later, from 1998-2002, we organized four pioneering, international conferences on art-science collaborative work that demonstrated a new hybrid "way of knowing" and experiencing our world. "Art-Science practice" was not only alive, but was providing a powerful new role for the arts in our society - that of expressing the human aspects of scientific research.

Although my work developing the concepts for and producing ASCI's projects have been intellectually stimulating and quite challenging, it was my first snorkeling trip in the Florida Keys that changed my life! We have since added a new Art-Science Humanitarian initiative to ASCI's programming, which begins with a focus on the environment and, more specifically, on our planet's ocean. This journey began in 1998, when the guide in our tourist snorkeling boat told us



(before we could go into the water) not to touch the reef; that it is a living organism with a thin protective membrane and touching it would cause it to die, not only at the touch-point, but eventually the entire reef. He also mentioned that Florida's reefs were already 90% dead, that about 65% of our global reefs were either dead or endangered, and that reefs can take a thousand years to grow! I then slipped under the surface of the water into a new world teeming with life, surrounding me with the moving shapes of vibrantly colored fishes. It was magnificent!

However, during my trip back home to New York City, I felt myself becoming more and more outraged that this amazing world that I had just experienced was dying, and I was also angry that no one was telling anyone about this travesty! This was even before I knew of the human consequences of the collapse of our ocean fisheries or the complexities of the other issues involved in ocean sustainability.

Over the next few years, I educated myself, read the Pew Trust and US government Ocean Reports, followed the hard work of ocean conservation NGO's from their websites, and then I asked myself: "What can I do to use my concern, passion, and talents to help the ocean conservation community get the truth out to the general public and youth by mobilizing the artistic community?"

On behalf of Art & Science Collaborations, I first researched and developed a very ambitious, multi-component, art-science public awareness project called "*Beneath-the-SEE*". ["SEE", not "Sea," because one of the biggest challenges to increasing public awareness comes from the fact that most people cannot "see" the destruction of our ocean which is happening mostly beneath its surface.] www.asci.org/Beneath/BeneathTheSEE.pdf I moved to Florida to be near the sea; I visited Washington D.C. and presented the project to NOAA program officers, however it was not "educational" enough for their funding needs. I then developed an "*Art-Science Teen Ocean Literacy*" programme for The Girl Scouts of America. However, although I received lots of compliments for my vision and efforts, no funding materialized. Until Leonard Sonnenschein's new Conservation for the Oceans Foundation provided the "seed" money for our "*Fishes Feed Us*" youth project. This multi-component project culminated in a youth performance on the United Nations Plaza on June 5, 2007 as part of the UN's World Environment Day activities.

Our "*Fishes Feed Us*" web-pages (www.asci.org/artikel884.html) are quite extensive in their documentation of this low-cost, art-science, global model project. We would like to disseminate this website's information in order to inspire other youth actions, and to provide "How-To" Guides to help others replicate the project in new ways. All aspects, even the logo, are available for public use.

The problem that this project highlights is the human consequences of our collapsing ocean fisheries. A poignant image that illustrates this situation is of young boys in the Philippines dividing their daily "catch" of fishes that are few and only the size of fish bowl gold-fish, so that their families can have the nutrition of a fish soup. Did you know that 1 in 5 people globally (approx. 1 billion) depend on fish as their primary source of protein, and that 200 million people depend on the sustainability of ocean fisheries for their livelihoods?

"*Fishes Feed Us*" is a collaborative, art-science, public awareness project that draws attention to the critical ill health of our planet's ocean. It is designed to engage and empower youth to become "ocean stewards" by using their unique "sphere of influence" to mobilize others. The project has five components: a FishesFeedUs Blog, a performative public awareness action, project web-pages, small sea creature animations for the project web-pages, and promotion/dissemination, all provided by our collaborating partners.

The FishesFeedUs Blog was designed and hosted by our premiere partner, the FISH Project at www.OneOcean.org in the Philippines, that is a government fisheries management program. This blog served as an online venue for youth in New York City (NYC) and youth living in Malaysia and the Philippines. The purpose was to make what the NYC youth learned in school more real and urgent, while giving the Indo-Pacific youth, who see the fish crisis up close, a "world stage" for their voices. Excerpts from the youth Fishes Blog became 10 monologues spoken by youth during our performance.

Our Philippine teen participants were already involved in an ocean literacy program in their country, so they did not have to be inspired to participate in our project. In fact, they were delighted to lead the blogging discussion and were thrilled when they received their first response from the USA bloggers

In order to inform and inspire the participation of the NYC kids in our KidsFishesBlog, I visited their schools and shared an amazing multimedia CD-Rom that Jean-Michel Cousteau's Ocean Future Society has produced about the importance of sustaining ocean reefs and the problems they currently face from the destructive actions of humans. After that, and mentioning the crisis that the children of fisher folks face in the Indo-Pacific region, they were "hooked."

So while our teens were blogging between different parts of the world, rehearsals began by thirty 4th and 5th graders at our partnering elementary school in Chinatown in New York City. These youth met twice a week for 5-weeks and worked with a NYC choreographer and assistant.



Fig. 1: Girls performing as anchovies during performance at United Nations

And then it was time... On June 5, 2007, on a windy and very hot day, our youth performers [dressed all in black] had a quick, on-site rehearsal; then the New York Office Director of the United Nations Environment Programme, Juanita Castano, introduced me; this was followed by our performers dramatically taking center stage! It was only a 10-minute performance in total, but the kids really got into "character" by "becoming" and moving like "schools" of fishes.



Fig.2: Boys performing as sea bass during performance at United Nations

However, the most important and “heart-wrenching” part of the performance came when 10 of our youth performers took their turn at the microphone to recite their short monologues. During the blogging sessions, the teens were asked to comment on our global fish crisis by presenting two different perspectives.



Fig.3: Youth at the microphone reciting performance monologues

I would like to share the one-liner monologues, as they are quite riveting, especially when spoken by 9 and 10-year olds!

Perspective of Ocean Fishes

There was a time when there were many of us, different kinds and sizes. Not anymore. Big monsters came and took everyone away. (Philip – Philippines)

1. My home is not a living sea anymore, but a stinky pool of trash and toxic chemicals, like DEATH following close behind me! (Philip – Philippines)
2. Boom! Everything seemed to stop. Then I saw fishes floating. Dead. With one dynamite explosion, the reefs, our home, were completely demolished. (Kristine – Philippines)
3. We are being bombed-out by terrorists! We are dying, there's no place safe for us to have our babies. (Danielle – Malaysia)
4. Swim to the nearest marine sanctuary! You'll be safe there from bombs and from people's selfish actions. (Philip – Philippines)

Perspective of Indo-Pacific and NYC Youth

Since the big commercial fishing vessels started coming into our local waters, there are fewer fish, and more pollution. If we can barely survive now, how are the future generations going to? (Francine – Malaysia)

1. One day we will have to go to a museum to see a fish, because we are eating up our ocean's supply too fast, too soon. (Sameena – New York City)
2. My dad lost his arm when he threw dynamite onto a reef. So now I have to do the fishing. I can't go to school, what choice do I have? My family has to survive. (Danielle – Malaysia)
3. I wish some groups would help fishers' children so that they could go to school. It is every child's right to be educated. (Angelica – New York City)
4. Education is the key. If people understand the human consequences of losing the world's fish stocks, they will try and help stop the depletion. (Jasmine – New York City)

These and other youth blog comments can be found online at:

<http://www.oneocean.org/fishblog/wp-content/themes/sky3c/monologues.php>. Near the end of our performance, the kids turned their fish costume-objects to their BLACK back-sides, thus representing DEATH. And then, in unison, they shouted to the audience, "*Together we can bring our fishes back,*" and then, while turning their fishes again to reveal the colourful front-sides, they began animating the fishes as they moved off-stage.

I strongly believe in the effectiveness of creating memorable, visceral experiences for transmitting information to our youth (about marine ecology, environmental sustainability, etc.), and art-science "project learning" is an excellent way to do this.



Fig. 4: Children reveal colourful front-sides of fish.

The third project component of "*Fishes Feed Us*" is our extensive web-pages. Just type "*Fishes Feed Us*" into a Google search if you forget the URL address.

Our project web-pages at <http://www.asci.org/artikel884.html> include:

- documentation text and images, including "how-to" guides
- a video of the performance that took place on the United Nations Plaza
- a hyperlinked listing of educational resources for youth and the general public
- a hyperlinked listing of actions youth and the public can take
- tips on creating your own ocean youth project
- patterns for making the hand-painted, cardboard "performance fishes"
- information about and links to our sponsor, partners, and collaborators

And finally, our partnering 8th-grade multimedia class at the Institute for Collaborative Education (a NYC experimental public school), created small sea creature animations to enliven our web-pages. They are located just above the navigation links at the bottom of our project web-pages. Participating in this project inspired the art teacher to initiate a collaboration with her school's science teacher, on a multimedia environmental education project with their students during 2007-2010.

I believe it will indeed require the involvement of all segments of our global society if we are to change our consciousness to one of respecting the interdependent roles that man and nature play in sustaining life on our blue planet. The arts, traditional as well as new media, have a critical role to play in raising awareness and engaging the ideas and energy of youth and women (and the general public) to assist the ocean conservation community in creating cooperative solutions to the sustainability of our planet's ocean health and, in turn, our own.



Poverty alleviation and sustainable use of aquatic resources

Lennart Nyman

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Abstract

Biodiversity is the fundament on which all human cultures base their existence. Genetic diversity is essential to biological production at large, terrestrial and aquatic, but species diversity and ecosystem function are equally essential to long-term food security. Some of the root causes of poverty have a cultural and political base, but access to natural resources and vulnerability to environmental degradation are also very important factors. Among the latter, poor quality water, poor soil quality, soil erosion, clear-cutting practices and lack of productive forests all lead to a downward trend of environmental stress and degradation, biodiversity loss, and overexploitation of renewable natural resources.

All these trends must be reversed to help alleviate poverty, in particular among the rural poor. The segment of the rural poor normally most severely affected by environmental degradation contains the small-scale coastal fisherfolk of Third World countries. Needless to say, women and children of those communities suffer most from this environmental degradation, which also means that reversing the negative trends will most strongly benefit women and children.

The most important remedies to help alleviate poverty among those communities encompass adoption of the basic principles of sustainable use of natural resources and conservation and restoration of local biodiversity. This in turn requires that both coastal terrestrial and aquatic ecosystems be restored and protected. On the terrestrial side protection of water catchments and coastal forests have top priority; on the aquatic marine side creation of protected marine areas (MPAs) and no-fishing zones are equally important remedies. Creation of MPAs contributes to poverty alleviation by helping protect biodiversity-rich areas, improving resource management and by promoting sustainable development. In addition, there will be indirect financial benefits from increased small-scale ecotourism and direct benefits for the fisheries sector. As a consequence of the globalization of the use of marine resources, such measures must be based on international cooperation, improved legislation, and promotion of methods that reverse the trends of overexploitation in general, and fish resources in particular. To date there is only one such player on a global scale – the Marine Stewardship Council (MSC). It is vital that both private enterprises and international aid programs address the need to financially help poor small-scale fishing communities explore the possibility of MSC certification. Certified fisheries will increasingly have an edge on uncertified fisheries in the global market, and this will in turn benefit the local community.