CORAL TRIANGLE INITIATIVE:
AN INTRODUCTION TO MARINE SPATIAL PLANNING

CORAL TRIANGLE INITIATIVE
ON CORAL REEFS, FISHERIES AND FOOD SECURITY

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Cover photo: Participants at a Climate Change Adaptation Training in Papua New Guinea develop coastal maps of their local areas, highlighting important natural and social resources. Photo: © World Wildlife Fund, Inc. / Milidel Quibilan

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Acronyms and Abbreviations

CCA	Climate Change Adaptation
CT	Coral Triangle
CT6	The six nations of the Coral Triangle Initiative: Indonesia, Malaysia, Papua New Guinea, Philippines, and Solomon Islands
CTI-CFF or CTI	Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security
CTSP	Coral Triangle Support Partnership
EA	Ecosystem Approach
EAFM	Ecosystem Approach to Fisheries Management
EBFM	Ecosystem-Based Fisheries Management
EBM	Ecosystem-Based Management
EEZ	Exclusive Economic Zone
FAO	Food and Agricultural Organization, United Nations
FMU	Fisheries Management Unit
FRA	Fisheries Reserve/Replenishment Area
ICM	Integrated Coastal Management
IOC	Intergovernmental Oceanographic Commission, UNESCO
IPCC	Intergovernmental Panel on Climate Change
IUCN-WCPA	International Union for Conservation of Nature-World Commission on Protected Areas
LEAP	Local Early Action Plan for Climate Change Adaptation
LMA	Locally Managed Area
LMMA	Locally Managed Marine Area
MCS	Monitoring, Control, and Surveillance
MPA	Marine Protected Area
MSP	Marine Spatial Planning
NPOA	National Plan of Action
RPOA	Regional Plan of Action
TURF	Territorial Use Rights in Fisheries
UNESCO	United Nations Educational, Scientific, and Cultural Organization
USAID	United States Agency for International Development

Glossary of Terms

These terms and their definitions have been selected from the CTI-CFF Integrated Glossary found in the CTI EBM Guide (Flower et al. 2013).

Adaptation: Adjustment in natural or human systems in response to actual or expected climate and/ or ocean changes, or their effects, which moderate harm or exploit beneficial opportunities. Various types of adaptation include: anticipatory, autonomous, and planned adaptation (United Nations Intergovernmental Panel on Climate Change 2007).

Adaptive management: A systematic process for continually improving management policies and practices toward achieving articulated goals and objectives by learning from the outcomes of previously employed policies and practices. The basic steps of adaptive management are to conceptualize; plan actions and monitor; implement actions and monitor; analyze, use, and adapt; and capture and share learning. Active adaptive management is where management options are used as a deliberate experiment for the purpose of learning (Millennium Ecosystem Assessment 2006).

Climate: Weather averaged over a long period of time, typically over 30 years or more. Climate is what you expect; weather is what you get (United Nations Intergovernmental Panel on Climate Change 2007).

Climate change: A change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/ or the variability of its properties, and that persists for an extended period, typically decades or longer (United Nations Intergovernmental Panel on Climate Change 2007).

Climate change adaptation (CCA): Actions taken to help society, communities, and ecosystems moderate, cope with, or take advantage of actual or expected changes in climate conditions. Adaptation can reduce vulnerability, both in the short and long term (United Nations Intergovernmental Panel on Climate Change 2007).

Climate Story: The summary of past, present, and potential future climate conditions and their potential impacts on target resources of importance to a community or society. The climate story is developed based on both community-based and scientific observations of climate change and potential impacts on target resources and the provision of ecosystem services.

Coastal and marine spatial planning: A public process of analyzing and allocating the spatial and temporal distribution of human activities in coastal and marine areas to achieve ecological, economic, and social objectives that are usually specified through a political process. Sometimes used interchangeably with marine spatial planning (MSP). (Ehler and Douvere, 2009).

Community-based Management: Management planning and implementation carried out by the people and stakeholders in a community.

Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF): A partnership of six countries working together to sustain extraordinary marine and coastal resources by addressing crucial issues such as food security, climate change, and marine biodiversity. (CTI-CFF 2009)

CTI-CFF Regional Plan of Action (RPOA): A 10-year, living, and non-legally-binding document to conserve and sustainably manage coastal and marine resources within the Coral Triangle region. The RPOA takes into consideration laws and policies of each country in the Coral Triangle (Indonesia, Malaysia, Philippines, Timor-Leste, Papua New Guinea, and the Solomon Islands). (CTI-CFF 2009)

Ecoregion: A large unit of land and water that contains a geographically distinct assemblage of natural communities sharing a large majority of species, dynamics, and environmental conditions, and consequently functions effectively as a conservation unit. (Omernik 2004)

Ecosystem: A relatively self-contained system that contains plants, animals (including humans), microorganisms and non-living components of the environment as well as the interactions between them. (Secretariat of the Pacific Community 2010)

Ecosystem approach (EA): A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Often used interchangeably with ecosystem-based management (EBM). (Convention on Biodiversity 2000)

Ecosystem approach to fisheries management (EAFM): An approach to fisheries management and development that strives to balance diverse societal objectives by taking into account the knowledge and uncertainties about biotic, abiotic, and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries. An EAFM is a practical way to implement sustainable development for the management of fisheries by finding a balance between ecological and human well being through good governance. The purpose of EAFM is to plan, develop, and manage fisheries in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems. (Garcia et al., 2003; FAO 2003a, 2011)

Ecosystem approach to fisheries management plan (EAFM plan): The output of a planning framework that outlines the integrated set of management arrangements for a fishery to generate more acceptable, sustainable and beneficial community outcomes.

Ecosystem goods and services: The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services, such as spiritual and cultural benefits; and supporting services, such as nutrient cycling or waste degradation, that maintain the conditions for life on Earth.

Ecosystem-based fisheries management (EBFM): Considered a component of ecosystem-based management, focused on the fisheries sector. EBFM considers both the impacts of the environment on fisheries health and productivity and the impacts that fishing has on all aspects of the marine ecosystem. Often used interchangeably with an ecosystem approach to fisheries management (EAFM).

Ecosystem-based management (EBM): A management framework that integrates biological, social, and economic factors into a comprehensive strategy aimed at protecting and enhancing the sustainability, diversity, and productivity of natural resources. EBM "emphasizes the protection of ecosystem structure, functioning, and key processes; is place-based in focusing on a specific ecosystem and the range of activities affecting it; explicitly accounts for the interconnectedness among systems, such as between air, land, and sea; and integrates ecological, social, economic, and institutional perspectives, recognizing their strong interdependencies". Sometimes used interchangeably with "ecosystem approach" or EA. (McLeod et al., 2005)

Fisheries management: An integrated process to improve the benefits that society receives from harvesting fish consisting of (i) information gathering, (ii) analysis, (iii) planning, (iv) consultation, (v) decision-making, (vi) allocation of resources and (vi) formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and accomplishment of other fisheries objectives.

Fishery management unit (FMU): The area of the ecosystem and fisheries that are the focus for management under an ecosystem approach to fisheries management. The fisheries can be any particular types of fishing, e.g., trawl fishery, and/or a particular resource fishery, e.g., shrimp fishery.

Fishery replenishment/reserve area (FRA): A zone where the taking of all plants and animals is prohibited for the long term (more than ten years) or permanently. This means that this is an area that the community has agreed to set aside and not harvest. FRAs are an effective way to build long-term abundant fisheries populations and resilience and are synonymous with marine reserves.

Food security: The availability of consistent and sufficient quantities of food, access to appropriate and sufficient foods, and consumption or appropriate use of basic nutrition and food preparation.

Food web: A system of inter-locking and interdependent food chains.

Gear restriction zones: A zone where one specific fishing method is prohibited because it is more damaging than other methods that are allowed. This type of zone might be useful if there are specific areas in the management area with habitats or species that are sensitive to certain gear types. For example, net fishing may not be allowed in certain areas of reef because it can severely damage reefs and the habitat of many fish.

Governance or governance system: The way in which formal and informal rules are set and implemented. It includes the planning and implementation mechanisms, processes and institutions through which citizens and governing groups (institutions and arrangements) voice their interests, mediate differences, exercise their legal rights and meet their obligations.

Indicator: A variable, pointer, or index that measures the current condition of a selected component of the ecosystem. The position and trend of the indicator in relation to a benchmark indicates the present status of the component. Indicators provide a bridge between objectives and action.

Integrated coastal management (ICM): An ecosystem approach to managing a coastal area characterized by a continuous and systematic process for managing competing issues in marine and coastal areas, including diverse and multiple uses of natural resources. ICM puts into practice effective governance, active partnerships, practical coordinating strategies, sustainable financial resources and strengthened technical institutional capacities. Under ICM, decisions are taken for the sustainable use, development, and protection of coastal and marine areas and resources.

Integrated management plan: The integrated management plan is both a process and a document. Its primary goal is to provide a planning framework to achieve healthy ecosystems and sustainable use of fisheries resources and the process by which a given area will be managed for a period of time.

Integrated watershed management: A rational framework for the development of water resources management strategies.

Integration: The process of simultaneously and synergistically working toward multiple objectives and goals–for example, the five goals of the CTI-CFF Regional Plan of Action–rather than undertaking separate activities in parallel or sequentially. Integration is carried out at the scale of priority geographies or management areas, including those within seascapes. For governance, integration means working across sectors (Flower et al. 2013).

Livelihood: "How we make our living, the things we use, and the choices we make to ensure that our lives run as we like." A sustainable livelihood, then, is a livelihood that "can continue into the future despite any changes and disasters and without losing that which makes the livelihood possible. This may include food production or being prepared for natural disasters. It is important to remember that income generation may be just one part of a livelihood" (Govan 2011).

Local early action plan (LEAP): A summary of the outputs of the four steps described in the CTI guide, Climate Change Adaptation for Coral Triangle Communities: Guide for Vulnerability Assessment and Local Early Action Planning (LEAP Guide, 2013). It includes a profile of the community, a climate story, assessment of vulnerability of target resources, and priority adaptation actions that a community wants to take to reduce vulnerability to climate and ocean change. The LEAP can serve as a stand-alone document that can be used to support budget requests or parts of it can be integrated into existing plans. (US Coral Triangle Initiative Support Program 2013)

Locally managed area (LMA): Any area of coastline and marine waters that is managed by the local community in collaboration with government or non-governmental organizations. This definition was developed to be inclusive of other commonly used terms for this type of locally based management including: Locally Marine Managed Areas (LMMAs); Territorial Use Rights in Fisheries (TURFs); Community-Based Coastal Resource Management; and Community-Based Management. LMAs can be a

tool for any or all of the following: fisheries management, biodiversity conservation, threatened species management, ecotourism development, and climate change adaptation. (Gombos et al. 2013)

Management area: The spatial extent of the land and/or water that is identified for management integration. Management areas, which should be as large as possible, may fall under the jurisdiction of one or more local communities, local governments, provincial or national governments, or a combination of all of these. Management areas are ideally defined by ecological boundaries, resource use patterns, and governance jurisdictions. Examples of management areas include seascapes, marine protected area (MPA) networks, and fisheries management units (FMUs). Examples of zones within managed areas include various types of MPAs, various types of FMUs, various types of land-based protected or management areas, and others.

Management goal: A broad statement of a desired outcome. Goals are usually not quantifiable and may not have established timeframes for achievement.

Management measures or actions: Specific controls applied to achieve the management objective, including gear regulations, areas and time closures (see MPA), and input and output controls on fishing effort.

Management objective: A description of a set of activities that, once completed, will achieve the desired outcome. Objectives can be quantified and measured and, where possible, have established timeframes for achievement.

Management plan: An explicit set of rules governing how to apply the principles and framework of natural resource management in a given area. This plan may be adapted to changes in the natural and social environment or upon the basis of new information about how a system functions. It may or may not have a legal basis for implementation.

Marine protected area (MPA): A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. MPAs include a wide variety of governance types (including community-based areas), and include but are not limited to marine reserves where no extraction is permitted. (Dudley 2008; International Union for the Conservation of Nature-World Commission on Protected Areas 2008)

Marine protected area network: A collection of individual MPAs or reserves operating cooperatively and synergistically, at various spatial scales, and with a range of protection levels that are designed to meet objectives that a single reserve cannot achieve. (International Union for the Conservation of Nature-World Commission on Protected Areas 2008).

Marine reserve: A type of MPA or zone within a larger MPA where no extraction is permitted and that is primarily established to "reserve" marine life for the future. Marine reserves are also known as no-take areas, fish sanctuaries, fish refugia, no-take replenishment zones, or fisheries replenishment areas. (International Union for the Conservation of Nature-World Commission on Protected Areas 2008)

Marine spatial planning (MSP): See "coastal and marine spatial planning".

Milestone: A step or event that, if achieved, indicates progress toward the completion of an activity and/or objective. "Milestone" is sometimes interchanged with "benchmark."

Monitoring, Control and Surveillance (MCS): The overall process and set of activities used to ensure laws, rules, and regulations are complied with.

National Plan of Action (NPOA): The national action plans established by each of the Coral Triangle countries to align national actions with the Regional Plan of Action based on national priorities.

Ocean zoning: A regulatory measure to implement marine spatial management plans that regulate access and use of specific marine geographic areas. Zones are usually defined or described using a combination of maps and regulations for some or all areas of a marine region. Zoning is an effective tool of the MSP toolbox (Ehler and Douvere 2009).

Precautionary approach: Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. (United Nations Conference on Environment and Development1992).

Precautionary principle: Preparing for unknown changes and protecting resources is the best approach for long-term community resilience to keep resource healthy in the long-term. With or without climate and/or ocean change impacts, these are things that will help our community be happier and healthier over time.

Recruitment: The addition of a new cohort to a population, or the new cohort that was added. The magnitude of recruitment depends on the time and life history stage at which it is recorded (Mora and Sale 2002).

Regional Plan of Action (RPOA): the set of goals, objectives, and actions agreed to by the six CTI-CFF countries in May 2009 that guide cooperative and joint actions at national levels to achieve regional outcomes (CTI-CFF 2009).

Rotational zone: a zone that is divided into two or more parts, each of which allows fishing in rotation so there is always one area that does not allow fishing. The area that is closed to fishing can be closed for one or more years at a time and then re-open as the other area closes. These types of zones allow fish populations to improve while they are closed and then be harvested when they are open.

Scoping: Determination of the broad parameters that a project will involve and affect, including a description of the geographic area, stakeholders, fisheries, critical habitats, and issues on which a project or resource management plan must focus (Secretariat of the Pacific Community 2010).

Seascape: Large multiple-use marine areas, defined scientifically and strategically, in which government authorities, private organizations and other stakeholders cooperate to conserve the diversity and abundance of marine life and promote human well-being. (Atkinson et al., 2011)

Spawning aggregation: A group of conspecific fish gathered for the purposes of spawning with fish densities or numbers significantly higher than those found in the area of aggregation during the non-reproductive periods (Domeier and Colin 2007).

Species-specific zone: A zone where harvesting one or more specific species is prohibited to allow those species to recover. For example, a zone where harvesting one or more important herbivore species is not allowed to help keep improve populations and keep herbivores abundant on your reefs so they can keep algae populations down. This type of zone is good for allowing populations of a certain species to improve.

Stakeholder: Any individual, group or organization who has an interest in (or a 'stake'), or who can affect or is affected, positively or negatively, by a process or management decision.

Sustainable development: Development (improvement in human well-being) that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable use: The harvesting of natural resources that does not lead to long-term decline of the resource and biodiversity, thereby maintaining its potential to meets the needs of the present without compromising the ability of future generations to meet their own needs.

Target resource: The social and ecological assets of the community. Social assets may include people, homes, schools, hospitals, roads, businesses, and livelihoods. Ecological assets may include rivers, sand dunes, wetlands, estuaries, mangroves, coral reefs, and fish. Target resources are the focus of vulnerability assessments and adaptation planning for climate change.

Temporary closure zones: A zone that is closed at certain times but open at other times. These areas are very similar to traditional closures (*tambu, tabu, sasi,* etc.) and provide a balance of short-term protection of species and harvest of the area. They do not provide long-term improvement to fisheries populations or resilience.

Trans-boundary areas: Areas of land and/or sea that straddle one or more borders between countries, subnational units such as provinces and regions, autonomous areas and/or areas beyond the limit of national sovereignty or jurisdiction, whose constituent parts are especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed cooperatively through legal or other effective means. (Sandwith et al. 2001)

TURF (Territorial Use Rights in Fisheries): Community-held rights of use (or tenure) and exclusion over the fishery resources within a specific area and for a period of time. Accompanying these rights might be certain responsibilities for maintenance and proper management of the resource base, as well as restrictions on the exercise of the rights of use and exclusion. (FAO 1982)

US CTI Support Program implementation partners: Lead national agencies for MPAs, fisheries and environment, Coral Triangle Support Partnership (CTSP) consortium members and other NGOs, key academic and technical persons involved in setting policy for MPAs, fisheries and climate change, and CTSP field staff who lead projects in each country supported by the US-CTI.

US CTI Support Program integration sites: Geographic areas where the integration of MPA, fisheries and climate change adaptation strategies are being planned and implemented under US Government funding and in support of Coral Triangle Initiative goals and objectives.

US CTI Support Program priority geographies: Broad geographies within which are the project sites, where CTSP is providing technical and financial support for field conservation.

Vulnerability Assessment: An evaluation of the exposure, sensitivity, and adaptive capacity of a target resource to climate threats. It serves to inform adaptive planning.

1. Background

The oceans of the Coral Triangle are among the most productive and biologically diverse in the world. As a consequence, they are both critical for economic and food security and as a global conservation priority. Over the past decades, the demand for ocean space for multiple uses has increased greatly through expansion of traditional uses (i.e. fisheries, marine transportation) and new uses (i.e. energy development, aquaculture). The ecological transition facing the region's ocean resources is happening rapidly, and the effects are far-reaching. The resources; the people who use and consume them; production practices; management institutions; the environment that supports them; and the local, national and international legal instruments governing their ownership and use will all be affected. The transition in ocean environments is especially apparent in developing countries in Asia where low-income people will be hardest hit when their fragile purchasing power and often-tenuous access to the resources upon which they depend for food and livelihood are further challenged (Pomeroy et al., 2013a).

Competition and conflict for space and resources characterizes the oceans of the Coral Triangle. Because of some of the highest rates of population growth and increasing food and development needs, these waters are now experiencing increased levels of conflict and social unrest as a result of differing and uneven levels of economic development, resource use, and technological change between urban and rural area within a country. Economic and technological changes in the last 15 years have caused serious discrepancies in access to ocean resources in the region. Increased activity in the ocean environment has led to two important types of conflict in the region: (1) conflicts among human uses (user-user conflicts); and (2) conflicts between human uses and the marine environment (user-environment conflicts). These conflicts weaken the ability of the ocean to provide the necessary ecosystem services upon which humans and all other life depend. (Pomeroy et al., 2013a)

The Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) is a partnership of six countries working together to sustain extraordinary marine and coastal resources by addressing crucial issues such as food security, climate change, and marine biodiversity. To support the efforts of its member nations working at regional, national, and local scales, the CTI-CFF adopted a Regional Plan of Action (RPOA) (CTI-CFF 2009) of the six CTI-CFF nations (the CT6—Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, and Timor-Leste). The (RPOA) puts forward five overarching goals: 1) strengthening management of seascapes; 2) applying an ecosystem approach to fisheries management (EAFM); 3) developing and strengthening the management of marine protected areas; 4) implementing climate change adaptation measures; and 5) protecting threatened marine species.

The RPOA and assocaited National Plans of Action (NPOAs) highlight EBM as the preferred approach to achieve national and regional outcomes. The Convention on Biological Diversity (CBD) refers to the ecosystem approach as "a strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way." It is clear that an integrated and coordinated approach to management, such as EBM, applied at large spatial scales, is needed to address the multiple impacts of diverse marine, coastal, and near-shore activities and resources uses to ensure the long-term sustainability and resilience of oceans and coasts and the people that depend on them in the Coral Triangle. (Flower et al., 2013).

Several approaches to managing large marine areas already exist including marine ecosystems, large marine ecosystems, seascapes, regional seas programs, and integrated coastal management (Bensted-Smith and Kirkman, 2010). This document is a brief guide to another integrated approach, marine spatial planning (Ehler and Douvere, 2009), the application of which offers distinct cross-sectoral benefits in terms of accomodating multiple objectives and priorities.

The application of marine spatial planning (MSP) is growing rapidly around the world. Over the past decade MSP has been developed and implemented in over 20 countries worldwide and currently covers about 10% of the surface area of the world's exclusive economic zones. A guide to *"Marine Spatial Planning: a step-by-step approach toward ecosystem-based management"* was published by UNESCO's Intergovernmental Oceanographic Commission and has been widely used in countries as diverse as the USA and Vietnam to initiate integrated marine management (Ehler and Duvere, 2009). There are some recent examples of MSP in the Coral Triangle, including seven-year Fisheries Improved for Sustainable Harvest (FISH) in the Philippines (FISH, 2010 and Pomeroy, 2011); the Bataan, Philippines, spatial planning and zoning plan and process (Bataan Coastal Care Foundation, 2007 and Pomeroy, 2011); and the Wakatobi National Park Authority's redesign of the park's management plan to address overfishing and destructive fishing practices (Reef Resilience, no date, and Pomeroy, 2011).

MSP can incorporate an ecosystem approach to achieve marine conservation objectives, but can also be used to achieve sustainable development outcomes. Coastal planners work to address land use issues, manage land-based pollution, and develop strategies to adapt to climate change. Fisheries managers encourage the sustainable exploitation of marine resources and monitor the status of fisheries. Conservation professionals and environmental ministries protect threatened species and critical habitats such as coral reefs and mangroves, often through the designation of marine protected areas. Local government and economic development agencies focus on basic services and livelihoods including tourism and other revenue-generating activities. Disaster-management agencies are focused on developing early warning systems and community preparedness to natural and climate-related threats. Most of the time, these interests act independently so that sectoral strategies and actions are done in relative isolation from one another.

2. Integrated Management Approaches and Ecosystem-based Management in the Coral Triangle

The purpose of this guide is to explain clearly and briefly how MSP can be used to implement ecosystem-based management. It also explains how MSP can be integrated with the ecosystem-based fisheries management, marine protected area management, and climate change adaptation work that the CTI-CFF nations are already undertaking to support the RPOA and respective NPOAs.

The CTI RPOA presents a regional platform for application of MSP at national and sub-national levels that will contribute to regional outcomes (CTI-CFF, 2009). In addition to being specifically represented in the RPOA and NPOAs of the CTI-CFF, several applied building blocks leading to application of EBM in the Coral Triangle are in place.

The CTI-CFF's work to has made inroads toward defineing, describeing and promoteing an EBM approach across the Coral Triangle .This work has resulted in a number of guides that specifically describe EBM within large managed areas, such as:

- *Toward ecosystem-based coastal area and fisheries management in the Coral Triangle: Integrated strategies and guidance*," (Flower et al., 2013);
- *Coral reefs, fisheries, and food security: Integrated approaches to addressing multiple challenges in the Coral Triangle* (Pomeroy et al., 2013b); and
- *The seascapes guidebook: How to select, develop and implement seascapes*" (Atkinson et al., 2011).

Additional guides support integrated management for specific outsomes or objectives. For fisheries management, this includes:

- *Regional Framework for an Ecosystem Approach to Fisheries Management in the Coral Triangle* (CTI-CFF, in prep)
- *Coral Triangle Regional Ecosystem Approach to Fisheries Management (EAFM) Guidelines* (Pomeroy et al., 2013a)
- *Incorporating climate change and ocean acidification into an ecosystem approach to fisheries management (EAFM) plan* (Heenan et al., 2013)
- *An ecosystem approach to fisheries management (EAFM) and the Coral Triangle Initiative. U.S. Coral Triangle Initiative Support Program Technical Brief* (US CTI Support Program, 2011)

There have also been several recent guides produced to support integrated management within MPAs, MPA networks, and locally-managed areas (LMAs), including:

- *Coral Triangle marine protected area system (CTMPAS) framework and action plan* (CTI-CFF, 2013)
- *Biophysical principles for designing resilient networks of marine protected areas to integrate fisheries, biodiversity and climate change objectives in the Coral Triangle* (Fernandes et al., 2012)
- *Designing marine protected area networks to achieve fisheries, biodiversity, and climate change objectives in tropical ecosystems: A practitioner guide* (Green et al., 2013)

- *Designing Effective Locally Managed Areas in Tropical Marine Environments: A Guide Series to Help Sustain Community Benefits Through Management for Fisheries, Ecosystems, and Climate Change* (Gombos et al., 2013)
- *Regional Coral Triangle Marine Protected Area System (CTMPAS) Framework* (CTI-CFF, 2013)

Finally, an integrated approach to climate change adaptation is recommended in two CTI guides:

- *Region-wide Early Action Plan for Climate Change Adaptation* (REAP) (CTI-CFF, 2011)
- *Community-based Local Early Action Planning Guide for Climate Change Adaptation* (U.S. CTI Support Program, 2013)
- *Climate Change Adaptation for Coral Triangle Communities: Guide for Vulnerability Assessment and Local Early Action Planning (LEAP Guide)"* (U.S. CTI Support Program, 2013)

All of the guides listed above were developed in partnership between the CTI technical working groups and the US CTI Support Program, in cooperation with the CT6 governments, and adopted for use by the CTI-CFF Interim Regional Secretariat. These documents anticipate the importance of MSP in the Coral Triangle as a main tool for applying EBM and achieving national and regional goals. However, none of these recent publications specifically address methods for applying these integrated approaches in a systematic way such as marine spatial planning. This brief guide to marine spatial planning or MSP therefore builds on this and other previous CTI work that establish the basis for EBM.

3. What Is Marine Spatial Planning?

Marine spatial planning (MSP) is a practical way to create and establish a more rational and integrated approach to the human use of marine space and the interactions among these uses. MSP also provides a way to balance demands for development with the need to protect marine ecosystems, and to achieve social, economic, and ecological objectives in an open, transparent, and planned way. The most widely used definition of MSP is the one found in the UNESCO/IOC guide to ecosystem-based marine spatial planning:

MSP is "…the public process of analyzing and allocating the spatial and temporal distribution of human activities in marine areas to achieve ecological, economic and social goals and objectives that are usually specified through a political process." (Ehler and Douvere, 2009)

The characteristics of MSP, many of which are common to other planning approaches including integrated coastal management and ecosystem-based management, are that it is:

- **Integrated and multi-objective,** across sectors and agencies, and among levels of government, and including social and economic objectives as well as ecological ones
- **Continuing** and **adaptive,** capable of learning from experience
- **Strategic** and **anticipatory**, focused on the long-term
- **Participatory**, stakeholders actively and effectively involved in the process
- **Place-based** or **area-based,** focused on a specific marine area or place; and
- **Ecosystem-based,** balancing ecological, economic, and social goals and objectives toward sustainable development

Over the past decade MSP has been recognized increasingly as an operational process that can lead to ecosystem-based management of marine areas (Douvere, 2008). MSP has proven to be a practical, operational approach to implement the still poorly understood concept of ecosystem-based management (Arkema et al., 2006). At least six countries (Belgium, The Netherlands, Germany, Norway, Australia, and China, and three American states (Massachusetts, Rhode Island, and Oregon) have implemented spatial plans for their respective marine jurisdictions. In two cases, Norway and The Netherlands, MSP is already in its second or even third, generation. Three other countries (England, Portugal, and Sweden) will implement marine spatial plans for their marine waters over the next few years. Over the next decade at least 30 countries will have produced and approved about 60-70 marine spatial plans at the national (EEZ), sub-national (territorial sea), and state/provincial levels that will cover about one-third of the surface area of the world's exclusive economic zones (EEZs) (Ehler, 2013).

4. Importance of Space and Time for Marine Spatial Planning

Until recently management in marine ecosystems has focused largely on how many fish of a particular species can be caught without depleting their populations, or what is the minimum mesh size that can be used in a particular fishery or how can coastal and marine tourism be encouraged? These questions often have no geographic constraints or no spatial structure within the broad area where they are applied. They also frequently do not consider variations in characteristics over time (temporal changes, or temporal diversity). In each place there are many managers, each focusing on only a subset of all marine issues that affect that place; each one largely ignoring what the others do. This situation is a recipe for conflict (Crowder et. al., 2006) and increased stress on marine ecosystems.

Some areas of the ocean are more important than others—both ecologically and economically. Animals, habitats, populations, oil and gas deposits, marine mineral deposits, and sustained winds and waves, are all found in various places and at various times. Successful marine management needs planners and managers that understand how to work with the spatial and temporal diversity of the sea. Understanding these spatial and temporal distributions and mapping them is an important part of MSP. Managing human activities to enhance compatible uses and reduce conflicts among uses, as well as to reduce conflicts between human activities and nature, are important outcomes of MSP. Examining how these distributions might change due to climate change and other long-term pressures, e.g., overfishing or overdevelopment, on marine systems is another issue particularly suited to the process of MSP.

Some ocean areas are more important than others, due to reasons such as its condition, benefit to fisheries, economic value for tourism, predicted resilience to climate change, or other reasons. Here, a healthy coral reef in Nusa Penida, Bali, Indonesia. Photo: © CTSP / Tory Read.

5. Why Marine Spatial Planning?

An integrated, ecosystem-based management (EBM) approach has been identified in the Coral Triangle as an appropriate approach to address problems caused by today's incremental, single-sector approach to marine management (See Section 2). However, examples of practical applications of an ecosystem-based approach are elusive. How to begin is the first challenge.

Marine Spatial Planning is an important and practical tool for implementing integrated management approaches including EBM, MPA networks, seascapes, EAFM, and CCA.

A huge gap exists between the concepts of ecosystem-based management and its implementation. Scientists characterize EBM differently than planning professionals who manage coastal and marine ecosystems. In practice, marine management objectives and measures often tend to miss critical ecological and human factors emphasized by scientists. Planners and managers in the Coral Triangle are beginning to put some EBM principles into practice (see, for example, Flower et al., 2013), but implementation needs to be much more thorough and science-based. The degree to which specific EBM criteria are translated from conceptual definitions to management actions is extremely variable on the ground. Tools for conventional, single-species management are available and widely used, but different and more explicit approaches are still needed to conduct EBM successfully (Arkema et al., 2006). The CTI Integrated is a first step towards filling that gap (Flower et al., 2013), but more technical guidance on applying these approaches through MSP is still needed.

6. A Deeper Look into Marine Spatial Planning

MSP is a practical approach to implement EBM in the Coral Triangle. However, marine spatial planning is only one element of the marine spatial management process. Other elements include implementation, monitoring, evaluation, financing, stakeholder participation, and applied research. All of these elements must be carried out in an effective spatial management process (See Figure 1).

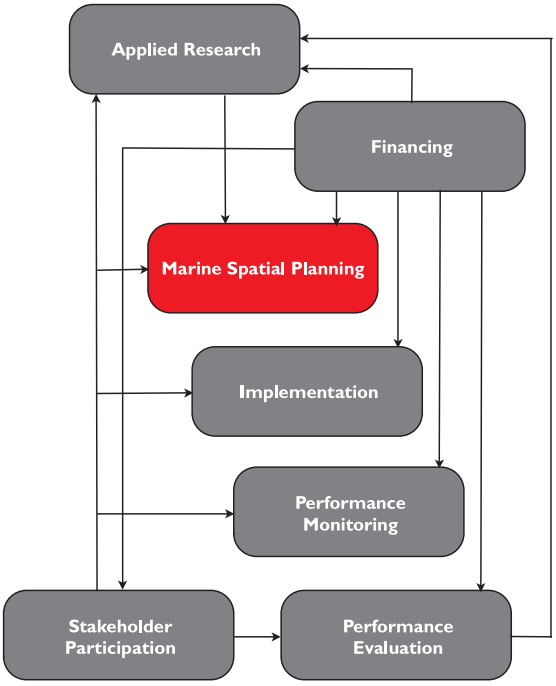

Figure 1. The Elements of the Marine Spatial Management Process (Source: Ehler and Douvere, 2006)

The development and implementation of MSP involves a number of steps (Ehler and Douvere, 2009), including:

1. Identifying need and establishing authority
2. Obtaining financial support
3. Organizing stakeholder participation
4. Organizing the process through pre-planning
5. Defining and analyzing existing conditions
6. Defining and analyzing future conditions
7. Preparing and approving the spatial management plan
8. Implementing and enforcing the spatial management plan
9. Monitoring and evaluating performance
10. Adapting the marine spatial management process

These 10 steps are not simply a linear process that moves sequentially from one step to another. Many feedback loops should be built into the MSP process. For example, goals and objectives identified early in the planning process are likely to be modified as costs and benefits of different management actions are identified later in the planning process. Analyses of existing and future conditions will change as new

information is identified and incorporated in the planning process. Stakeholder participation will change the planning process as it develops over time. Planning is a dynamic process and planners have to be open to accommodating changes as the process evolves.

Comprehensive MSP provides an integrated framework for management that provides a guide for, but does not replace, single-sector planning. For example, MSP can provide important contextual information for marine protected area management, ecosystem-based fisheries management, or climate change adaptation plans, but does not replace them.

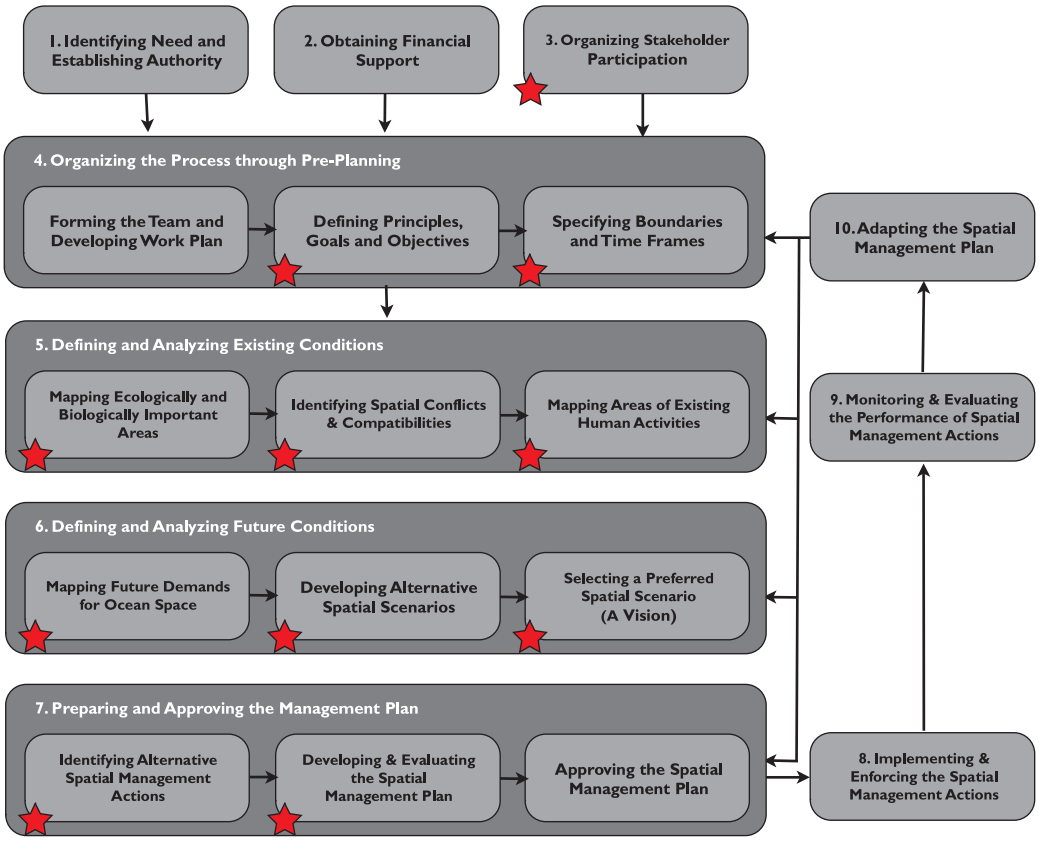

Figure 2. A Step-by-Step Approach to Marine Spatial Planning. Note: The red star (★) indicates a step in the MSP process in which stakeholders should be actively engaged. (Source: Updated from Ehler and Douvere, 2009)

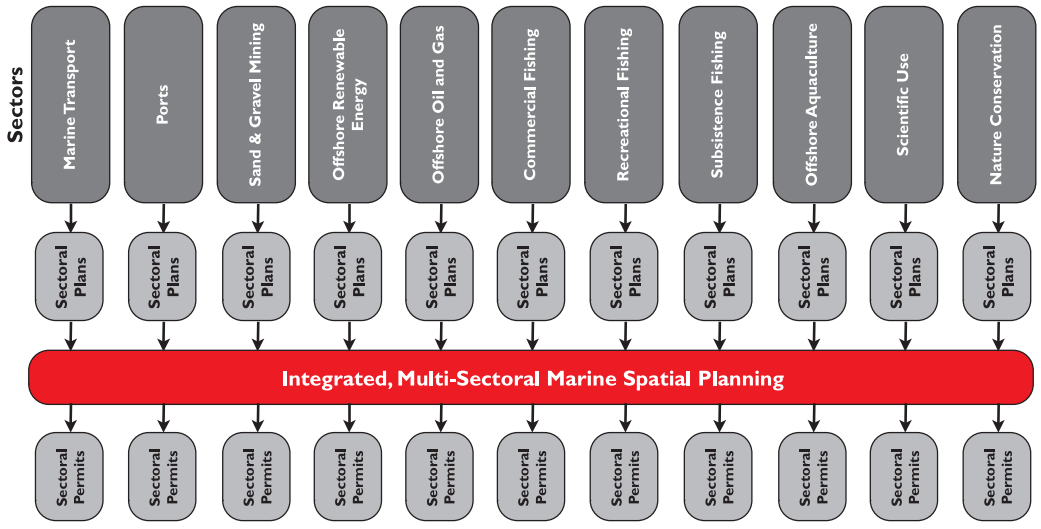

Figure 3. Relationship Between Multi-Sector Marine Spatial Planning and Single-Sector Planning and Permitting (Source: Ehler and Douvere, 2009)

MSP does not produce a one-time "master plan" or "blueprint" for a marine area. It is a continuing, iterative process that learns and adapts over time. It is comprised of four continuing stages:

- **Plan-making**, or generating and adopting one or more integrated plans or policy frameworks that have strong spatial dimensions, for the protection, enhancement, and sustainable use of development of a marine area and its resources;
- **Plan implementation**, including the execution of programmed works or investments, enabling change, encouraging improvement, and through regulation and enforcement of proposed changes and ongoing activities in, on, or over and under the sea, in accordance with the plan;
- **Monitoring and evaluation** of plan performance, or assessing the effectiveness, efficiency, and equity of the plans, their time scales and implementation incentives, considering ways in which they need to be improved, and establishing review and adaptation procedures; and
- **Adaptation** of the current plan in the next round of planning, including modifying goals and objectives, management actions, and reallocating resources to those actions that appear to be working from those that do not.

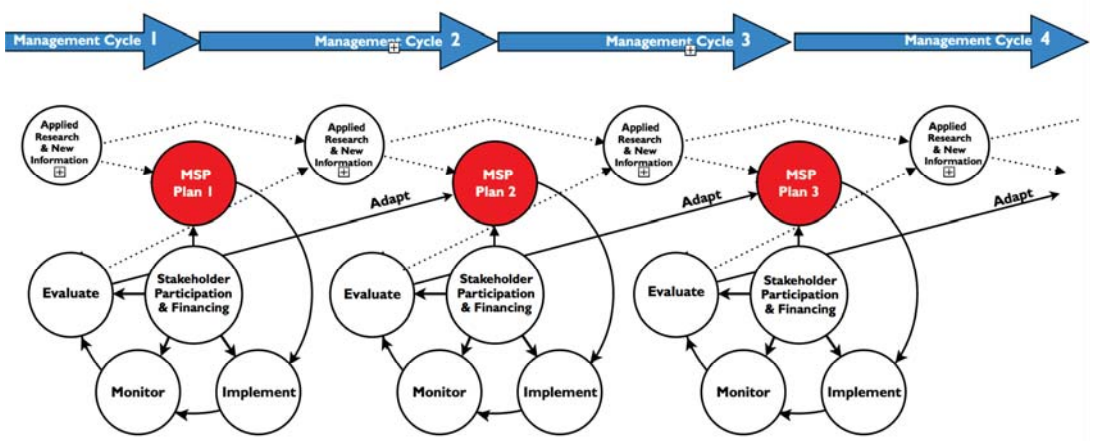

Figure 4. The Continuing Process of Marine Spatial Management (Source: Ehler and Douvere, 2009)

7. Benefits of MSP

When developed effectively, marine spatial planning can have significant economic, social, and environmental benefits. The following table identifies some of the most important benefits of marine spatial planning.

Table 1. Examples of the Benefits of MSP

Economic	• *Increased certainty of access to desirable areas for new private sector investments, where infrastructure is frequently amortized over 20-30 years*
	• *Identification and early resolution of conflicts among incompatible uses through planning instead of litigation*
	• *Streamlined and more transparent permit and licensing procedures*
	• *Improved capacity to plan for new and changing human activities, including emerging technologies and their associated effects*
Environmental	• *Identification of ecologically and biologically significant areas as a basis for space allocation*
	• *Establish context for planning a network of marine protected areas*
	• *Identification and reduction of the cumulative effects of human activities on marine ecosystems*
Social	• *Improved opportunities for local community and citizen participation in planning*
	• *Identification of effects of decisions on the allocation of ocean space (e.g., closure areas for certain uses, protected areas) on communities*
	• *Identification and preservation of social, cultural, and spiritual values related to use of ocean space*
Administrative	• *Improve speed, quality, accountability, and transparency of decision making, and reduction of regulatory costs*
	• Improve consistency and compatibility of regulatory decisions
	• *Improve information collection, storage and retrieval, access, and sharing*

8. Barriers to MSP

Barriers to integrating management approaches, including marine spatial planning, are not uncommon in coastal or marine areas (Flower et al. 2013). These include:

- **Legal and institutional authorities**: Existing legal and institutional authorities often promote a sector-based approach. Sometimes these authorities exist in opposition to the idea and practicalities of integration. Reforming these authorities to enable and promote greater inter-sectoral collaboration can be difficult;
- **Timing**: Integrating new strategies with ongoing work must be timed appropriately to minimize overburdening human and financial resources and to ensure political and social acceptance;
- **Unintended negative impacts**: Care must be taken to avoid unintended negative impacts of integrating new strategies. For example, activities to minimize climate impacts on important infrastructure (e.g., roads, homes, or hotels) could negatively affect shoreline integrity in the medium term to long term;
- **Increased initial investment**: Initial costs may increase because new and/or additional human and financial resources are needed for site-based integration. However, the management costs ultimately will be much greater if managers delay efforts to adequately address climate change and other long-term impacts;
- **Initial "cultural" resistance**: In some cases, a project team that historically focused on implementing a specific tool or management strategy (e.g., working in MPAs) may not have the capacity or experience to implement activities from other management strategies (e.g., climate change adaptation). Integration may require team members to acquire new skills and/or technical assistance.
- **Limited financing**: Initially, it may be difficult to find funding to support integrated management. However, growing recognition of the need for and utility of holistic and comprehensive planning may change this in the future.

Additional challenges facing the Coral Triangle countries as they struggle to close the gap between theory and practice of integrated management include:

- Access rights, laws and institutional structures in some countries are outdated and do not reflect social and political realities, so that governance structures have inherent conflicts;
- Governance structures may not be appropriate or there are chronic weaknesses in their application, especially in relation to natural resources—ineffective enforcement is a widespread problem in the Coral Triangle;
- Traditional tenure can present complicated challenges including settling of ownership boundaries and traditional access rights;
- Commitment to meet short-term social and economic needs can conflict with the emphasis on sustainability and long-term benefits of integrated management;
- Frequent changes in political leadership make it difficult to secure the sustained policy commitment over decades that integrated management requires; individual and institutional champions of integrated management can counter-balance this problem but they are few and civil society organizations in many countries are weak; and

- Insufficient integrated management capacity in terms of the number of skilled personnel and budget often presents significant challenges.

These challenges do not mean that integrated management cannot work in Coral Triangle countries, but they do highlight the importance of adapting integrated management to the social, political, cultural, and overall institutional context of each country and area involved, and the importance of considering the whole marine governance set-up, not just the large-scale elements (Bensted-Smith and Kirkman, 2010).

Integrated management is a process that starts with what is being done now, builds on successes, and streamlines the application of management strategies to achieve the intended outcomes. With a dedicated multi-stakeholder team, it is possible in the Coral Triangle countries to identify the barriers that may exist in each area and, keeping in mind the intended benefits that will come from the process of the integrating management actions, to identify strategies to overcome them. (Flower et al., 2013)

9. Outputs of Marine Spatial Planning

The principal output of MSP is a comprehensive spatial management plan for a marine area or ecosystem. Think of this plan as a kind of "vision for the future". It sets out priorities for the area and defines what these priorities mean in time and space. Typically, a comprehensive spatial management plan is strategic or advisory in nature, has a 10-20 year horizon, and reflects social, political priorities for the area. The comprehensive marine spatial plan is often implemented through a zoning map(s) and regulation(s) and/or a permit system.

Case-by-case permit decisions made within individual sectors (for example, the fisheries or tourism sectors) should be based on the zoning maps and the comprehensive spatial plan.

MSP focuses on the human use of marine spaces and places. It is the missing piece that can lead to truly integrated planning from coastal watersheds to marine ecosystems across the Coral Triangle.

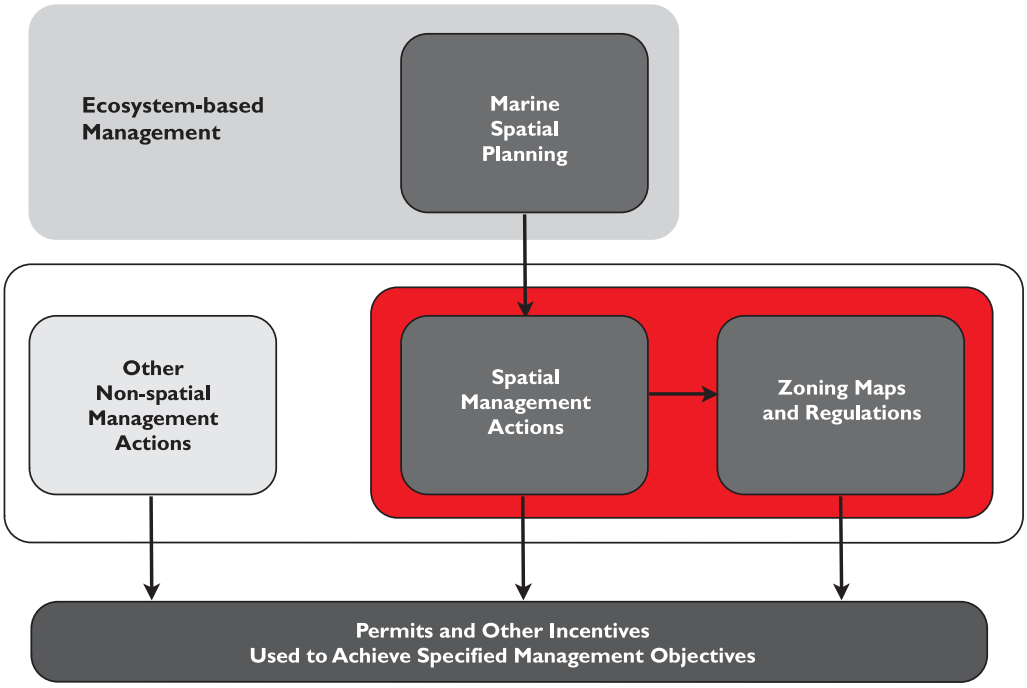

Figure 5. The Outputs of Marine Spatial Planning

10. Relationship between MSP and Ocean Zoning

Although the two phrases are often used interchangeably, marine spatial planning is not ocean zoning. Ocean zoning is integral to MSP just on land, where zoning is an important tool of comprehensive urban or regional planning. Zoning maps and regulations are the principal tool for implementing terrestrial comprehensive plans. It's is an important tool in the MSP toolkit—but not the only one. Zoning is not planning—on land or in the sea. We already zone the sea without considering other uses or nature—and the result many times is chaos.

Using zoning as the principal tool with which to implement marine spatial planning is a distinctly North American and Australian idea and in many cases may not be completely transferable to Coral Triangle countries. For example, in Norway, integrated management plans for the Barents and Norwegian seas do not use the term "zoning"; these plans contain no zoning maps or regulations. MSP can be and has been implemented without zoning.

The Great Barrier Reef Marine Park in Australia has over 30 years of experience with marine management with a heavy emphasis on ocean zoning. Its zoning plans were developed in early 1980s with help from Australian land use planners. Zoning is only one of the many spatial management tools used in the Great Barrier Reef, and it's not necessarily the most effective way to manage all ocean activities, according to Jon Day of the GBR Marine Park Authority. Some activities are better managed using other spatial and temporal tools, including:

- Permits, often tied to specific areas within zones
- Enforceable management plans
- Site plans/special management areas
- Other spatial restrictions, e.g., defense training areas
- Best environmental practice/codes of practice such as those developed under the CTI-CFF

Zoning is without question an important tool for implementing marine spatial plans. But zoning is not planning. Finally, to be effective zoning must be periodically reviewed to take into account:

- Rapidly increasing use of marine areas and resources;
- Technological change;
- Changes in economic and political conditions;
- Climate change and other threats to marine life (e.g., acidification); and
- Changes in the use of time and space by marine life.

These changes can be best addressed through a continuing, strategic, and adaptive process of MSP.

11. Examples of Spatial and Spatio-temporal Management Actions

Table 2 illustrates the four major categories of management actions related to (1) Inputs, (2) Processes, (3) Outputs, and (4) Space and Time. The last category is the focus of this report. It is important to remember that MSP and spatial and spatio-temporal management actions cannot do it all. Other types of management actions (for example, gear restrictions) will be needed to manage any marine area.

Table 2. Categories of Marine Management Actions

INPUT MANAGEMENT ACTIONS	OUTPUT MANAGEMENT ACTIONS
Actions that specify the inputs of human activities in marine areas • *Limitation on number of fishing vessels allowed to fish in the marine area* • *Limitation of shipping or fishing vessel size or horsepower* • *Limitation on the amount of chemical fertilizers or pesticides applied to agricultural lands*	Actions that specify the outputs of human activities in marine areas • Limitations on amount of pollutants discharges to a marine area from industrial sources, both onshore and offshore • Limitations on ballast water discharges, including alien species and pathogens, from shipping • Limitation on allowable catch within the marine area • *Reduce by-catch of non-target species* • *Reduce by-catch of dugongs caught in fishing gear* • Limitation on sand and gravel extraction with the marine area • *Limitation on fecal coliform discharges to coastal waters* • *Limitation on sedimentation and storm water runoff to reduce effects on mangroves and sea grasses*
PROCESS MANAGEMENT ACTIONS	**SPATIAL/TEMPORAL MANAGEMENT ACTIONS**
Actions that specify the nature of the production process of human activities in marine areas • *Specification of fishing gear, mesh size, etc.* • *Specification of "best available technology" (e.g., waterless biological toilets) or "best environmental practice" (e.g., contained wastewater gardens, stream bank stabilization) for sources of marine pollution* • *Prohibition of destructive fishing practices, e.g., dynamite, cyanide, throughout the marine area* • *Protection of mangroves and seagrasses that act as filters to maintain coastal water quality*	Actions that specify where in space and when in time human activities can occur in marine areas • ***(See Table 3 for examples)***

Table 3. Examples of Spatial and Spatio-temporal Management Actions by Sector (Spatio-temporal actions are highlighted in bold type)

Human Activity	Examples of Spatial and Temporal Management Actions
Commercial Fishing	• Areas designated for commercial fishing only • Areas closed to commercial fishing all the time • Areas closed to commercial fishing **by season** • Areas closed to commercial fishing for ecological reasons, e.g., during spawning seasons • Areas where certain types of gear, e.g., bottom trawls, driftnets, or gillnets, are prohibited or restricted • Improve baseline data on living marine resources, including potential changes in their composition due to climate change
Recreational Fishing	• Areas designated for recreational fishing only at all times • Areas designated for recreational fishing **by season** • Areas closed to recreational fishing at any time • Areas closed to recreational fishing **by season**.
Subsistence Fishing	• Areas designated for subsistence fishing only at all times • Areas designated for subsistence fishing **by season** • Prohibition of destructive fishing practices, e.g., dynamite, cyanide, throughout the marine area
Offshore Aquaculture	• Areas designated or permitted for offshore aquaculture
Habitat Protection	• Manage coastal development to reduce sedimentation and turbidity in coastal areas where sea grasses are found • Reduce agricultural pollution and nutrient runoff in areas where sea grasses are found • Protect dugong foraging and breeding habitats
Marine Transport	• Manage vessel traffic to reduce strikes of marine mammals, e.g., dugongs, whales • Designate ecologically or biologically important areas as "Special Areas" or "Particularly Sensitive Sea Areas" (PSSAs) • Develop a traffic information system to improve monitoring of vessel traffic • Improve information on the use of the Coral Triangle marine environment by residents to avoid conflicts with marine transportation • Identify areas of heightened ecological and cultural significance in light of changing climate conditions and increasing marine use to protect those areas from impacts of shipping • Identify "Areas to be Avoided" (ATBAs) based on navigation hazards and biological characteristics
Ports	• Identify "Areas to be Avoided" (ATBAs) based on navigation hazards • Established navigation lanes
Dredging	• Areas designated for disposal of dredged material (spoil) • Areas where dredging is restricted for ecological concerns, e.g, **during fish spawning, sea turtle hatching**
Offshore Oil and Gas	• Designate areas where oil and gas activities should be prohibited at any time • Restrict seismic operations **when marine mammals are present in the marine area** • Restrict oil and gas operations in areas of subsistence access and harvest • Identify areas where oil and gas activities should be prohibited **by season, e.g., during marine mammal migrations** • Select supply routes, frequency and timing to avoid effects on biota or harvesting of wildlife by residents • Prohibit discharges of drilling cuttings and produced water in sensitive marine areas • Prohibit discharges of solid waste into the marine environment
Offshore Renewable Energy	• Identify "Areas to be Avoided" (ATBAs) based on navigation hazards and biological characteristics • Identify special development areas
Marine Mineral Mining	• Areas identified as potential sites for marine mineral mining, e.g., sand and gravel, • Areas leased for marine mineral mining

Human Activity	Examples of Spatial and Temporal Management Actions
Offshore Pipelines	• Areas designated as offshore pipeline corridors • Install, operate, and maintain pipelines to minimize disturbance of seafloor habitats and other uses of the seafloor
Offshore Cables	• Areas designated as offshore cable corridors
Tourism	• Limitation of the number of visitors according to the nature and wildlife vulnerabilities of special areas at any time • Ensure that tourism activities to not conflict with nature conservation efforts
Nature Conservation	• Designate ecologically and biologically sensitive areas (EBSAs), e.g., the nesting and feeding habitats of seabirds, turtle nesting beaches, turtle foraging grounds, migratory pathways • Designation of no-take marine reserves • Designate multiple-use marine areas
Cultural Uses	• Ensure that the customary use of marine life, e.g., dugongs, marine turtles, is sustainable where it is permitted • Designate customary use areas
Scientific Uses	• Improve knowledge of **migratory patterns** (spatial and **temporal**) of marine life in the marine area • Determine the distribution, abundance and trends of marine life populations to provide a base for conservation efforts and actions using traditional knowledge and/or scientific methodologies.

12. Stakeholder Participation is Critical to MSP

Involving key stakeholders, including those in the ocean energy and fisheries sectors, in the development of MSP is essential for a number of reasons. The most important reason is because MSP aims to achieve multiple objectives (social, cultural, economic and ecological) and should therefore reflect as many expectations, opportunities or conflicts as possible that are occurring in the MSP area. The scope and extent of stakeholder involvement differs greatly from country to country and is often culturally influenced. The level of stakeholder involvement will largely depend on the legal or cultural requirements for participation that often exist in each country.

Generally speaking, all individuals, groups or organizations that are in one way or another affected, involved or interested in MSP can be considered stakeholders. However, involving too many stakeholders at the wrong moment or in the wrong form can be very time consuming and can distract resources from the expected or anticipated result. To involve stakeholders effectively (e.g., leading toward expected results) and efficiently (e.g., producing expected results at least-cost), three questions should be asked:

- Who should be involved?
- When should stakeholders be involved?
- How should stakeholders be involved?

Where no legal obligations exist, it is important to define what type of stakeholder participation will be most suitable for a successful result. For instance, involving indigenous people in MSP efforts may not be a legal requirement, but they could however be greatly affected (positively or negatively) by MSP management measures, and should therefore participate.

Wide-ranging and innovative approaches to stakeholder participation and proactive empowerment should be used in the MSP process. Stakeholder participation and involvement in the process should be early, often, and sustained throughout the process. Stakeholder participation and involvement encourages "ownership" of the plan and can engender trust among the various stakeholders. Different types of stakeholder participation should be encouraged at various stages of the MSP process. The key stages at which stakeholders should be involved in the process include:

- **The planning phase:** Stakeholders need to be involved and contribute to the setting of goals and objectives of MSP. They also need to be involved in the evaluation and choice of specific management measure options and the consequences of these choices on their areas of interest;
- **The implementation phase:** Stakeholders should be involved in the actual implementation of MSP and its management measures. For example, an approach to enforcement may be identified that would involve local communities in the regulatory and enforcement process. When the local communities understand the problems and benefits of taking action—and agree upon the management measures to be taken—they will be part of the enforcement process, at least to the extent of encouraging compliance; and
- **The monitoring and evaluation (during implementation) phase**: Stakeholders should be involved in the evaluation of the overall effectiveness of MSP in achieving goals and objectives. The post-evaluation effort should involve all stakeholders in a discussion to identify plan results, evaluate results against objectives, and plan for the next round of planning.

13. MSP In Relation to Other Planning Processes

MSP does not replace single-sector planning and management, e.g., fisheries management, tourism management, climate change adaptation. Instead, it aims to provide guidance for a range of decision-makers responsible for particular sectors, activities, or concerns so that they will have the means to make better decisions in a more comprehensive, integrated, and complementary way.

In many ways the process of MSP is very similar to the process of integrated coastal management. For example, both are integrated, strategic, and participatory—and both aim to maximize compatibilities among human activities among human activities and reduce conflicts both among human uses and between human uses and nature. The difference is geographic focus.

When coastal zone management was first conceived over 40 years ago, one definition of the "coastal zone" was "the area of land affected by the sea and the area of the sea affected by the land". That definition was interpreted to cover the coastal plain to the edge of the continental shelf. However, the boundaries of coastal zone management have been limited in most countries to a narrow strip of land within a kilometer or two from the shoreline. Only rarely have the inland boundaries of coastal management included coastal watersheds or catchment areas. Even more rarely does coastal management extend into the territorial sea and almost never beyond to the seaward limit of the exclusive economic zone.

MSP focuses on the human use of marine spaces and places. It is the missing piece that can lead to truly integrated planning from coastal watersheds to marine ecosystems.

14. MSP Can Be Used to Implement Multiple Aspects of Ecosystem-based Management

Ecosystem-based management (EBM) is science based and has a set of guiding principles that differentiate it from some other management approaches. Effective MSP would incorporate these aspects as well. These include:

- Uses ecologically relevant boundaries rather than political or administrative boundaries, and management at larger geographic scales or longer time frames;
- Views marine resources as elements of complex systems, and seeks to employ strategies that acknowledge and use complexity in management;
- Seeks to balance and integrate the needs of multiple human user groups while maintaining the health of the underlying system that supports those needs;
- Is participatory, collaborative and involves a diverse set of organizations and individuals in thinking about and making decisions;
- Seeks to be adaptive through monitoring and evaluation tied to changes in future management directions;
- Involves the dynamic interplay between terrestrial, marine and freshwater systems;
- Integrates ecological, social and economic objectives and recognizes humans as part of a linked social-ecological system; and
- Recognizes interactions within and across ecosystems. (McLeod et al., 2005)

Today EBM has become widely accepted as a key framework for delivering sustainable development in both the terrestrial and the coastal and marine environment. It is already embraced under the CTI-CFF Regional Plan of Action and the National Plans of Action developed by each Coral Triangle Initiative country (Section 2). EBM therefore provides an important framework through which Coral Triangle countries can assess biodiversity and ecosystem services and potential responses can be evaluated and implemented.

Application of the ecosystem approach involves a focus on the functional relationships and processes within ecosystems, attention to the distribution of benefits that flow from ecosystem services, the use of adaptive management practices, the need to carry out management actions at multiple scales, and inter-sectoral cooperation.

Despite its broad acceptance and wide range of principles, definitions and guidelines, the ecosystem approach still has few examples of actual practice. In many cases, governments and stakeholders lack the necessary tools to make an ecosystem approach operational in the marine environment, especially with regard to cross-sectoral integration.

A number of established approaches, including integrated water resources management, integrated ocean and coastal area management, and MSP, meet this challenge. These approaches are consistent with EBM and support its application in various sectors or biomes, including coastal and marine environments. In fact, the application of ecosystem approaches in the marine and coastal areas builds on the concept of integrated management, already widely used for the management of these areas (Flower et al., 2013).

MSP is well suited for spatial and spatio-temporal EBM measures

A range of tools and measures will be needed to achieve the multiple objectives of an ecosystem-based management approach, but a focus on the spatial and temporal aspects of ecosystem-based management through MSP is one way to make this approach more tangible. MSP can do this because:

- **MSP addresses the heterogeneity of marine ecosystems in a practical manner.**

  MSP takes into account that some things only occur in certain places. Important ecological areas, for example, are located in areas of high diversity, endemism or productivity, spawning and nursery areas, and migration stopover points. At the same time, economic activity can and will only take place where the resources are located, as for example, oil and gas deposits, sand and gravel deposits, and areas of sustained winds or waves.

- **MSP focuses on influencing the behavior of humans and their activities over time.**

  Although goals and objectives for a certain area are usually set for both ecosystem/natural processes and human activities, it is only the human component (human activities and resource use) that can be managed, not the ecosystem itself, e.g., through management measures or actions that change behavior of humans and their activities over time.

- **MSP provides a management framework for new and previously inaccessible scientific information.**

  Through remote sensing, tracking technologies, and global positioning technologies, science is making visible what had previously been hidden or inaccessible and increases the need for a management framework that allows the effective integration and use of new scientific information in decision-making processes.

- **MSP makes conflicts and compatibilities among human uses visible, and therefore tangible.**

  Through the mapping of ecosystems, ecologically and biologically significant areas, and human activities affecting them one can see where conflicts are or will be located.

- **MSP guides single-sector management toward integrated decision-making and management.**

  The development of marine spatial plans for an entire region visualizes alternative scenarios (drawn from a specified set of sectoral goals and objectives) for ecosystem-based management, which in turn can provide guidance to a range of decision-makers, each responsible for only a particular sector or activity of the entire area, e.g., fisheries managers will see what conflicts and compatibilities their management plans will have with plans for the offshore development of wind farms.

One way to achieve more effective implementation of ecosystem-based management in the marine environment is to use marine spatial planning to guide spatial and temporal management activities.

15. Integrating MSP With Terrestrial and Coastal Management Processes and Plans

Although spatial planning has been used in terrestrial environments for many decades, it is a relatively new approach in the marine environment. Examples of seamless marine and terrestrial planning (using management approaches such as ICM, land use planning, or integrated water management) are few and far between. Coastal planning, land use planning, water management planning are rarely connected to one another—and almost never connected to marine planning. And to make matters worse, conservation planning is rarely practiced across terrestrial, coastal, and marine ecosystems.

Marine and Terrestrial Plans and Planning Processes Should Overlap and Link

How do we link marine and terrestrial planning? Clearly these systems are linked from an ecological perspective. Some activities that take place on land can have a significant effect on the marine environment, e.g., agriculture, and vice versa. Many marine activities rely on land-based facilities and infrastructure. Some sectors are active both on land and at sea and developments can have both marine- and land-based elements. Management approaches that are introduced for marine areas should accommodate these complex interrelationships.

Marine plans should overlap with terrestrial plans. Overlapping plans could ensure that marine and land planning will address the connections between marine and terrestrial environments, and not be restricted by an artificial boundary at the coast. In fact, the geographic overlap between marine and existing terrestrial plans should encourage how the sensible integration of plans is actually achieved.

MSP can only be integrated with terrestrial planning if the marine planning system is designed with terrestrial planning in mind. For this to happen, marine planners need an understanding of and involvement in the terrestrial planning system, while community and local authority involvement in preparing marine plans will help increase land-side knowledge of marine planning.

A process of alignment can be realized through liaison between respective terrestrial and marine planning authorities through the MSP development, implementation and monitoring and evaluation stages. This liaison will provide a forum for resolving any identified conflicts between terrestrial policy and the emerging marine plan. In addition, the information base underpinning marine planning should be shared so as to achieve consistency in the data used in plan-making and decisions on land and at sea.

Terrestrial and Marine Management Plans should consider impacts and implications for each other

Marine planners should carefully consider the impacts of marine activities on the coast, e.g., pollution, seascape and visual effects, noise, extra marine or land traffic into ports, cables running into connecting stations on land, and also to terrestrial impacts on the marine environment. Marine planners should also make clear the importance of the socio-economic links between what happens at sea and communities that will be affected by changes to those activities. By placing coastal communities at the interface of two planning systems, marine planning has the potential, where appropriate, to contribute to the transformation of coastal communities from geographically peripheral areas to hubs for sustainable economic growth.

Many landscape designations, such as national parks and UNESCO World Heritage sites, are found on the coast. Where this is the case, marine plans should ensure that any nearby development or marine activity is located, designed or managed sensitively. Its potential effects on the designation should be carefully considered and the aim should be to avoid compromising the objectives of designation of these areas, for example, as set out in their management plans.

Marine planners should build sound relationships with the relevant public authorities at the local level to ensure early involvement in the MSP process. This will enable the skills, experience and knowledge of coastal managers and terrestrial planners to feed into marine plans. The ideal situation would be one where all terrestrial/coastal plans and policies have ensured during their policy development the "marine-proofing" of their content: in other words, the implications for the marine space of any terrestrial policy with coastal application or relevance has been considered fully and is set out clearly throughout all text.

At the same time, marine plans should ensure fully "terrestrial-proofed" policy content. In other words, the implications for the marine space of any policy with terrestrial application or relevance will be considered fully and be set out clearly throughout all text.

Pollution and sedimentation from coastal development (here in Timor-Leste) can adversely affect sensitive marine habitats.
Photo: © USAID CTSP / Donald Bason

The MSP process will be more effective, useful and sustainable, if terrestrial and marine planners are aware from the outset that the parallel processes of "terrestrial-proofing" and "marine-proofing" are desirable in all land-sea policy interaction.

16. MSP For Marine Protected Area Management

MSP is not only conservation planning. A network of marine protected areas might be one outcome of MSP. However, MSP seeks to broaden the context of MPA management by balancing economic development and environmental conservation, and not focus only on the goals of conservation or protection. Nevertheless, MSP can provide a context for more effective MPA management.

The design and effective implementation of networks of MPAs is critical to maximize their benefits to both conservation and fisheries management. If well designed and effectively managed, MPAs can play an important role in EBM, including achieving sustainable use of marine resources at multiple scales. If well designed, MPA networks can be an effective strategy for achieving fisheries, biodiversity and climate change objectives in tropical marine ecosystems. In the past, biophysical design principles (and few socio-economic principles) have tended to focus on achieving only one or two of these objectives – not all three simultaneously.

MSP Supports Managing MPAs for Multiple Objectives

The benefits of MPAs are well documented, including an increase in the diversity, density, biomass, body size and reproductive potential of many species (particularly key fisheries species) within their boundaries. MPAs can also provide conservation and fisheries benefits to surrounding areas through the export of eggs, larvae and adults to other reserves and fished areas.

In many cases, however, biophysical principles developed for MPA network design have tended to focus on protecting biodiversity, often in the face of climate change. Fisheries issues, while usually considered, have not always been addressed fully in the design process, e.g., fisheries issues are generally considered in terms of avoiding conflicting use with marine reserves, rather than positioning MPAs to maximize benefits for fisheries management and are seldom designed to maximize their contribution to protecting biodiversity in the face of climate change.

To meet this need for the Coral Triangle, a new CTI-CFF publication, *Designing Marine Protected Area Networks to Achieve Fisheries, Biodiversity, and Climate Change Objectives in Tropical Ecosystems: a Practitioner Guide* (Green et al., 2013), provides planning guidelines that take both maximizing fisheries and adapting to climate change into consideration. This new guide, based on the best available science, identifies 15 principles to guide spatial planning for designing and establishing networks of marine protected areas (Table 4).

Table 4. Principles to Guide Spatial Planning for Designing and Establishing Networks of Marine Protected Areas (from Green et al., 2013). To the extent that the planning and implementation context supports the application of these principles, they should be implemented in the order they are presented.

1. Prohibit destructive activities throughout the management area.
2. Represent 20-40% of each habitat within marine reserves (depending on fishing pressure and if there is additional effective protection in place outside of reserves). Include habitats that are connected through movements of key species.
3. Replicate protection of habitats within marine reserves.
4. Ensure marine reserves include critical habitats (e.g. spawning, feeding and nursery areas).
5. Ensure marine reserves are in place for the long-term (20-40 years), preferably permanently.
6. Create a multiple use marine protected area that is as large as possible.
7. Apply minimum and variable sizes to MPAs (depending on key species and how far they move, and if other effective marine resource management methods are in place).
8. Separate marine reserves by 1 to 20 km (with a mode between 1 and 10 km).
9. Include an additional 15% of key habitats in shorter-term marine reserves.
10. Locate MPA boundaries both within habitats and at habitat edges.
11. Have MPAs in more square or circular shapes.
12. Minimize and avoid local threats.
13. Include resilient sites (refugia) in marine reserves.
14. Include special or unique sites in marine reserves (e.g. habitats that are isolated or important for rare and threatened species).
15. Locate more protection upstream.

Full application of these principles will help achieve the multiple objectives of: marine biodiversity conservation; fisheries management associated with tropical near shore habitats; and the incorporation of climate change considerations to build long-term resilience of the management area. While the guide does not integrate the important social, economic and political considerations for effective, long term and sustainable MPA networks, for the first time multiple objectives are accommodated in these principles and shown to be mostly complementary to each other for basic marine resource management strategies.

Designating zones for restoration or rehabilitaton can be an important part of an MSP. Here, a coral nursery restoration at the WorldFish research station in Gizo, Solomon Isalnds.
Photo: © USAID CTSP / James Morgan

MSP can place MPA and MPA network management within a geographically larger management framework

The Coral Triangle covers about six million square kilometers of ocean and coastal waters surrounding Indonesia, Malaysia, Philippines, Papua New Guinea, Solomon Islands and Timor-Leste, and has almost 2,000 MPAs designated throughout the region (A White, pers. com.) covering about 208,000 km^2—and only about 1.6% of the area of marine waters of the Coral Triangle (Figure 6 and Table 5). The average size of these MPAs is relatively small—only about 100 km^2.

Even an effectively managed network of MPAs will have limited effect on marine resources without help from MSP. The future of marine biodiversity, of associated ecosystem service benefits, and indeed of MPAs themselves, is heavily dependent on the management of human activities in their surrounding environment *(Douvere and Ehler, 2009).*

The Coral Triangle Marine Protected Area System attempts to place local, national, and priority-area MPAs in the Coral Triangle within a larger management framework and link these to a regionally adopted MPA management effectiveness monitoring and evaluation system (CTI-CFF, 2013).

MPAs are most likely to achieve their objectives if they are applied as part of larger scale approach to management that considers the entire ecosystem, including humans, and aims to maintain healthy, productive and resilient ecosystems so they can provide the ecosystem services humans require. There is a need to provide wider contextual information about stressors outside MPAs that will affect them—something that MSP can provide.

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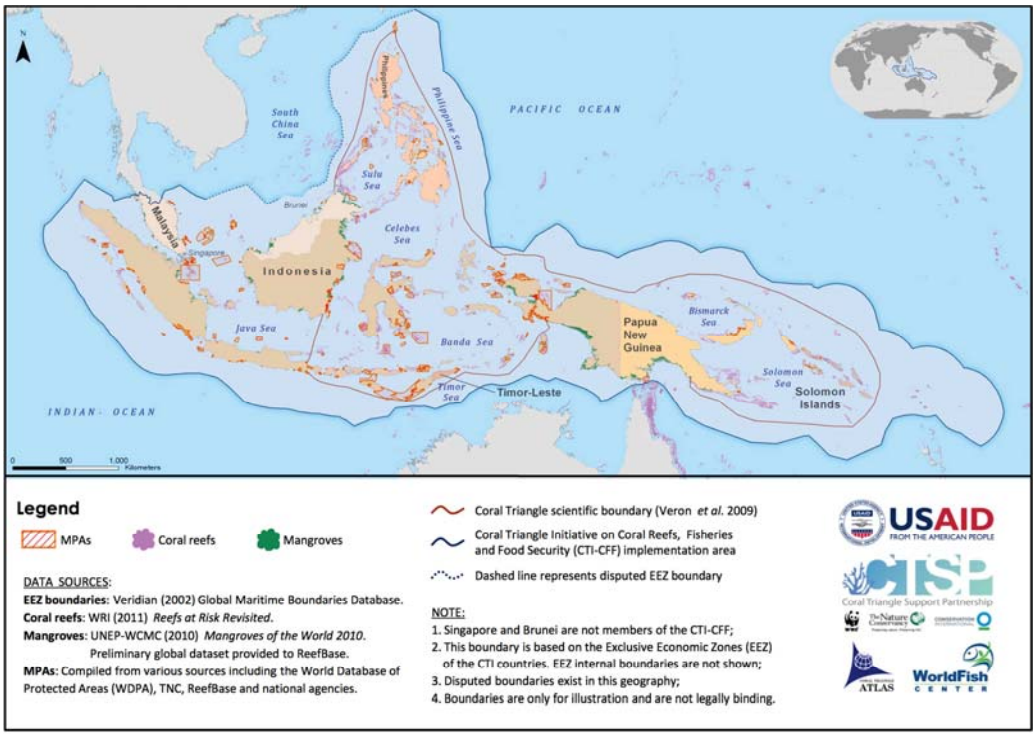

Figure 6. Marine Protected Areas in the Coral Triangle

Table 5. MPA Statistics in the Coral Triangle Countries

CT Country	Total Number of MPAs	Number of MPAs with Known Boundaries	Total Area for Known Boundaries (Km^2)	Total Area of EEZ (Km^2)	Percent of EEZ Area Covered By MPAs
Indonesia	108	83	170,841 157,841*	2,700,000	2.7%
Malaysia	51	50	13,653 15,661*	418,000	3.5%
Papua New Guinea	59	35	4,558 4558*	3,120,000	0.2%
Philippines	1,653	348	17,164 20,940*	2,200,000	1.1%
Solomon Islands	100	82	1,325 1,325*	1,340,000	0.1%
Timor-Leste	1	1	557 556*	72,000	1.3%
CT Region	**1,972**	**599**	**208,152 200,881***	**9,850,000**	**1.6%**

Compiled from various sources including the World Database of Protected Areas (WDPA), Reefbase Pacific, and national agencies.
*Data as reported by governments and slightly different from the CT Atlas due to discrepancies from new or missing polygon data.

Source: MPA data from Alan White, pers. comm., and CTI-CFF, 2013.

17. MSP For Ecosystem Approaches to Fisheries Management

In 2003, the United Nations Food and Agriculture Organization (FAO) defined EAFM as:

"An approach to fisheries management and development that strives to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic, and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries."

A new CTI report, "*Coral Triangle Regional Ecosystem Approach to Fisheries Management (EAFM) Guidelines*" elaborates: "Sustainable management in the face of long-term, non-fisheries activities that impact marine ecosystems and the associated fisheries, thus, suggests EAFM is concerned about managing issues and resources often outside of the purview of fisheries authorities. Because of the broad issues involved, the full implementation of EAFM requires collaboration and cooperation across and between communities and a diverse range of local, provincial, and national government agencies and communities with overlapping responsibilities for managing activities that impact marine ecosystems and at broader spatial and temporal scales." (Pomeroy et al., 2013)

EAFM improves on conventional fisheries management approaches. EAFM does so by considering not only fishing activities and the dynamics of targeted fish populations, but also competitors, predators, and prey; the quantity and quality of the habitat that supports each life-stage; cultural, societal, and economic importance; the effects of climate change and invasive species; and the dynamic interactions among these components. EAFM also considers interactions with other human uses such as energy, mineral extraction, coastal development, tourism, shipping, and national security to improve future management decisions.

In Papua New Guinea, small boats are carved by hand. Photo: © World Wildlife Fund, Inc. / Tory Read

Trawlers at the fish landing in Kota Kinabalu, Malaysia, fill their holds with another day's catch. Photo: © World Wildlife Fund, Inc. / Tory Read

EAFM incorporates most aspects of conventional fisheries management and integrates many other existing approaches to marine and coastal resources management. EAFM can be considered a sectoral management approach, however, because it focuses on fisheries management outcomes, albeit in a way that is consistent with a wider ecosystem well-being focus (both natural and human). Sectoral approaches such as EAFM fit within broader multi-sectoral approaches, such as EBM and, to a lesser extent, integrated coastal management (ICM) and MSP, which deal with management goals across diverse sectors such as fisheries, mining, shipping, tourism, coastal development, agriculture, and forestry. Within these multi-sectoral and single-sectoral management approaches are specific management actions that might be chosen to address

specific goals, objectives, and needs of a place (for example, spatial management tools like MPAs, locally managed marine areas (LMMAs), and territorial use rights fisheries (TURFs), or temporal closures, gear restrictions, or traditional management practices). Together, these can address multiple objectives, covering both fisheries management and conservation objectives.

The implementation of EAFM typically includes a systematic process of data collection, analysis and planning, implementation, monitoring and evaluation. At the heart of EAFM process is an integrated management plan. EAFM includes stakeholder involvement throughout the management process, management that is adaptive, and objectives that are broad in scope. MSP follows a parallel process and has similar characteristics.

Fishermen haul in their nets in Indonesia.
Photo: © World Wildlife Fund, Inc. / Tory Read

Coastal people in the Solomon Islands rely on marine resources for their subsistence livelihoods. These fishermen sell their artisanal catch at the public market on Ghizo Island.
Photo: © World Wildlife Fund, Inc. / Tory Read

MSP can provide spatial information important for EAFM decision-making

MSP can provide essential information for the development of a plan for EBFM. For example, spatial and temporal information on ecologically and biologically sensitive areas (EBSAs) is routinely collected and mapped for MSP during its analysis and planning phase. EBSAs would include: areas of high biodiversity, high endemism, and high productivity, as well as spawning areas, nursery areas, migration corridors and stopover points. These areas are often seasonal or limited to certain months. Since MSP usually has at least a 20-year planning horizon, changes in the location or timing of EBSAs due to climate change are also identified when and if possible.

Spatial and temporal EAFM actions should be included in integrated coastal management and MSP management plans when appropriate.

In addition, the MSP planning process also includes collecting information and mapping existing and future human activities in the marine area within and around the EBFM area. For example, the analysis and planning phase of MSP routines collects information on the spatial and temporal distribution of marine transport, marine mining, oil and gas, and tourism.

Harvesting of seaweed in Indonesia serves as an alternative livelihood for both men and women. Photo: © Coral Triangle Center

Many people in Sabah, Malaysia, buy fish each day from vendors at the public market in Kota Kinabalu, Sabah. Photo: © World Wildlife Fund, Inc. / Tory Read

Many local fishermen in the Coral Triangle use nets like these in Timor-Leste as their main gear. Photo: © World Wildlife Fund, Inc. / Tory Read

MSP supports management at the spatial, temporal, and governance scales appropriate for EAFM

Transitioning towards an ecosystem approach will involve broadening the scale of what is being managed—spatially and temporally—and likely will also involve more attention to governing across scales. Fisheries management quickly becomes ineffective without attending to the relevant spatial scales of the ecosystem (e.g., including habitat, fish nursery grounds in management actions; fishing communities and households particularly dependent upon the ecosystem); without attending to the temporal scale of ecosystem interactions (e.g., seasonal fish spawning aggregations; long time scales of climate change impacts); and without ensuring an appropriate match of governance to the scales of the system (e.g., cooperating across local jurisdictions, sub-national, and national scales). Establishing and implementing an effective EAFM, thus, should be based on the spatial, temporal, and governance scales appropriate to achieve the prioritized goals and management objectives. These same considerations apply to MSP as well.

18. MSP For Climate Change Adaptation

We have an opportunity and a responsibility to reduce the vulnerability and increase the resilience of human and natural systems to climate change impacts. The scale, scope, and pace of climate change is having and will continue to have complex impacts on food security, flood protection, tourism and recreation, economic activity, jobs, and cultural heritage. Sea level rise, increased severe storm events, rapid erosion, changing ocean temperature, and saltwater intrusion present serious and growing threats to low-lying coastal communities through the destruction of infrastructure, flood inundation, loss of arable land, and the potential displacement of millions of people. In addition, rising ocean temperature and ocean acidification are expected to have significant impacts on many marine species, food webs, and ocean ecosystem structure and function, and the many benefits they provide.

MSP provides and opportunity to take planned, coordinated action today to adapt to the climate of the future.

Adapting to Coastal Climate Change: A Guidebook for Development Planners (Coastal Resources Center – University of Rhode Island and International Resources Group, 2009) provides a detailed treatment of climate concerns in coastal areas. The guide proposes an approach for assessing vulnerability to climate change and climate variability, developing and implementing adaptation options, and integrating options into programs, development plans, and projects at the national and local levels.

In addition, the *Region-wide Early Action Plan for Climate Change Adaptation* (CTI-CFF, 2011) established a set of early actions to adapt to climate change across the region and the *Climate Change Adaptation for Coral Triangle Communities: a Guide for Vulnerability Assessment and Local Early Action Planning* (U.S. CTI Support Program, 2013) encouraged implementation of the REAP-CCA at the community level—the front line of adaptation.

Many communities are reporting that they are experiencing the impacts of climate change and variability. Community freshwater water supplies on small islands are being affected by increased coastal inundation. Fishing grounds traditionally used by a community have migrated farther offshore. Severe storms have destroyed homes and livelihoods. Many communities are reacting to climate-related changes and variability by adapting practices and infrastructure to minimize impacts.

MSP can support the planning and implementation of climate change adaptation actions

MSP can be used to implement adaptation actions that address at least four climate change hazards or climate change related threats. Spatial and temporal climate change adaptation actions should be included in integrated coastal management and MSP management plans. Examples of these actions include:

1. **Increasing sea temperature**
    a. Increase ecological resilience of coral reefs to the effect of warming by reducing non-climate stresses, e.g., marine pollution, habitat loss, overfishing; and
    b. Increase protection of more resilient coral reefs or refuge coral reefs, e.g., those in regions of high flow, naturally cooler, or other ameliorating conditions.

2. **Ocean acidification**

    a. Reduce other non-climate stresses and ameliorate other climate stresses to increase resilience of coral reefs to early pH shifts.

3. **Sea level rise**

    a. Protect coastal features that protect the shoreline, including mangroves, sea grass beds, and coral reefs;

    b. Plan new coastal protection and development with sea level rise projections in mind;

    c. Prepare contingency plans for exiting protection (parks, reserves, environmental regulations) and development in light of climate change; and

    d. Plan for inland movement of natural and built communities.

4. **Increasing storm frequency/intensity**

    a. Identify coastal areas subject to flooding, high winds, high waves, erosion; and

    b. Use ecological buffer zones to provide habitat and connectivity, minimize erosion, providing flood storage and reducing flood velocities, and improve water quality through filtration of harmful sediments, pollutants, and nutrients.

19. Recommendations for Moving Ecosystem-Based Marine Spatial Planning Forward in the Coral Triangle

The ways in which MSP could contribute to the goals of the CTI-CFF RPOA are summarized in Table 6. A number of management and capacity development actions could move MSP forward in the Coral Triangle:

- Build capacity for MSP in all countries of the Coral Triangle. Little if any capacity for MSP currently exists. An investment in MSP training across the region could have long-term benefits, especially when it builds on the successes of established programs. For example, the recent MSP training for MPA managers developed by NOAA, Conservation International, and the Indonesian Ministry of Marine Affairs, and recently adopted for government use in Indonesia, could be adapted and taught widely across the region (Ministry of Marine Affairs and Fisheries, 2013).

- Establish governance structures that integrate coastal and marine management to provide robust protection of both in the face of climate change, unsustainable fishing, and marine pollution. Adaptation plans cannot be developed on a sector-by-sector basis. Doing so risks creating problems such as adaptation being effective against one issue but maladaptive against another. It will be important to plan holistically and create governance structures that can support, implement and monitor these efforts. Flower et al. (2013) and Pomeroy et al. (2012) provide some initial guidance on integrated governance approaches for EBM.

- Develop stakeholder and community engagement processes for communities to improve their ability to survive climate change impacts and other future stresses. Involving coastal people and communities in planning provides greater stability and efficacy for solutions to social and ecological systems within the Coral Triangle. Fundamentally, it will be local knowledge that generates innovative management actions that may prove most successful. Reducing the influence of local stress factors on coastal ecosystems makes them able to better survive future stresses such as climate change. Protecting the diversity of components (communities, populations, and species) under the guidance and actions of local people strengthens the resolve of these systems in the face of climate change. CTI-CFF tools such as the Leap Guide (US CTI Support Program, 2013) and the Resilient LMA Guide Series (Gombos et al., 2013) present successful approaches for community engagement in management planning.

- Pursue the establishment of integrated coastal and marine management, including MSP, across the region to reverse the decline of the health of coastal and marine ecosystems. This should include implementation of policies that eliminate deforestation of coastal areas and river catchments, reduce pollution, expand marine protected areas, regulate fishing pressures and abolish destructive practices. It is important that these actions not aim to restore or protect ecosystems under past conditions, rather they must prepare for conditions under future conditions, including a changing climate (CTI-CFF, 2012).

- Critically review and revise conservation and development efforts at the local, national and regional levels for their robustness in the face of climate change. Business-as-usual conservation and development will not achieve success. The new mode of action requires integration between conservation and development, and the realization that many past approaches are no longer effective due to the impacts of climate change (CTI-CFF, 2012 and, for example, Heenan et al., 2013).

- Build capacity to engage in planning for integrated management, including MSP. Integrated planning and management will require that we educate current and future practitioners, as well as the concerned constituencies. Mechanisms must be created to develop current resource managers and planners so that they can immediately implement these new approaches. Since the problem of climate change is not one that we will be solving in this generation, planning and responses to climate change will be iterative and adaptive as the target continues to move over the coming centuries. Therefore, it will also be necessary to develop training for future capacity through education in academic settings. Informed stakeholder and community engagement is at the core of successful adaptation, so in addition to professionals and students, civil society must be given access to the information they need to understand and respond to future conditions (for example, Ministry of Marine Affairs and Fisheries, 2013).

Table 6. Summary of ways in which MSP can contribute to RPOA management approaches and goals.

Management approach	Similarities between management approach and MSP	Ways in which MSP can contribute to this Management Approach	Notes
Ecosystem-based management	Share the same guiding principles	• Addresses the heterogeneity of marine ecosystems in a practical manner • Focuses on influencing the behavior of humans and their activities over time • Provides a management framework for new and previously inaccessible scientific information • Makes conflicts and compatibilities among human uses visible, and therefore tangible • Guides single-sector management toward integrated decision-making and management	• EBM or EA has been recommended in RPOA • Several CTI-CFF documents recommend MSP as a way to put management integration and EBM into practice.
Integrated Coastal Management and Other Terrestrial Planning Approaches (e.g., land use planning or integrated water management)	All approaches can be used to manage for linkages between land and water-based systems and activities	• Similarities with land use planning allow alignment and liaison between terrestrial and marine planning authorities. This can be achieved at MSP development, implementation and monitoring and evaluation stages	• MSP can only be integrated with terrestrial planning if the marine planning system is designed with terrestrial planning in mind • Ideally, terrestrial and marine management plans should manage for the implications their policies may have on the other's environment (i.e., "marine-proofing" and "terrestrial-proofing")

Management approach	Similarities between management approach and MSP	Ways in which MSP can contribute to this Management Approach	Notes
MPAs and MPA networks	• Both use a spatial approach to management, including zones. • Use a combination of spatial and temporal regulations with other measures. • Both can play an important role in EBM • Both work to achieve sustainable use of marine resources at multiple scales	• Can be used to implement the management measures recommended in *Designing Marine Protected Area Networks to Achieve Fisheries, Biodiversity, and Climate Change Objectives in Tropical Ecosystems: a Practitioner Guide* (Green et al., 2013) • MSP can provide a context for more effective MPA management, including its integration with EAFM and CCA.	• MSP goes beyond the goals and objectives for MPAs; it seeks to balance economic development and environmental conservation, and not only focus on the goals of conservation or protection • MSP can help place MPA and MPA Network management in a broader geographic concept (aligned with a Seascapes approach and the CTMPAS)
Ecosystem Approach to Fisheries Management	• Both include stakeholder involvement throughout the management process • Both use adaptive management processes • Both identify objectives that are broad in scope • Both are based on based on the spatial, temporal, and governance scales appropriate to achieve the prioritized goals and management objectives	• MSP can provide spatial information on important areas for fisheries management, such as ecologically and biologically sensitive areas (EBSAs) • MSP can develop spatial information on other existing and future uses of the marine environment within and around the EAFM area • MSP planning process also includes collecting information and mapping existing and future human activities in the marine area within and around the EBFM area	• EAFM fits within broader multi-sectoral approaches such as EBM and, to a lesser extent, ICM and MSP, which deal with management goals across diverse sectors such as fisheries, mining, shipping, tourism, coastal development, agriculture, and forestry
Climate Change Adaptation	• Both operate on long time scales (for MSP, a 20 year time horizon is typical) • Both manage for and balance social and environmental outcomes. • Both make provisions for adaptive management.	• MSP can support the planning and implementation of climate change adaptation actions • Changes in the location of species and habitats, or timing of processes, may be identified using MSP	

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