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# Assessing the feasibility of ecosystem-based fisheries management in tropical contexts

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**Abstract**

This analysis documents the reasons for emerging interest in ecosystem-based fisheries management (EBFM) and relates this management model to others. It highlights the central challenges to EBFM in the tropical context and examines an ongoing project, Fisheries Improved for Sustainable Harvest (FISH), in the Philippines—likely the first EBFM project in the tropics. The Philippine legal and institutional context provides major governance challenges to EBFM, especially as management is scaled up. A monitoring framework with process and output criteria is applied to FISH to establish progress to date. Major institutional and governance challenges for EBFM will require monitoring, evaluation, and adaptation.


*Keywords:* Ecosystem-based fisheries management; Feasibility; Governance; Tropics

## 1. Introduction

Ecosystem-based management (EBM) as applied principally to fisheries management is most commonly referred to as ecosystem-based fisheries management (EBFM) [1]. The emphasis on fisheries is justified considering the considerable influence that fisheries now have on fish abundance [2], trophic structure [3], and biodiversity [4]. Furthermore, human societies have long-standing relations with marine fisheries ecosystems, and the importance of sustainable fisheries cannot be underestimated when food security, income, economic development, and justice are considered [5–7].

In this analysis we explore EBM of fisheries in the generally biologically diverse, but economically impoverished, tropical context. We begin by making generalizations about the status of EBFM based on review of the increasingly extensive literature. The second part of this paper is an evaluation of the current status of an ongoing EBFM initiative in the Philippines. The third part explores one of the most challenging aspects of EBFM in a tropical context—development of supportive institutional frameworks. Criteria for monitoring progress toward EBFM are suggested and applied to the Philippine EBFM effort. This analysis is grounded in the empirical and field experience of the authors, interviews, field observations, legal analysis, and scenario analysis that has engaged practitioners and resources users at the local level in the Philippines. While most analysis for EBFM is in the developed world, the analysis of EBFM in the Philippines presents conclusions that may be relevant to other tropical contexts which frequently share particular ecological, socio-economic, and historic conditions.

## 2. Developing a conceptual model for EBFM

We incorporate a review of hundreds of citations in the marine science and policy literature that refer to ecosystems in a management context. In the listing below we have

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captured the major "species" of ecosystem management (EM) approaches. The purpose is to illustrate a range of the approaches in the literature. With each approach we attempt to capture its chief focus and to identify its application in practice. Thus, we maintain a caveat that these represent a composite and not a perfect rendition of any of the cited papers.

### 2.1. Fisheries centric ecosystem approaches

#### 2.1.1. Ecosystem considerations (EC) [8–9]

EC does not make the claim that the ecosystem is the prime focus in decision-making; however, ecosystem information is considered as part of the basis for management. The use of such information is conservative with management measures that reflect on other aspects of the ecosystem than fishery management—for example, habitat used by fish and other species, level of fishing removals versus biomass, effects of removals and patterns of impacts, and seabird and marine mammal interactions. This is done in conjunction with setting annual catch limits and in management plan amendments for the Alaskan fisheries.

#### 2.1.2. Ecosystem-based fishery management (EBFM) [10–12]

This approach examines current fishery management practices and postulates that an improved understanding and management of stock interactions, stock-prey relationships, and stock-habitat requirements will result in more sustainable fisheries. A prerequisite is the ability to control and account for harvests and fishing effects by controlling overfishing and reducing bycatch and impacts of fisheries on the ecosystem. A set of ecosystem principles is posited and policies to implement them are indicated. Management decisions would be oriented toward precautionary management to better take into account risk and uncertainties as well as to anticipate or plan for trends or changes over time in the fished ecosystem. Probably the most advanced implementation of this in the US context is the North Pacific Fisheries Management Council approach. In the developing nation context, the Fisheries Improved for Sustainable Harvest (FISH) project is at early stages of implementation in the Philippines and described below.

#### 2.1.3. Ecosystem approach to fisheries (EAF) [5,13,14]

This approach differs from the EBFM approach by balancing societal economic needs with ecological function. It focuses on fishery management to make decisions while taking into account other ecosystem components. The Food and Agricultural Organization (FAO) approach is perhaps the most elaborated effort to make operational an EAF using reference points and ecosystem indicators. We are not aware of any regions where this approach is actually taken although the foundations are evolving in some countries and regions (e.g., the Southwest Indian Ocean).

### 2.2. Marine ecosystem focus

#### 2.2.1. Ecosystem-based management (EBM) [15–18]

Instead of a focus on fisheries, the EBM approach calls for an integrated comprehensive approach to management of all human activities in the ocean. Some groups have applied the broad EBM framework to wild capture fisheries [18]. This concept is in the process of development in terms of institutional arrangements required to implement it. It is not clear if existing agencies acting in common are expected to achieve the goal or if it is necessary to establish a core EM entity to do this. The key question is whether decision-makers and institutions are capable of responding.

#### 2.2.2. Ecosystem approach to management (EAM)

This approach is being developed within the US National Oceanic and Atmospheric Administration (NOAA) as a model which could be implemented under current conditions. In a general sense, the intent is to maintain a holistic perspective on fisheries (i.e., EAF) but to nest that into an EAM approach that would apply to all of the marine responsibilities of NOAA and eventually other agencies, e.g., US Department of Interior agencies and the US Environmental Protection Agency. While the main discussion is in a US context, it still presents a model for management in any marine region. The leading example may be in the planning process that Australia is undertaking regionally in its Exclusive Economic Zone (EEZ), but generally most consider the fisheries management under the Commission for the Conservation of Living Marine Resources of the Antarctic Region [19] to be the most elaborated effort in this regard.

#### 2.2.3. Large marine ecosystem management (LME) [14,20–24]

The LME effort to identify the large marine ecosystems of the world has been underway for over a decade. The LME work has delineated 64 LMEs globally and is proceeding slowly to translate these into management-relevant terms. There is demonstrated progress in some areas like the Alaskan Bering Sea region of the US [8], the Gulf of Guinea, the Benguela Current area in southern Africa, and the CCAMLR region [19]. Few of these ecosystems fall within the management authority of a single state, thus there remain significant obstacles to dealing with multi-lateral fisheries management of shared stocks [25], much less with developing ecosystem approaches.

#### 2.2.4. Ecosystem management (EM) [26]

This approach is yet broader than the previous. It purports to manage ecosystems and all activities within them. As for marine application, there does not appear to be any examples and most marine ecologists would agree that the scientific understanding of marine ecosystems lags

that of terrestrial systems [27]. Thus, this may be seen as more of an ideal construct than a pragmatic approach.

If we place the above frameworks in some sort of continuum the following observations emerge. EC represents the starting point of moving from a complete focus on fisheries yields irrespective of the ecosystem toward an ecosystem that is not fished. This might be illustrated as a continuum as in Fig. 1. There is a difference in information type before decision-makers with each approach. As the ability to incorporate ecosystem information increases and the management orientation shifts toward maintaining a sustainable fishery in ecosystem terms, one moves toward the right on the continuum. With respect to EAM and EM, the EBFM approach is not as comprehensive and is decidedly fishery-focused.

From the standpoint of fisheries, EBFM produces a more reliable yield from stocks that are managed for abundance rather than for maximum sustainable yield (MSY) because this makes for greater resilience in the populations of exploited species [28]. Further, the impacts of the fisheries on other aspects of the ecosystem are seen as important. From the standpoint of managing a total ecosystem, EBFM gives a positive starting point in contrast to the perspective that we will never know enough about the ecosystem to manage it.

### 2.3. Synthesis

The fundamental conclusion is that there is neither agreement on what terms to use nor on ecosystem information use in marine environmental management, despite several significant efforts [1,10,15,17,29]. A secondary conclusion is that most of the literature and above models focus on fisheries as the chief human activity of interest because of concerns about the status of fish stocks and their management, direct and indirect impacts of fishing, and the ability of the marine environment to satisfy human economic and nutritional needs and wants in the form of fish. Therefore, we elect to use the term EBFM as a logical focus for getting started with management of marine living resources within an ecosystem context.

After review of the global EBFM and associated literature, the following conclusions can be made:

- The majority of EBFM proponents conclude that many of the world's fish populations are currently overexploited and that associated ecosystems are being degraded. In part, this decline is perceived as the result of management model failure and in part from a lack of or poor implementation of the model through traditional management practice.
- Most approaches focus on protection or restoration of marine environments to a presumed natural state. This may be unrealistic in light of the existing and expanding human ecological footprint.
- Most current approaches are based on humans as a disturbance element rather than as embedded in the ecosystem or as sources of management solutions. This influences the form and implementation of management practices.
- Much of the literature suggests an overemphasis of social benefits and profit from fisheries that tend to result in overexploitation and environmental collapse (or at least shifts into states of lower biodiversity).

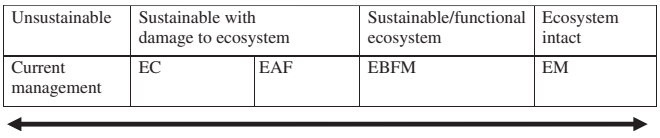


Fig. 1. Continuum of fishery ecosystem state and fishery management model.

Most EBFM approaches are de facto oriented to a management approach exemplified by top-down control whereby national agencies practice sectoral fisheries management. It is assumed that the real and perceived failure of these institutions to perform is a function of their lack of ecosystem approach and not simply management failure or lack of capacity. This may not be true and deserves much more detailed analysis. It might be stated that where top-down control is effective, the prerequisites are present to forge ahead with an EBFM approach [10]. Absent such abilities, EBFM, narrowly construed, cannot be implemented in many contexts. A key element here is that a top-down and data-rich approach is assumed to be a prerequisite and therefore an obstacle to implementation. Fundamentally a lot can be done with the tools of ecosystem "reasoning" to adjust fishery management without having definitive and quantitatively derived answers to each and every management issue. In the case of scientifically data-poor systems, local and traditional knowledge can be informative [30].

Much of the literature lacks a true management dimension. The focus tends toward an idealized version of how the results of fishery management "should" be accomplished without adequate consideration of what is being done and of the constraints on current efforts. At a minimum, movement toward recommending ecosystem approaches must specify the institutions, laws, budgets, and information that are required to actually achieve the ecosystem goals.

Few recommendations for ecosystem approaches are empirically based in which a management approach is linked to actual areas and its performance monitored against postulated ecosystem-based principles or goals. This may be the crux issue at this juncture. The theory is well-developed but empirical testing and practical guidance are not. Quite a bit of the information focuses on developing models for marine ecosystems [31]. This is a key element, but the models tend to be only of the fished food web and not of the fishery—much less the ecosystem and the associated human communities.

How the developing country context will influence ecosystem approaches is poorly understood. Most recommendations are coming from developed nation contexts and perspectives [18] and may contribute to the tendency to suggest top-down approaches. Command and control management mechanisms have generally failed in post-colonial contexts. Increasingly, some proponents are suggesting that EBFM requires the use of participatory processes and local knowledge in order to engage multiple stakeholder groups and fill information gaps, a trend in various forms of resource management [30,32]. The below case describes an experiment in adapting EBFM to contexts where participatory process are standard.

### 2.4. Framework for a practical definition of EBFM

Based on the previous characterization of the literature, three basic questions arise. First, what does EBFM contribute to reform in fishery management? Second, how can this reform occur? Third, what research and analysis will assist in assessing the EBFM approach?

### 2.5. What does EBFM contribute to reform in fishery management?

EBFM cannot be achieved in a management system that is unable to control fishing effort and effects. For EBFM to be effective it must be recognized that to a lesser or greater degree fisheries have impacts on other fisheries (through bycatch or trophic interactions) and on other aspects of the fished ecosystem. If fishery management is conscious of these interactions it is starting on the road of EBFM. If the management approach is ignorant or dismissive of EC, it is not likely that EBFM can be implemented.

The fact that so many examples of unsustainable fishing exist and that we see fishing down food webs over time is demonstration that institutional arrangements for fisheries management have not yet evolved sufficiently. Similarly, when small-scale fisheries are not achieving sustainable results they may be taking place under conditions where traditional control measures are inadequate or are breaking down without adequate replacements.

### 2.6. How can this reform occur?

The existing recommendations match the most valuable theoretical approaches with the least pragmatic management approaches if management is specified at all. Furthermore, there are few concrete examples from which to extrapolate. From an empirical perspective, the reform can occur in some fishery management areas by using what is known about the ecosystem to manage fisheries. This sounds like an obvious approach, but it frequently does not happen.

In order to encourage EBFM information to be brought into management decisions, certain mechanisms need to be developed. The idea that a Fisheries Ecosystem Plan could be prepared for fishery management to initiate EBFM is novel. In the Philippines, and as detailed later, such plans should also include coastal dimensions due to connectivity and management precedents. To the extent the information and institutional competence could be developed, then EBFM could emerge.

The mainstreaming of new ideas is a long and tedious process. Readers should note that it has taken twenty years of concerted effort for integrated coastal management (ICM) to enter into the planning documents of key Philippine national agencies [33–35] through workshops, educational materials, demonstration projects, and sustained financing over decades [36,37].

Assuming that there was sufficient management interest expressed in EBFM it would be necessary to incorporate scientific information from a variety of sources. In the natural sciences, ecosystems are characterized from the perspectives of area extent, structure, function, processes and dynamics over various temporal and spatial scales (e.g., see [38]) and levels of complexity [39]. Ecosystems can be viewed from the parallel perspective related to societal organization for use, management, and protection. In this case, extent of jurisdiction, management structure, and functions and processes can be described. Additionally, the institutional dynamics of interactions over time and in various locations can be described including societal complexity [40–42]. Despite important recent contributions [21] there remains considerable room for empirical work on these fronts [43].

There is also much work to be done integrating both natural and social science information to broadly inform management decisions. Melding these two sources of information is a fundamental challenge for a science-based approach to setting EBFM policies. It is also apparent that local and traditional knowledge can play important roles in explaining how ecosystem/society relationships change through time.

## 3. EBFM in the Philippines: challenges and opportunities

The impetus to change fisheries management in the Philippines is strong, but EBFM faces considerable challenges there and in many tropical, developing country contexts. Philippine marine fisheries are in a state of severe degradation [6,44–46]. The biomass of fish stocks in several important fishery bays in the Philippines is less than 10% of what it was in 1950 [47] with fisheries catch-per-unit-effort declining in most places [44,48]. Coral reefs, mangroves, and water quality are being degraded in many locations [49,50]. Systemic conditions underlie these environmental trends and limit the options available to policy makers. The rising national Gini Index for the Philippines, for example, now at 47 out of 100 and among the highest in the world, indicates that wealth is becoming increasingly concentrated in fewer hands [51]. Poverty, now directly affecting about 40% of the Filipino populace, is worsening. Natural resources are extracted at ever

increasing rates as the Philippine population grows (approximately 88 million people increasing at 1.84% annually) and pressures mount to export commodities to service external debt (55.6 billion US$ or 3.5 times the annual national budget expenditures) [51].

Table 1 displays some of the key fisheries problems and contributing factors affecting marine fisheries in the Philippines, many of which are common in other tropical contexts [44,52]. The issues are complex and inter-related requiring holistic policy responses.

### 3.1. Central challenges to EBFM in the Philippines

While important to take into consideration when designing and evaluating EBFM programs in the tropics, some contextual issues will likely remain outside the direct influence of EBFM initiatives. Well-engrained colonial and neo-colonial conditions that result in weak formal institutions, cronyism, and corruption—similar to many developing countries—are centrally important (but under represented in fisheries management literature). Reliance on international donor-supported, relatively short-term projects—which establishes an inherent instability in management—is unlikely to decrease in the near future due to the scale of the problem and limited financial resources of the Philippine government [36].

The general realization that declining fisheries conditions are linked to imbalanced fisheries policies is evolving slowly toward a state more favorable to EBFM. Empirical evidence [45,46,48,53] supports this conclusion with such trends identified decades ago [54]. Despite the mounting evidence, the predictable tendency has been to favor immediate needs for cheap protein and jobs which tends to favor continued expansion of fisheries, export of high-value commodities, and use of widely recognized destructive gears such as fine mesh gill and trawling nets, cyanide (for live food and aquarium fish) and blast fishing [6]. Fishing effort continues to increase in artisanal and commercial sectors with almost no management, and fishers seek out the few healthy areas near marine protected areas (MPAs) [55]. Three-year terms for mayors, limited funds for enforcement and personnel, limited sharing of resources between municipalities, and competing concerns such as poverty alleviation are also destabilizing to management efforts [35–37,56]. None too late, educational programs have broadened public understandings of the links between food security, economic health, and environmental quality [57,58] and appreciation for sustainable fisheries management appears to be growing [44]. While consensus is emerging as the extent of the problems, the preferred policy response is debated.

EBFM, as are all related models, is under scrutiny since it suggests a rebalancing of the key variables of environment conservation and economic development. However, if EBFM is perceived to favor a mainly environmentalist/natural science-based agenda, as opposed to one that places societal needs at least on par with ecosystem health, then its broad diffusion through Filipino society is unlikely [59–62]. Framing EBFM as a policy that is beneficial to society by supporting food security, sustainable economic growth, and environmental health is a more tenable strategy. Since EBFM is a relatively new model for

Table 1
Key marine fisheries problems and contributing factors

| Core fisheries problems | Contributing factors |
|---|---|
| Declining fish stocks and loss of biodiversity | Overfishing, habitat degradation, illegal and destructive fishing, siltation and pollution |
| Loss of revenues and benefits from fisheries and coastal resources | Postharvest losses, overcapacity, inefficient marketing |
| Systemic underlying conditions | |
| Widespread poverty | Growing poverty in region, lack of economic alternatives among artisanal fishers, unequal wealth distribution |
| Rapid population growth | Policy inattentiveness to overpopulation and food security issues, lack of delivery mechanisms for reproductive health programs in rural coastal communities |
| Open access to marine resources | Lack of economic alternatives for resource users, inter- and intra-sectoral conflicts, low enforcement capacity, low awareness and participation in management in many cases, conflicting and fragmented national policies |
| Inconsistent policies and programs for sustainable fisheries | Continued investments in production-oriented programs while resources in decline, national policies undermine site-level sustainable resource management processes |
| Weak institutional and stakeholder capacity to plan and implement fisheries management | Absence of incentives and vision for institutional change to support sustainable fisheries, inadequate technical and financial support to fisheries management initiatives, weak and inadequate law enforcement, inadequate interagency coordination mechanisms for fisheries and coastal resource management |

resource management, it will take time for a constituency to form around it like the ones that exist for community-based MPAs and integrated coastal management in the Philippines. Fortunately the experience and tools of ICM are directly relevant [34,63].

Three key Philippine laws (the 1991 Local Government Code, the 1998 Fisheries Code, and 1997 Agriculture and Fisheries Modernization Act) shape fisheries policy and jurisdictions for the Bureau of Fisheries and Aquatic Resources (BFAR, a national agency), the Department of Environment and Natural Resources (DENR, a national agency), and Municipal Governments [64,65]. In addition, every five years, the Fisheries Code mandates an updated national fisheries management plan, the most recent completed in 2005.

Since the passage of the Local Government Code (LGC) in 1991, the management of coastal areas has been assigned to the municipal government level. As perhaps the most decentralized marine governance system in the world, Philippine coastal Municipal Governments have jurisdiction over marine space and uses out to 15 km offshore. DENR retains control over permitting of structures proposed in marine and foreshore areas. BFAR, while technically mandated to manage all fisheries, has relinquished almost all management within municipal waters to Municipal Governments. Commercial fishing vessels, defined as greater than 3 gross tons, are supposed to fish outside municipal waters (except with Municipal Government approval to enter the 10–15 km zone) and are managed, albeit loosely, by BFAR.

The LGC was a turning point in the legal-institutional landscape and supported the proliferation of community and municipal-level marine resource management projects. However, there is growing realization that over-reliance on a limited suite of management tools, most commonly community-based MPAs, is problematic. Major fish stocks straddle the 15-km municipal waters boundary (as migrating adults and over the life time of particular fish species) [45]. Furthermore, the municipal water boundary is perceived as arbitrary by many commercial fishing operations that had historic access to areas now legally off limits. Many of these commercial fishing operations continue to fish within municipal waters throughout the country and enforcement capacity is not sufficient to restrain them.

Institutional jurisdictions that have fostered grass roots environmentalism may pose a challenge to EBFM. To quote an experienced Philippines coastal-fisheries manager,

> The geopolitical boundaries and way the country's political units are laid out are all wrong for the ecosystem approach!… The way municipal governments are all given their own jurisdiction (over municipal waters) is good for short-term municipal government-led management, but long-term and larger management will be almost impossible because of the way they are laid out and the sea is divided up into tiny little pockets with very powerful leaders who want to do it their way.
>
> (Stuart Green, October 2004)

Altering the LGC will invariably meet resistance since the highly decentralized system was intended, in part, to ensure broad public influence over government policy—an understandable goal in many postcolonial, postdictatorship societies.

There is no clear road map to scale up from community-municipal to larger ecosystem levels. In contrast to the prevailing practice [66] and theory [59] that emphasize participatory processes, many of the key articles on institutionalization of marine EBM emphasize national and international accords as central to management success [67]. In practice, the incentives for participating in scaled-up management and curtailing resource extraction may become unclear at higher levels of management required by EBFM. Resolving when EBFM is most appropriately dependent on command and control (Pikitch et al. [1], Wang [67]) or bottom-up management models (Christie and White [68]; Malawi Principles in FAO [69]) or a combination of both will require experimentation and evaluation.

The lack of research infrastructure, multi-disciplinary research capacity, and long-term databases to support state-of-the-art EBFM, as currently defined, represents a final suite of challenges. While natural and physical marine sciences are relatively advanced in the Philippines, the resources for more intensive monitoring are not widely available. In some tropical countries, considerable relevant traditional and local knowledge is an important and underutilized source of information [70–72]. However, focusing on developing research capacity is not a stand-alone solution. Case studies show that data—despite the method, quality, and relevance—are rarely the primary basis for coastal marine decisions in the Philippines even when scientific evidence is conclusive [73]. Social, economic and political incentives to adopt EBFM will need to be developed.

### 3.2. Operationalizing EBFM in the Philippines

While the problems are numerous, the Philippines is known globally for innovative responses to such challenges. Two scenario analysis workshops engaged a total of approximately 100 Filipino NGO fisheries management practitioners, government officials, and commercial and artisanal fishers in the exploration of opportunities and challenges of EBFM. In both workshops, participants were tasked with discussing the implications, costs, and benefits of an evolution from current management systems to a form of EBFM that considered ecosystem function and expanded management to ecosystem scales.

The scenario analyses and discussions clearly demonstrated an interest in EBFM as presented by workshop organizers. The links between habitat condition (e.g., coral

cover, mangrove cover) and fisheries productivity or links between trophic levels (e.g., predatory and forage fish) was common knowledge. The mismatch between the ecosystem/problem scale (generally large) and the management intervention scale (generally small) was apparent to almost all workshop participants.

The workshop participants were both inspired *and* intimidated by the prospect of scaling up fisheries management interventions to one that has ecological significance on a large-scale. Institutional, informational, and economic barriers were paramount in everyone's mind. The current lack of strict enforcement of basic fisheries regulations in many areas and unpopularity of limiting fishing effort, especially for poor artisanal fishers, suggests that considerable challenges lie ahead.

Participant opinion that EBFM emerges from current management practices such as community-based MPAs, participatory planning, and integrated coastal management was consistent in both workshops. In other words, people have the most faith in a process that capitalizes on past institutional and monetary investments in fisheries management and marine conservation, rather than starting anew with radically new management models and field interventions. The joint management of commercial/offshore and artisanal/inshore fisheries was identified as essential to attaining ecosystem-scale management. Current management schemes are lacking in this type of holistic approach to what have historically been considered opposing sectors vying for the same dwindling resources.

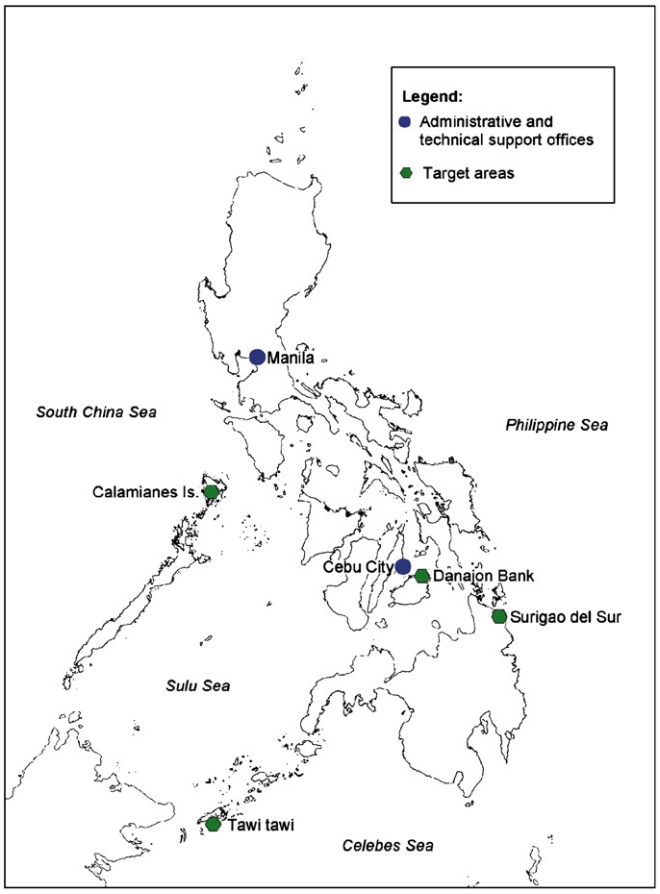


Fig. 2. FISH target areas and administrative centers.

### 3.3. EBFM case: FISH project

The FISH project is a seven-year effort focused on strengthening the capability of local and national institutions to manage coastal resources and marine fish stocks (www.oneocean.org). It is funded with an eight million dollar grant from 2003–2010 from the US Agency for International Development (USAID) to the Philippine government with technical assistance provided by Tetra Tech EMI, a private consultant agency, and other institutions (e.g., University of Washington). FISH has adopted an EBFM framework that is defined in the following manner:

> Ecosystem based fisheries management considers geographically specified fisheries management that takes account of knowledge and uncertainties about, and among, biotic, abiotic, and human components of ecosystems, and strives to balance diverse societal objectives. Such an approach will address human activities and environmental factors that affect an ecosystem, the response of the ecosystem, and the outcomes in terms of benefits and impacts on humans. A distinguishing feature of an ecosystem approach is an emphasis on protecting the productive potential of the system that produces resource flows. For an ecosystem that is already degraded, the goal becomes one of rebuilding or restoring the ecosystem.

The FISH project staff, composed of fisheries scientists, coastal resource managers, and local area field workers (about 30 persons), is initially focusing on four important target areas in the Philippines (Fig. 2).

This project represents USAID's first formal commitment to EBFM, and the continuation of previous efforts to establish integrated coastal management [35–36]. This project is unique for the Philippines and other tropical countries in the following ways:

1. The definition of project target areas was informed by ecological criteria (fisheries boundaries that represent ecosystem function) rather than based mainly on political boundaries.
2. The project is working with groups of municipal and provincial government agencies whose jurisdictions cover the fisheries ecosystem of concern.
3. The project's planning process encourages municipal governments to look beyond their boundaries and commit to an EBFM plan as opposed to only municipal government plans.
4. Ecosystem response to management interventions will be measured throughout the project with specific and

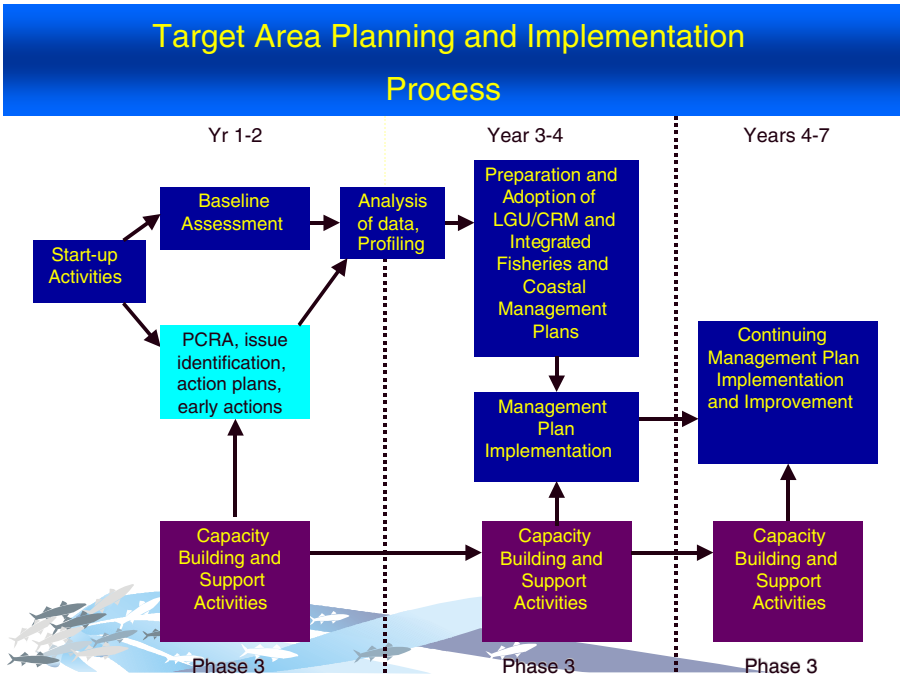


Fig. 3. Target area planning and implementation process for FISH EBFM process.

ambitious goals of 10% increase in biomass of selected fisheries in focal sites of the larger project target areas.

The FISH project will approach EBFM by following the general plan described in Fig. 3. A primary output of the FISH project is an integrated fisheries and coastal EM plan for each of the four target areas. The process of management plan development will be both scientifically rigorous and highly participatory to engage local stakeholders. It will follow these general steps:

(1) Conduct scientific baseline studies on fisheries and coastal habitats for planning and impact evaluation.
(2) Facilitate participatory coastal resource assessment (PCRA) [74] and community planning activities to engage key stakeholders in coastal and fisheries management planning and implementation processes.
(3) Conduct municipal and/or inter-municipal fisheries management planning workshops to develop a clear and viable legal and institutional plan.
(4) Facilitate formal adoption of the fisheries EM plan with corresponding resource allocation (budget and staff) by duly constituted government authorities.
(5) Facilitate formal creation of local level coastal law enforcement units.
(6) Conduct thematic capacity building and trainings for municipal governments (Local Government Units or LGUs), community leaders, and resources users.
(7) Implement initial fisheries management activities for each project site as appropriate to test feasibility before expansion.

Based on project goals and previous experience with fisheries and coastal management [34,35], FISH will emphasize a suite of specific fisheries management activities:

1. Implementing MPA networks designed to protect and rehabilitate coral reef and other coastal habitats, support fish stocks through spill over of adults and larval dispersal, and therby provide social and economic benefits.
2. Limiting access to fishery resources through fisher and fishing boat registration, licensing of fishing operations, zoning fishing areas, gear restrictions and other options as appropriate for a given area.
3. Strengthening fisheries law enforcement.

## 4. Institutionalizing EBFM

EBFM in the Philippines will require the engagement of national, provincial, and municipal government organizations, non-government organizations, and community groups. Fortunately basic legal and institutional structures exist that can be built upon. The LGC states:

> Section 33. Cooperative Undertakings Among Local Government Units—Local Government Units may, through appropriate ordinances, group themselves, consolidate, or coordinate their efforts, services and resources for purposes commonly beneficial to them…

The 1998 Fisheries Code (RA 8550) calls for a holistic approach to coastal and fisheries management.

Title 1, Chapter 1 §2—Declaration of Policy (pp. 1–4):

Table 2
Philippines EBFM case study progress

| Process criteria[a] | Progress by FISH |
|---|---|
| Transparent and participatory planning process (e.g., community groups formed and consulted, community groups influence project and management plan development and implementation) | 3<br>Project staff consult local officials and community groups, overall project design and goals set by project staff |
| Social and natural science generated information influencing planning (e.g., baseline and ongoing monitoring, planning mechanism in place to incorporate information) | 4<br>Project emphasizes systematic ecological and social monitoring, presentation of monitoring results to policy makers and other stakeholders through booklets and workshops |
| Local knowledge of resources and patterns of resource use influencing planning (consistent use of PCRA methods) | 3<br>PCRA techniques conducted in project sites with outcomes complementing scientific monitoring information |
| Ecological knowledge of some form utilized in planning (e.g., management areas represent ecological boundaries, knowledge of fish stock status/trophic interactions, linkages between fish populations/habitats influencing management policy) | 4<br>Scientific monitoring of habitats, fish biomass, and stock sizes informs planning. Project spatial coverage defined by detailed assessment of ecological boundaries (e.g., large barrier reefs and offshore areas) |
| Monitoring information used adaptively (mechanisms in place to encourage or require use of scientific and local knowledge to alter resource management policy) | 4<br>Monitoring is done regularly and informs management policy. Scientific information emphasized |
| Education program in place to encourage policy makers and resource users to adopt EBFM | 3<br>Educational and scenario planning workshops conducted. Educational print materials in preparation |
| *Output criteria* | |
| Fish biomass measured in and near management areas (use of systematic measures of fish biomass as indicator of project success) | 3<br>Goal set for 10% increase in biomass in project areas (target based on feasibly, not set through ecological principles) |
| Reference points for catch per unit effort are established at a precautionary level | 2<br>Goal of 10% increase in CPUE for project sites (target based on feasibly, not set through precautionary principle) |
| Threatened species and habitats are protected | 2<br>Coral reef systems protected. Protection of endangered marine species (e.g., turtles, whales, etc.) not emphasized |
| Habitat and biodiversity protection with establishment of no-take MPA networks (use of systematic measures of habitat and biodiversity protection as indicator of project success) | 2<br>New MPAs networks planned for, but not yet implemented |
| Critical habitat protected from pollution, coastal development and other externalities | 2<br>Management focuses on fisheries and not on linkages between terrestrial and aquatic systems beyond general education |
| Management of ecologically defined assemblages of fish rather than single species | 3<br>Plans and strategies emerging to manage multiple stocks and linkages between inshore and offshore fisheries |
| Reduced or managed fishing effort | 3<br>Management plans in development to register boats and limit effort |
| Multisectoral planning organizations established and functional | 3<br>Regional groups in formation |
| Projects work to establish legal/policy frameworks that foster EBFM | 3<br>Local and national policy development underway |

[a]Ranking criteria:

1 = Not considered within project design, criterion not attained.
2 = Considered within project design in minor manner, implementation beginning.
3 = Considered within project design in significant manner, implementation underway.
4 = Important component of project design, implementation well advanced.
5 = Central component of project design, criterion attained.

It is hereby declared the policy of the State:

- to achieve food security as the overriding consideration in the utilization, management, development, conservation and protection of fishery resources in order to provide the food needs of the population…
- to ensure the rational and sustainable development, management and conservation of the fishery and aquatic

resources in Philippine waters including the Exclusive Economic Zone (EEZ) and in the adjacent high seas, consistent with the primordial objective of maintaining a sound ecological balance, protecting and enhancing the quality of the environment; …

- to manage fishery and aquatic resources, in a manner consistent with the concept of an integrated coastal area management.

The development of the Fisheries Code was 10 years in the making before enactment by the Philippine Congress in 1998 and many opportunities remain to realize its full implementation.

Planning and implementation will require the orchestration of various sectors at multiple levels of governance. Multi-sectoral planning boards with decision-making authority are under formation. At the June 2005 planning meeting hosted by FISH, a Bohol-based multi-sectoral and multi-institutional board named the Danajon Bank Fisheries Management Planning Technical Working Group was formed and endorsed by the Governor of Bohol Province. The group's mandate is to develop a fisheries EM plan and to propose harmonized policies and inter-LGU coordination mechanisms for the management of Danajon Bank, a large double barrier reef and FISH site [75].

## 5. Monitoring progress

The monitoring of initial attempts at EBFM in the Philippines is a useful means to track progress toward the various goals of EBFM. Table 2 captures, in a qualitative sense, the general progress toward various goals that are embedded in the above discussion and FISH project plans. Such evaluative schemes have been developed for ICM and MPA efforts in the Philippines as a means toward encouraging self-monitoring and adaptive management [34,35,73,76]. The criteria emphasizes two important aspects of any successful planning process—process and output.

## 6. General principles for tropical EBFM and future directions

While compelling arguments for EBFM have been made, the imperative of ecosystem-wide thinking will not erase the institutional and economic constraints in most developing countries. Nonetheless, there are some initiatives underway in the Philippines that are moving forward and provide learning opportunities. While in accordance with the general guidelines for EBFM or EAF as defined by NOAA [77], FAO [5], and WWF [18], FISH represents a country-appropriate interpretation of EBFM that considers social, ecological, and historical context.

The EBFM approach necessarily builds incrementally and complements existing management systems that are already proven and functioning in the Philippines. FISH is building from considerable previous investment in integrated coastal management at the community, municipal, and provincial levels. EBFM tools include the fundamentals of sound coastal planning as well as more focused tools such as MPAs, limits on fishing effort and gear type, and fisheries law enforcement, among others. Placing these standard management tools into an EM perspective and plan is novel and potentially useful.

The detailed monitoring of early initiatives in order to capture lessons for their improvement and to inform other such efforts should be a high priority. We lack the empirically grounded knowledge base to inform the scaling-up of current management efforts to ecosystem scales without risking decoupling important constituencies (such as municipal governments and resource users in the Philippines) from the management process and moving beyond institutional or financial capacity. Investment in EBFM for tropical contexts is limited, and investment in external, detailed evaluation is even less. It should be noted that this mistake was made with ICM and community-based MPAs in the 1980s and 1990s [78]. This hampered adaptation and improvement in field implementation and in design of donor supported projects [35]. Once such detailed studies are conducted, robust empirically grounded guidelines for EBFM should be developed, experimented with in various contexts, and re-evaluated.

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