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ECOSystems Improved for Sustainable Fisheries (ECOFISH) Project

**ECOSYSTEMS IMPROVED FOR  
SUSTAINABLE FISHERIES  
(ECOFISH) PROJECT**

## **ECOSYSTEMS IMPROVED FOR SUSTAINABLE FISHERIES (ECOFISH) Project**

# **BASELINE ASSESSMENT PLAN**

**ECOFISH Document No.: 07/2013**

Version: Draft

*Implemented with:*

Department of Agriculture-Bureau of Fisheries and Aquatic Resources  
National Government Agencies  
Local Government Units  
Assisting Organizations

*Supported by:*

United States Agency for International Development  
Contract No.: AID-492-C-12-00008

*Managed by:*

Tetra Tech ARD

30 April 2013

# **Ecosystems Improved for Sustainable Fisheries (ECOFISH) Project**

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Tetra Tech-ARD

30 April 2013

***DISCLAIMER***

*The views expressed in this document do not necessarily reflect the views of the United States Agency for International Development or the United States Government.*

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## List of Abbreviations and Acronyms

BFAR	-	Bureau of Fisheries and Aquatic Resources
CBMS	-	Community-Based Monitoring System
COP	-	Chief of Party
COR	-	Contracting Officer's Representative
CPUE	-	Catch per Unit Effort
CRM	-	Coastal Resource Management
CTI-CFF	-	Coral Triangle Initiative for Coral Reefs, Fisheries, and Food Security
DQA	-	Data Quality Assessment
DENR	-	Department of Environment and Natural Resources
EAFM	-	Ecosystem Approach to Fisheries Management
ECOFISH	-	Ecosystems Improved for Sustainable Fisheries Project
FACTS	-	U.S. Foreign Assistance Coordination and Tracking System
FGD	-	Focus Group Discussion
FISH	-	Fisheries Improved for Sustainable Harvest Project
GCRMN	-	Global Coral Reef Monitoring Network
GIS	-	Geographic Information System
GPH	-	Government of the Philippines
IR	-	Intermediate Result
KII	-	Key Informant Interview
KIM	-	Knowledge and Information Management
LGU	-	Local Government Unit
LIT	-	Line-Intercept Transect
MERF	-	Marine Environment Resources Foundation
MKBA	-	Marine Key Biodiversity Area
MPA	-	Marine Protected Area
NGO	-	Nongovernmental Organization
PMP	-	Performance Monitoring Plan
PO	-	People's Organizations
PPP	-	Public-Private Partnership
USAID	-	United States Agency for International Development

# 1. Introduction

The technical assistance and services contract was awarded to Tetra Tech for the implementation of USAID/Philippines' Ecosystems Improved for Sustainable Fisheries (ECOFISH) Project in June 29, 2012, under contract number AID-492-C-12-00008. The main objective of the ECOFISH Project is to improve the management of important coastal and marine resources and associated ecosystems that support local economies. The ECOFISH Project is intended to foster fishing sector reforms through the application of the Ecosystem Approach to Fisheries Management (EAFM) in larger marine conservation areas and involving clusters of Local Government Units (LGUs). It will promote the growth and restore the profitability of fisheries through conservation of ecosystem health and effective management.

The ECOFISH Project is in line with the current U.S. Country Assistance Strategy with respect to assistance directed at reducing threats to biodiversity and improving natural resources and environment. It is also expected to contribute to achieving "Development Objective 3: Environmental Resilience Improved" (particularly "IR1.3. Natural Resources and Environmental Services Improved") of the proposed results framework for the planned USAID/Philippines Mission's Country Development Cooperation Strategy. The ECOFISH Project is also designed to contribute to priority goals and actions laid out in the Philippine Development Plan (2011-2016) particularly Chapter 4 (Competitive and Sustainable Agriculture and Fisheries), and Chapter 10 (Protection, Conservation and Rehabilitation of Environment and Natural Resources). This five-year project will provide technical assistance to the Government of the Philippines (GPH), through the Department of Agriculture – Bureau of Fisheries and Aquatic Resources (DA-BFAR) and implemented in partnership with selected LGUs.

This document puts together the project team's plans in the collection and analysis of data and information to be able to describe and establish the baseline at the start of the project. These established data and information will serve as reference points for the project's performance through scheduled monitoring events. This baseline assessment plan will focus on the methodologies that will be used to establish baseline conditions for key performance indicators that describe the status of marine fish stocks, employment, capacity to manage fisheries and other relevant reference points at the start of the project. This document, however, will not include baseline and monitoring parameters that have zero values at the start of the project. They will just be subject to a simple accounting system that will likewise be set up by the project. This plan is guided by the ECOFISH Results Framework and will complement the Performance Monitoring Plan (ECOFISH Document No. 06/2013). It describes methodologies for collecting and analyzing data to evaluate progress and impact of the project interventions over the life of the project.

Information derived from the baseline assessment will not only serve as reference points for project performance. It will also serve as information to roll out early fisheries management actions, as well as other project interventions such as drafting of management plans, vulnerability assessment, input to national database on EAFM, input to the State of the Marine Resources Report, species and gear specific studies, MPA network analysis, cost-benefit analysis, and value chain analysis.

## **2. Project Objectives**

The main objective of the ECOFISH Project is to improve the management of important coastal and marine resources and associated ecosystems that support local economies. It will conserve biological diversity, enhance ecosystem productivity and restore profitability of fisheries in eight marine key biodiversity areas (MKBAs) using the ecosystem approach to fisheries management (EAFM) as a cornerstone of improved social, economic and environmental benefits.

The application of EAFM principles and practices is a proven approach for reversing the decline of fish biomass in municipal waters and build community resilience. EAFM aims to manage fisheries at ecosystem scales rather than the scales defined by jurisdictional boundaries. Effective collaborative governance arrangements for EAFM provides the multiple benefits of improving ecosystem management, reducing the unit costs of management, and making the establishment of sustainable financing mechanisms and public-private partnerships (PPPs) more feasible and attractive to investors. Development of PPPs is a key strategy of the Philippine Development Plan.

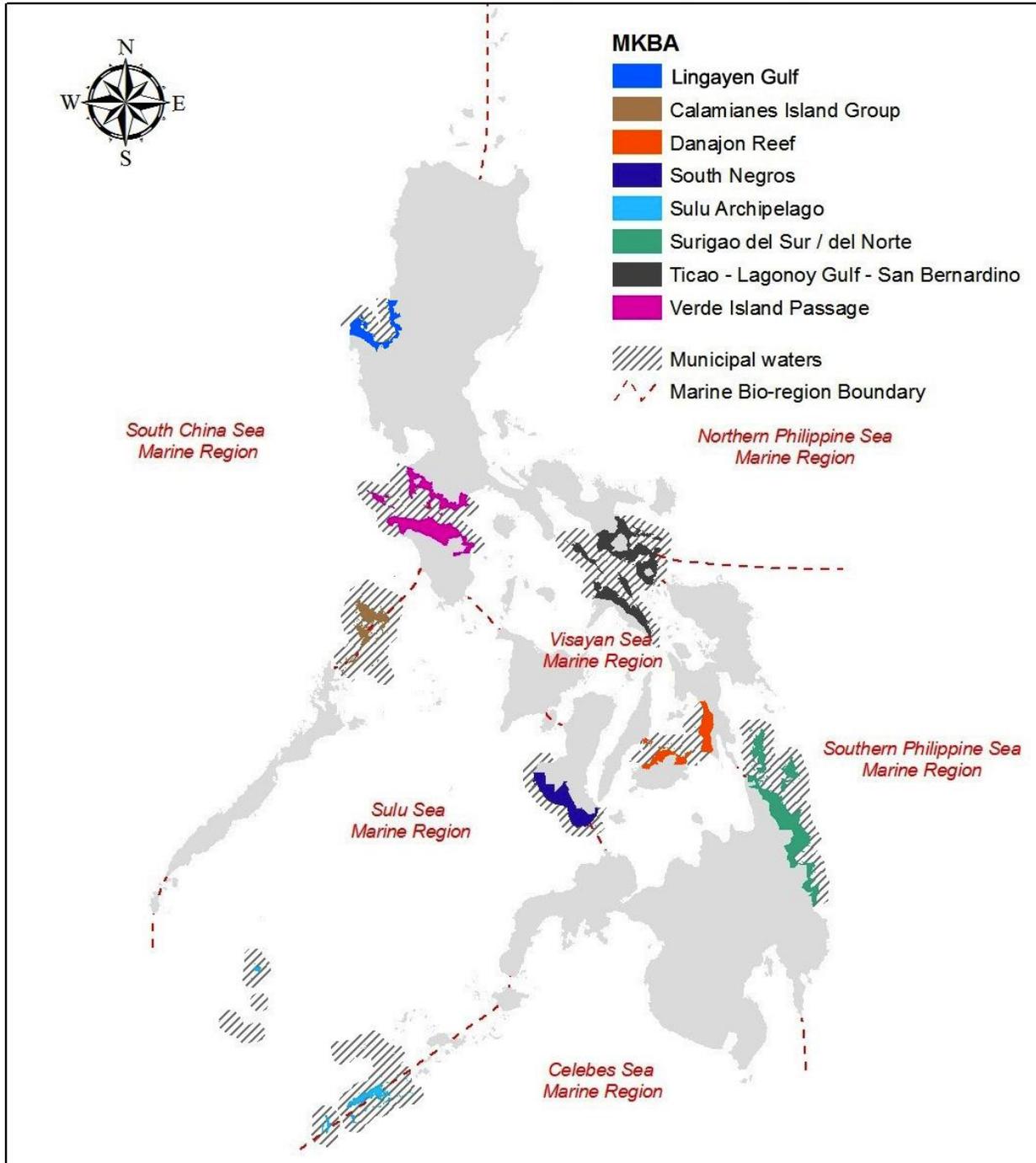
The ECOFISH Project is designed to make an impact on eight MKBAs in the country (Figure 1), namely: (1) the Calamianes Group of Islands MKBA, (2) Lingayen Gulf MKBA, (3) Ticao Pass – Lagonoy Gulf - San Bernardino Strait MKBA, (4) Danajon Reef MKBA, (5) South Negros MKBA, (6) Surigao del Sur and Surigao del Norte MKBA, (7) Sulu Archipelago MKBA, and (8) Verde Island Passage MKBA. They represent all six marine bio-regions of the Philippines and were selected due to their extremely high need for marine biodiversity conservation.

## **3. Results Framework**

At the end of five years, the 13 ECOFISH project deliverables are expected to lead to the following key results:

- (A) An average of 10% increase in fisheries biomass across the eight MKBAs.
- (B) A 10% increase in the number of people gaining employment or better employment from sustainable fisheries management from a baseline established at the start of the project.
- (C) Establishment of a national capacity development program to enhance the capacities of LGUs and relevant national agencies to apply ecosystem-based approaches to fisheries management.
- (D) Eight public-private partnerships supporting the objectives of the ECOFISH project created and operating.
- (E) One million hectares of municipal marine waters under improved management.
- (F) A core of 30 LGUs across the eight MKBAs with improved capacity for implementing ecosystem approaches to fisheries management.

Table 1 presents the main relationship between the 13 deliverables and the six key results. Tasks and deliverables leading to Results C and D build the foundation for project activities. Those for Results E and F drive the implementation at the MKBA level, and taken together they attain the overall ECOFISH Results A and B.



**Figure 1. Map of the Eight Marine Key Biodiversity Areas (MKBA) of ECOFISH**

**Table 1. Main Relationship between Project Tasks, Deliverables and Results**

Tasks	Deliverables	Results	
		<p><b>Result A.</b> An average of 10% increase in fisheries biomass across the eight MKBAs.</p> <p><b>Result B.</b> A 10% increase in the number of people gaining employment or better employment from sustainable fisheries management from a baseline established at the start of the project</p>	Final Outcomes
<p><b>Task 1.</b> Establish and Implement a National Training Program</p> <p><b>Task 2.</b> Provide Technical and Advisory Support at the National Level</p> <p><b>Task 3.</b> Create Public-Private Partnerships</p>	<p><b>Deliverable 1.</b> Policy Studies on EAFM, MPA, and Climate Change</p> <p><b>Deliverable 2:</b> Toolkits, Sourcebooks, and Case Studies on EAFM, MPA, and Climate Change</p> <p><b>Deliverable 3:</b> A National Database on EAFM Established Using the Annual Monitoring Data in the 8 MKBAs</p> <p><b>Deliverable 4:</b> State of the Marine Resources Report</p> <p><b>Deliverable 5:</b> National, Regional and Municipal EAFM Trainings Conducted</p> <p><b>Deliverable 6:</b> Public-Private Partnerships Supporting ECOFISH Objectives Established</p>	<p><b>Result C.</b> Establishment of a national capacity development program to enhance the capacities of LGUs and relevant national agencies to apply ecosystem-based approaches to fisheries management.</p> <p><b>Result D.</b> Eight public-private partnerships supporting the objectives of the ECOFISH project created and operating</p>	Build Foundation
<p><b>Task 4.</b> Provide Technical and Advisory Support at the Local Level</p> <p><b>Task 5.</b> Develop a Registry of Users of Municipal Fishing Waters</p> <p><b>Task 6.</b> Identify and Implement Sustainable Financing Programs to Support EAFM Projects</p> <p><b>Task 7.</b> Establish a Baseline on Coastal and Marine Resources and Relevant Socio-economic Information, Develop and Apply Metrics on Monitoring EAFM Implementation in Target MKBAs</p>	<p><b>Deliverable 7:</b> Bio-physical, Social and Economic Baseline Assessments of the 8 MKBAs</p> <p><b>Deliverable 8:</b> Scientific Studies on Select MKBA- Specific Fish Species</p> <p><b>Deliverable 9:</b> MPA Network Analyses in the 8 MKBAs</p> <p><b>Deliverable 10:</b> Fisheries Management Plans of Select Inter-LGU Alliances in the 8 MKBAs</p> <p><b>Deliverable 11:</b> Registry of Users of Municipal Fishing Waters Established in Select Municipal LGUs in the 8 MKBAs</p> <p><b>Deliverable 12:</b> Revenue Generation System for Fisheries Management Established and Effectively Implemented in Select LGUs</p> <p><b>Deliverable 13:</b> Sustainable Financing Programs for EAFM Implemented in Select LGUs in the 8 MKBAs</p>	<p><b>Result E.</b> One million hectares of municipal marine waters under improved management.</p> <p><b>Result F.</b> A core of 30 LGUs across the eight MKBAs with improved capacity for implementing ecosystem approaches to fisheries management.</p>	Implement Best Practices

## 4. Site-Level Implementation

The project has developed an approach to site-level implementation in the MKBAs. This tailored approach will employ different entry points for various interventions. The project team will work with a broad array of stakeholders to scale implementation into focal, expansion, and replication areas (Table 2) within each MKBA and tailor the types and timing of project activities to the needs of each. A focal area in each MKBA will be established or strengthened (as in the case of the former FISH Project focal areas). Focal areas will be used to apply EAFM principles and practices and measure changes compared to baseline conditions.

**Table 2. Estimated Number of Municipalities for Different Scales of Project Implementation**

Marine Key Biodiversity Areas	Number of municipalities in focal areas	Number of municipalities in expansion areas	Number of municipalities in replication areas	Total
1. Calamianes Island Group	3	1	0	4
2. Lingayen Gulf	4	7	6	17
3. Danajon Reef	10	7	2	19
4. South Negros Island	3	3	5	11
5. Sulu Archipelago	3	2	6	11
6. Surigao del Sur and del Norte	7	5	27	39
7. Ticao Pass - San Bernardino Strait - Lagonoy Gulf	5	4	33	42
8. Verde Island Passage	7	4	15	26
Total	42	33	94	169

## 5. Baseline Assessment

This baseline assessment plan describes the methodology that will be used to establish baseline conditions for key performance indicators at the start of the project. It also details the methods on how to measure and monitor increase in fisheries biomass, number of people gaining employment, capacity of partners to apply ecosystem-based approaches to fisheries management, area of municipal waters under improved management, number of local government units capable of implementing EAFM, and number of public-private partnership created during the life of the project. This plan, together with the Performance Monitoring Plan (ECOFISH Document No. 06/2013), establishes the methodologies for collecting and analyzing data to evaluate progress and impact of the project interventions over the life of the project.

## 5.1. Fisheries and MPA Baseline Assessment

The fisheries and MPA baseline will be determined and established using the most practical method applicable for typical exploited multispecies fish stocks in the tropics like the Philippines. The choice of methods and parameters to be measured is based on the following assumptions:

- Use assessment and monitoring methods appropriate to project goals that are cost efficient.
- Apply best available scientific methods, and in particular, those methods used and tested in USAID's 7-year FISH Project.
- Select and modify methods to build on already existing Philippine data collection methods.
- Only fisheries dependent methods shall be conducted to measure increase in biomass across MKBAs.
- Subsequent assessments to evaluate project result in years 2015 and 2017 shall be carried out in the same months when baseline data collections were conducted and taking into consideration the phase of the moon.
- Other fisheries related parameters to be measured shall supplement or serve as basis for evaluating the primary project result.
- To the extent possible (namely, without unduly sacrificing the accuracy of results for project evaluation purposes), practical methods shall be selected or designed such that, these can be carried out by the stakeholders beyond the life of the project.

With the assistance of site coordinators, the Baseline Assessment Team will assemble and review all available secondary information about the fisheries in the MKBAs and more specifically, in the focal areas. This initial step will give the team a general idea of the fisheries in the various areas, determine information deficiencies, and provide guidance on the appropriate and efficient field data collection protocol for fisheries baseline assessment in the focal areas.

This section describes methods that will be used to establish the baseline conditions for ECOFISH Project Result A, that is,

**“An average of 10% increase in fisheries biomass across the eight MKBAs”.**

The first component of the parameter is the catch rate, in this case, the average catch per unit effort (CPUE) of selected fisheries in the focal areas. The average CPUE will become the proxy estimate of fish biomass in the focal areas. The computation will be the percentage change in CPUE, compared to baseline, using fisheries dependent methods. Information to compute for these parameters will primarily be collected through catch and effort monitoring and further supported by information from key informant interviews (KII).

The basic parameters used to measure the change in biomass are the weighted averages of catch per unit effort of various fishing gears used during the 3-month catch and effort monitoring using the number of samples as weighing factor:

$$\overline{\text{CPUE}}_{\text{baseline}} = \frac{(\text{CPUE}_1 \times n_1) + (\text{CPUE}_2 \times n_2) + \dots + (\text{CPUE}_n \times n_n)}{n_1 + n_2 + \dots + n_n}$$

where:  $\overline{\text{CPUE}}_{\text{baseline}}$  = proxy estimate of fish biomass represented by the weighted average catch per unit effort estimated using fishery-dependent surveys

$\text{CPUE}_1$  = average catch per operation of 1<sup>st</sup> fishing gear type monitored

$\text{CPUE}_2$  = average catch per operation of 2<sup>nd</sup> fishing gear type monitored

$\text{CPUE}_n$  = average catch per operation of n<sup>th</sup> fishing gear type monitored

$n_1$  = number of samples of the 1<sup>st</sup> fishing gear type monitored

$n_2$  = number of samples of the 2<sup>nd</sup> fishing gear type monitored

$n_n$  = number of samples of the n<sup>th</sup> fishing gear type monitored.

The change in biomass  $\Delta\text{CPUE}$  is measured as the change in the catch per unit of effort of selected fisheries surveyed using fisheries-dependent methods:

$$\Delta\text{CPUE} = \frac{\overline{\text{CPUE}}_{\text{monitoring}} - \overline{\text{CPUE}}_{\text{baseline}}}{\overline{\text{CPUE}}_{\text{baseline}}} \times 100$$

where:  $\Delta\text{CPUE}$  = change in CPUE estimated using fishery-dependent survey methods

$\overline{\text{CPUE}}_{\text{baseline}}$  = weighted average catch per unit effort of gears used in the fisheries-dependent survey during baseline assessment

$\overline{\text{CPUE}}_{\text{monitoring}}$  = weighted average catch per unit effort of gears used in the fisheries-dependent survey during monitoring

100 = multiplier to express the result as percent change.

The second component of the parameter is the reef fish biomass in marine protected areas, in this case, the average reef fish biomass inside and adjacent to MPAs in the focal areas. The computation will be the percentage change in reef fish biomass, compared to baseline, using MPA assessment methods. Information to compute for these parameters will primarily be collected through fish visual census.

The basic parameters used to measure the change in reef fish biomass are the weighted averages of reef fish biomass using the area of the MPA as weighing factor:

$$\overline{\text{MPABiom}}_{\text{baseline}} = \frac{(\text{RFishBiom}_1 \times a_1) + (\text{RFishBiom}_2 \times a_2) + \dots + (\text{RFishBiom}_n \times a_n)}{a_1 + a_2 + \dots + a_n}$$

where:  $\overline{\text{MPABiom}}_{\text{baseline}}$  = MPA fish biomass represented by the weighted average reef fish biomass estimated using MPA assessment methods

$\text{RFishBiom}_1$  = average reef fish biomass of 1<sup>st</sup> MPA surveyed

$\text{RFishBiom}_2$  = average reef fish biomass of 2<sup>nd</sup> MPA surveyed

- RFishBiom<sub>n</sub> = average reef fish biomass of n<sup>th</sup> MPA surveyed
- a<sub>1</sub> = area of the 1<sup>st</sup> MPA surveyed
- a<sub>2</sub> = area of the 2<sup>nd</sup> MPA surveyed
- a<sub>n</sub> = area of the n<sup>th</sup> MPA surveyed.

The change in biomass  $\Delta$ MPABiom is measured as the change in the reef fish biomass of MPAs surveyed using MPA assessment methods:

$$DMPABiom = \frac{\overline{MPABiom}_{\text{monitoring}} - \overline{MPABiom}_{\text{baseline}}}{\overline{MPABiom}_{\text{baseline}}} \times 100$$

- where:  $\Delta$ MPABiom = change in MPA biomass estimated using MPA assessment methods
- $\overline{MPABiom}_{\text{baseline}}$  = weighted average of reef fish biomass of MPAs surveyed during baseline assessment
- $\overline{MPABiom}_{\text{monitoring}}$  = weighted average of reef fish biomass of MPAs surveyed during monitoring
- 100 = multiplier to express the result as percent change.

The average change in fisheries biomass  $\Delta$ B is the combination of both components and estimated using the following:

$$DB = \frac{(DCPUE \cdot w_c) + (DMPABiom \cdot w_m)}{w_c + w_m}$$

- where:  $\Delta$ B = change in fisheries biomass
- $\Delta$ CPUE = change in CPUE estimated using fishery-dependent survey methods
- $\Delta$ MPABiom = change in MPA biomass estimated using MPA assessment methods
- w<sub>c</sub> = weighing factor for fishery-dependent survey methods
- w<sub>m</sub> = weighing factor for MPA assessment methods

The weighing factors will scale the components relative to the area they cover in their respective focal areas. For the estimation of the overall weighted average of all the focal areas of the eight MKBAs, weighing factors will likewise be applied and the values will be proportionate to the areas covered by the respective area of coverage of each focal area. These values, however, can only be finalized after the profiling and finalization of municipal waters included in each respective focal area.

### **5.1.1. Catch and effort monitoring**

Fisheries dependent survey consists mainly of catch and effort monitoring of all fishing activities during a specific period of time. In this case, a 3-month time series data will be collected to determine CPUE of municipal fishing gears operating in the focal areas. Landed catch of fishing gears will be monitored on a daily basis for 3 straight months. The idea is to collect the same set of parameters during establishment of baseline in year 2013 and during subsequent project monitoring that was also to be conducted during the same 3-month period in years 2015 and 2017. Enumerators will be hired to do daily catch and effort monitoring in selected landing sites. The same months of the year will be used in monitoring increase or decrease in CPUE in the future. The catch monitoring schedule will follow a 3-day cluster scheme, designating the first 2 successive days for field work and the third day as rest day. The scheme always starts on the first day of each month. This will provide a higher likelihood of sampling both lean and peak days of fishing, covering holidays, weekends, and “must” fishing days, such as the eve of market days.

Aside from CPUE, the total monthly landings for the 3 months shall also be established. CPUE alone will only show the catch rate of a fisher operating a specific fishing gear. It does not, however, fully reveal the effect of changes in fishing pressure brought about by increase or decrease in the number of fishing gears or number of fishers. To determine this, additional sets of information have to be gathered. These include the total number of fishers operating in the focal areas, the total number and type of fishing gears being used, and the number of days of operation for the sampling duration. Non-fishing days for specific fishing gears influenced by the lunar phases, tidal fluctuations, magnitude of currents and weather conditions shall be carefully noted and considered in the estimation of total landings. Together, these sets of information can provide estimates of the daily or monthly total landings by all gears operating in the focal areas during the baseline data collection and in future catch monitoring activities.

An inventory of municipal fishing crafts (classified into motorized and non-motorized), fishing gears, and fishers in the focal areas shall be conducted. In addition, information about gear types, size, specifications, mode of operation, frequency of use, and seasonality of fishing operations shall be collected. This information, together with that on commercial fishing crafts (in case they are also operating in the area), will give baseline information on the level of fishing effort in the area.

For catch monitoring purposes, the team will also determine major and minor municipal landing sites in the focal area. Sampling sites for catch data collection shall be selected in such a manner that both major and minor landing sites are proportionately represented. Future catch monitoring activities to evaluate the quantitative objectives shall be conducted in the same sites selected and the same months of the year.

Actual catch data collection shall be conducted every day in all selected sampling sites for 3 consecutive months. At least three catches for each gear type shall be collected and processed everyday. For relatively large catches, samples are to be taken. Fish samples should be bought so as not to bother the fishers and also enable the data collectors to process more catches.

Enumerators will be assigned in strategic sampling sites and provided with gridded maps to accurately trace the source of the catch. Information to be collected shall include the following: sampling site, date, and time; fishing ground location (with reference to map grids); fishing boat size, propulsion, horsepower, number of fishers; fishing gear type, specifications (design, dimension, mesh or hook size, bait used and accessories); mode of operation, number of hauls, time of setting and hauling; total weight of catch; species composition by weight and number; and length frequency distribution of important species. Information like the number of operation, harvesting, or landing per day shall be considered. All catch should be convertible to kilograms per day.

The overall effect of project interventions will be measured as percentage change in the weighted average of CPUEs of the fishing gears operating in each focal area. It will be the weighted average relative to their number operating in the focal area. The overall average for the 8 MKBAs will be weighted relative to the area covered by the intervention, primarily represented by the selected focal area of each MKBA.

As a support measurement to verify the catch rates trend, the percentage change in the weighted average of CPUEs of selected fishing gears (bottom set gill net or bottom set longline) common to all or majority of the focal areas will likewise be computed as another basis for estimating this particular project result of increase in fish biomass.

### **5.1.2. Key informant interview and focus group discussion**

Since actual data collection is limited only to a 3-month duration, information on seasonal variations will be captured through key informant interview and focus group discussion. Qualified key informants at the barangay level are the presidents or chairs of people's organization, barangay captain (especially if he or she is also a fisher), barangay council chair of fisheries and environment committee, fish warden, and elderly fishers with long fishing experience. Information to be gathered shall include the following: types of fishing gears used by the fishers in their area, specifications, mode of operation (including seasonality of use), estimated average catch per day (seasonal variation if applicable), and ranking of major species caught (include seasonal variation if applicable).

### **5.1.3. Other fisheries-related measurements**

Fisheries management interventions, if successful, will not only positively affect CPUE, total landings, or stock density but in the long term, can also result in improvement of catch composition and size composition, particularly towards catching economically more valuable and larger fishes. These qualitative features can be derived from existing data collected in both fishery-dependent and independent surveys mentioned above.

#### ***Catch Composition***

Species composition of catches by all fishing gears operating in the focal areas shall be determined during the baseline data collection phase and will serve as basis for comparison in future catch monitoring activities. In the 3-month catch monitoring activities and test fishing experiments, catch samples are to be sorted to establish the species composition by weight and

number. Putting them together, these sets of information will indicate the aggregate species mix during the baseline data collection for comparison with future catch monitoring activities. Changes can be measured in terms of change in the abundance of commercially important species in the catch or in the average trophic level of the catch. As an added feature, the weight and number ratio can also be estimated and can provide an indicative value of the average size of each particular species of fish or invertebrate in the catch.

### ***Size Composition***

Change in the average sizes of fishes is not among the parameters to directly measure the quantitative objectives of the project but can also be determined from the information to be collected. This can be used to establish the mean sizes of various fishes caught by different fishing gears operating in the focal areas during the baseline assessment phase and to serve as basis for comparison in future catch monitoring activities. Though the weight to number ratio can serve as an indicative value of the average size of a particular species of fish or invertebrate in the catch, this can, however, be better statistically shown by the length frequency distribution. With individual lengths of fishes and invertebrates in the sorted catch measured, the length frequency distributions for species in the catch can be constructed and will serve as basis for future comparison. Through this, increase or decrease in average size through time can be statistically compared. These sets of information can also become inputs to length-based stock assessment tools.

### **5.1.4. Activities and schedule**

Fisheries baseline data shall be collected in selected sampling sites within each focal area. Two core teams will be formed, one for the MKBAs in the four old FISH Project sites and the other for the four new MKBAs. The first group will be conducted by the prime contractor (Tetra Tech – ARD) while the other will be lead by MERF. A senior researcher will lead each core team supported by one junior researcher and 10 to 14 enumerators in each focal area. The two teams will collaborate to standardize the method particularly learning from the lessons and knowledge gained during the catch monitoring by the FISH Project (FISH Project 2010).

Catch and effort monitoring will be conducted for a total period of 3 months. A coordinator will be assigned to supervise the enumerators and perform weekly data encoding. Encoded data will pass through a quality control process prior to input into the performance monitoring database. The schedule for conducting specific components of the fisheries baseline assessment in each focal area is shown in Table 3.

**Table 3. Schedule of Activities During the Three-Month Fisheries Baseline Assessment in the Focal Areas.**

Focal Area Activities	2013																					
	Month 1			Month 2			Month 3			Month 4			Month 5			Month 6						
Make representation with LGU for experimental fishing	█	█	█																			
Hire enumerators		█	█																			
Train enumerators and field assistants			█	█																		
Monitor catch and effort					█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Encode and analyze data					█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Prepare final report																					█	█

## 5.2. Marine Protected Area Baseline Assessment

Strengthening and establishing MPAs in each focal area to enhance fisheries production and marine ecosystem integrity is a major management mechanism of the FISH Project. These MPAs will form the building block of a network of MPAs to be established in each MKBA. An MPA network is a group of MPAs that interact ecologically such that sources of eggs, larvae, and propagules in one MPA may enhance recruitment in another. It can protect a species or group of related species if the component MPAs are sited in areas where such species are most vulnerable, such as, in aggregation sites, in critical habitats of particular life stages or along chosen points in migratory routes. As a key step towards MPA establishment, baseline assessment will be conducted in existing MPAs or in potentially new areas where MPAs will be established in each focal area. An MPA network will also have a social component that strengthens management effectiveness through sharing management protocols and issues among network members.

A key activity prior to selection of MPAs to be supported by the project, as well as establishment of new MPAs in the area to form the network of MPAs, is the inventory of existing MPAs in each MKBA. Existing MPAs, active or inactive, will be evaluated using MPA Management Effectiveness Assessment Tool (MEAT). MEAT as a tool have elements to gauge important threshold indicators and processes that would help evaluate the management effectiveness of an MPA and therefore guide the project in determining its necessary inputs, interventions, or investments to promote effective MPA management. The selection of MPAs that will form part of the network as well as the immediate project intervention to strengthen management of existing MPAs will be based on this.

### 5.2.1. Selection of existing or potential MPAs

The baseline assessment of MPAs will be conducted in existing or potential MPAs that are likely to be included in the MPA networks to be established by the Project. Some focal areas may contain MPAs that the project could build upon to develop into an MPA network. In other areas,

no MPAs currently exist, thus requiring the identification of potential ones. Table 4 presents the criteria (in a rough order of priority) for selecting MPAs to be monitored.

**Table 4. Criteria for Selecting MPAs to Include in the Baseline Assessment.**

Criterion	Remarks
1. Recently established or not functioning well	Benefits (or lack thereof) from the MPA should be traceable to the support initiatives of the FISH Project
2. Minimum size of 10 ha; preferred size greater than 20 ha	More likely to be effective and thus more likely to exhibit detectable signs of improvement
3. No-take zone is present and likely to be enforced	Strong community support or interest in establishing or managing an MPA
4. Habitat has ecological value and potential for improvement	Live coral cover present, possible source or sink for coral reef and fisheries recruitment
5. Habitat is not under grave threat or risk of irreversible damage	Potential risk areas such as pollution and reclamation areas should be avoided

During an initial reconnaissance trip, the team will conduct informal consultations with selected informants to assess the first three and fifth criteria, and a manta tow survey to assess criteria number 4. The manta tow survey will cover the reef areas in the vicinity of existing MPAs or those areas that are most feasible for functional and implementable MPAs. At least three existing MPAs within each focal area will be selected for the surveys on the basis of information from the initial manta tow survey and from informal discussions with local fishers.

### **5.2.2. Reef fish biomass inside and adjacent to selected MPAs**

Reef fish biomass and density will be measured in three MPAs within each focal area. Reef fish assemblages will be surveyed using the standard visual census techniques in English *et al.* (1997). All fish (including juveniles) encountered within 5 meters of either side of the 50-m transect line will be identified and counted, and their size (total lengths) will be estimated to the nearest 1 cm. A minimum of five transects will be surveyed inside and another five outside of each selected MPA (or other reef site). Length data will be converted to biomass estimates by using length-weight relationships in the literature. Biomass of “major,” “target,” and “indicator” species will be separately estimated. Biomass will be expressed as metric tons per km<sup>2</sup> and density will be expressed as number of individuals per km<sup>2</sup>.

### **5.2.3. Reef fish species richness inside and adjacent to selected MPAs**

As part of reef fish assessment described above, the number of species encountered in each transect will be noted, thus providing data on species richness. Species richness will be expressed as number of species per km<sup>2</sup>.

### **5.2.4. Benthic condition inside and adjacent to selected MPAs**

The line-intercept transect (LIT) method (English *et al.* 1997) will be used to obtain data on life form/genera that will be the basis for assessing the percentage of living coral cover. Video

footages of the transect (video transect method, English et al. 1997)) as well as panoramic shots will be taken as documentation and as supporting data to estimate coral cover. In addition, the general characteristics of the reef site will also be noted, such as depth, steepness of slope, general reef typology, and bottom rugosity. The baseline assessment of the benthic conditions will be made simultaneously with reef fish assessment and along the same transect line.

### 5.2.5. Activities and schedule

**Table 5. Schedule of Activities for the MPA Assessment in the Focal Areas**

Focal Area Activities	2013																															
	Jan				Feb				Mar				Apr				May				Jun				Jul							
Make representation with LGU for Habitat Assessment																																
Prepare logistics and supplies for Habitat Assessment																																
Establish sites and do Habitat Assessment Surveys																																
Encode and analyze data																																
Bi-monthly report																																
Prepare report																																

B- Batangas; N – Southern Negros; L – La Union; S – Sorsogon.

The baseline conditions and their subsequent monitoring for the rest of the ECOFISH Project will just require some form of accounting and benchmarking. This includes measuring the capacity of partners to apply ecosystem-based approaches to fisheries management, the area of municipal waters under improved management, the number of local government units capable of implementing EAFM, and the number of public-private partnerships created during the life of the project.

### 5.3. Socio-Economic Baseline Assessment

This section describes methods that will be used to establish the baseline conditions for ECOFISH Project Result B, that is,

**“A 10% increase in the number of people gaining employment or better employment from sustainable fisheries management from a baseline established at the start of the project”.**

Measurement will be based on a combination of parameters including household incomes, household expenditures, resource uses, and employment. Percentage changes will be used for the sample population directly relying on their coastal and marine resources for their primary livelihoods. Improvement may come from increased incomes, which in turn may come from increased savings, increased expenditures for improving standards of living, or decreased costs in fishing due to shorter distances of time spent fishing. It may also come in the form of better employment opportunities, away from traditional catch harvesting. Finally, it may come in the

form of improved health status or social standing in the community due to improvements in the status of their coastal and marine resources.

The change in the number of people gaining employment or better employment  $\Delta E$  is measured from the following:

$$\Delta E = \Delta NP + \Delta SF + \Delta HS + \Delta EQ + \Delta MPA + \Delta EF + \Delta PP + \Delta FG + \Delta V - \cap (\Delta NP, \Delta SF, \Delta HS, \Delta EQ, \Delta MPA, \Delta EF, \Delta PP, \Delta FG)$$

where:  $\Delta E$  = percent change in number of people gaining employment or better employment from sustainable fisheries management  
 $\Delta NP$  = percent change in number of people with higher net profits from fishing  
 $\Delta SF$  = percent change in number of people eating seafood more regularly  
 $\Delta HS$  = percent change in people with higher household savings and/or expenditures (attributed or correlated with improved fish catch)  
 $\Delta EQ$  = percent change in number of people with higher perceptions of improved environmental quality  
 $\Delta MPA$  = percent change in number of people with higher awareness and support for MPAs  
 $\Delta EF$  = percent change in people with perceived improvements in enforcement  
 $\Delta PP$  = percent change in number of people employed through project interventions  
 $\Delta FG$  = percent change in number of people using less destructive or friendlier gears  
 $\cap(\Delta NP, \Delta SF, \Delta HS, \Delta EQ, \Delta MPA, \Delta EF, \Delta PP, \Delta FG, \Delta V)$  = the intersections of two or more of the above

The removal of the intersection is to prevent the double counting of values common to both or to any combination of parameters.

### 5.3.1. Socio-economic monitoring parameters

Socio-economic monitoring parameters will be classified according to the following:

#### *Resource Use For Livelihoods*

It is important to identify which coastal and marine resources that local residents depend on for their livelihoods. The type of dependence can be classified as either being primary or otherwise, i.e. how much of their average incomes come from the use of marine resources. If incomes are mostly derived from the use of marine resources (i.e. 50% or more of total household income), then dependence is said to be primary. If marine resource use augments household income (e.g. less than 50% dependence), then dependence is secondary.

Reasons for monitoring resource use patterns include the need to identify which reef-related activities will be affected by development and management strategies, who benefits and who loses from those strategies, and how can impacts on reefs (caused by those strategies) be minimized.

The quantitative indicators to be included are:

1. Number of resource users per type of activity, e.g. number of municipal fishers for municipal fish catch harvesting, number of aquaculture operators, number of tourists, etc.
2. Quantity of resources affected by each activity, e.g. quantity of municipal fish catch harvested per year, total mangrove area dedicated to fishpond development, total area dedicated to tourism, etc.
3. Quantity of resources consumed by resource user, e.g. total fish consumed by fishing household, total fishpond production consumed by aquaculture operator, etc.
4. Quantity of resources sold by resource user.
5. Income derived from sales; this will necessarily include market prices, especially levels at which primary producers sell their harvest.
6. Costs directly incurred by resource user (only those directly related to the activity being monitored, e.g. operating costs in fishing).
7. Household expenditures using common major expenditure items, e.g. food, clothing, shelter, etc.

Other indicators that should be monitored under this parameter include:

1. Technologies used in reef-related activities, e.g. fishing gears used, fishing boats used, fishing techniques used, etc.
2. Location of reef activities and stakeholders; if possible, GIS maps should accompany the baseline indicators for more accurate planning and intervention programs; e.g. fishing grounds, MPAs, shipping routes, etc.
3. Timing and seasonality of resource use; this is important also in establishing long-term trends in resource use, e.g. if fishing seasons are getting longer or shorter, if fishing grounds are getting bigger or smaller, etc.
4. Markets accessed by resource user, e.g. for local consumption only, for export to neighboring municipality or province, for export to premiere urban areas, for export outside the country, etc.; markets may also include information on whether the resource is consumed right away, or if it still undergoes processing towards another form of consumable product, e.g. canning or bottling, medicinal use, etc.

### ***Socio-demographic Profile of Resource Users***

Demographic and social indicators are important not just to inform coastal resource managers on who are the primary users involved in resource use, but also to properly target interventions for resource management. Knowing who your stakeholders are, particularly their economic and social characteristics will enable managers to properly design their programs, thus ensuring better targeting and higher probability of effectiveness.

Indicators should include the following:

1. Household characteristics: household members, respective ages, civil status, gender, educational attainment, current employment, religion, length of stay in current residence, and estimated income.
2. Household amenities: drinking water source, sanitation facilities, electricity/lighting, garbage disposal, cooking fuel, house construction materials, and household appliances.
3. Food security and health: household diet composition especially with respect to seafood/fish and general health conditions.

### ***Stakeholder Perceptions***

Perceptions are important indicators that can help management determine whether their plans and programs are creating impacts on the target communities, and if such impacts are being recognized. They can validate hard evidence of either improvement or degradation established through biophysical monitoring data, or even economic evidence established through actual income and expenditures data. They can likewise signal management if there is widespread acceptance among local residents, which usually spells the difference between a short-lived and sustainable conservation program. Perception surveys may be conducted for the following:

1. Perception on status of marine and coastal resources: quantity and quality of resources and benefits they derive from resources.
2. Perception on threats: sources of human threats, sources of natural threats (e.g. climate change impacts), impacts of threats on the status of marine and coastal resources.
3. Perception on MPAs: presence of MPAs, benefits from MPAs, costs incurred because of MPAs, MPA Management effectiveness: structure, composition, activities, etc., and awareness of and support for MPA programs.
4. Perception on enforcement activities: effectiveness of enforcement agencies, probabilities of enforcement chain elements occurring: detection, arrest, prosecution, conviction, imposition of penalties and/or fines, and probability of repeat offenders.

### ***Community Profile***

Community services, facilities and demographic indicators that affect marine and coastal resources include the following:

1. Medical services, e.g. hospitals, clinics, medical personnel, health insurance programs.
2. Educational facilities.
3. Public utilities: sewage treatment facilities, garbage collection and disposal, electricity supply, water supply.
4. Communication facilities: telephone lines, cellular phone signals, and television and radio signals.
5. Markets.
6. Transportation: land, air, sea, and condition of roads, ports, terminals, airports.

7. Tourist facilities: lodging facilities, eateries and restaurants, and groceries, convenience stores.
8. Local businesses, including banks and financial institutions.
9. Population, growth rate, migration rate, literacy rate, ethnicity.

### ***Other Resource Uses: Indirect Uses and Non-Use Values***

Economic theory suggests that there are other uses of marine resources apart from those that directly contribute to people's livelihoods. Such uses are what are termed indirect uses, i.e. those that provide ecosystem services such as storm protection, nutrient cycling, climate regulation, etc. Such services are crucial in ensuring the continued existence of life on the planet, thus are equally important as resource uses for livelihoods. Resources also contain non-use values, whereby they are valued by some stakeholders (usually located in other provinces, or even other countries) even without the possibility of using them either directly or indirectly. Examples include existence values (mere existence of the resource has value) and bequest values (the value of the resource lies in its continued existence for future generations).

Measuring the contribution of these ecosystem services and non-use values is less straightforward though, and technical economic modeling is usually needed. Valuation of indirect and non-use values will be done on a case-to-case basis, depending on whether there are economic instruments that will be targeted for such values in the MKBAs. However, it is not expected that these parameters will form part of the monitoring system of the MKBAs on a regular basis.

### **5.3.2. Methods for data gathering**

There are basically four methods of gathering data necessary to populate the monitoring system. Each one is presented below, along with a brief description and potential sources of information. A more detailed discussion of each one's objectives, advantages, disadvantages, requirements and suggested approaches is contained in the GCRMN Socmon Manual (Bunce *et al.* 2000).

#### ***Secondary data gathering***

If there is available data from existing surveys, this will be the first source for the monitoring data. The Community-Based Monitoring System (CBMS) being implemented by all LGUs in the country already contains valuable information that can be used for CRM socio-economic monitoring. Previous CBMS results were said to be unreliable because of too many non-responses. However, updating has been going on, and if CBMS surveys are going to be conducted regularly, this can be a good source of data for many of the indicators included in this protocol. The socio-demographic profile of stakeholders, for instance, is mostly available from CBMS results. Some indicators under resource users for livelihood can also be derived from regular CBMS surveys.

#### ***Key Informant Interviews (KIIs)***

Some of the indicators can best be provided with data by certain people who are knowledgeable about the place and have been residing and working in the area for quite some time. Examples would include LGU officials and key staff members such as the Municipal Planning and Development Officer, Barangay officials, members of NGOs and/or POs working in the area, key government agency representatives such as from the Bureau of Fisheries and Aquatic Resources (BFAR), etc. Some governance indicators and community profiles may be established through KIIs.

### ***Focus Group Discussions (FGDs)***

FGDs are powerful tools to get information if accuracy is not so much of an issue. The advantage of FGDs is that discussions can be conducted in a more in-depth fashion, and responses can be explained in greater detail. Participants can engage the facilitator and vice-versa, sometimes leading the discussion into relevant topics that may not have been identified in the design of the FGD. The main disadvantage of this method is that it cannot be relied on solely for more quantitative information, particularly if the monitoring indicator calls for accurate estimates of totals and averages. Nevertheless, it can serve the purposes of some of the indicators in the monitoring protocol.

### ***Individual Household Surveys***

The most expensive and tedious type of primary data gathering, but the most accurate and most quantitative, is the conduct of individual household surveys across target populations. Such techniques allow the monitoring team to make generalizations on characteristics of the population using acceptable sampling techniques, without having to gather data from the whole population. Quantitative data further allows deeper statistical analysis, therefore allowing for more technical studies and policies to be drafted. Questions are usually close-ended, e.g. multiple choice, true or false, yes or no, etc. Hence, further discussions are not encouraged such as during FGDs.

Intensive household surveys will be conducted for the MKBAs across three populations: municipal and commercial fishers, fishpond operators, and fish and seafood processors, e.g. makers of fish sauce, fish paste, salt, etc. Aside from the demographic profiles, questions on resource use will allow the estimation of resource rent, therefore establishing whether or not fishing beyond the maximum economic yield is already occurring in the MKBAs. The survey will further provide information on perception prevalent among fishing villages, which in turn can be used by MPA and CRM managers to better target their IEC campaigns and assess whether or not their programs are changing behavior towards more environment-friendly attitudes and values.

## **5.4. Benchmarking of Capacity of Partners to Apply Ecosystem Approaches to Fisheries Management**

To measure the cumulative effect of courses developed, training programs conducted, and on-site development and implementation of fisheries management interventions to increase capacity of partners to apply ecosystems approach to fisheries management, ECOFISH has developed an

EAFM Benchmarking System (Appendix 1) to determine the baseline as well as subsequent status during the monitoring events throughout the life of the project. Benchmarking will be conducted at the start of the project (year 1), which will serve as baseline, and during the monitoring events (year 3 and year 5). This can also be performed on an annual basis since the other purpose of setting the benchmark and monitoring progress is to guide partners, particularly the fisheries managers, in effectively implementing EAFM programs primarily by being guided by reference points for the various stages of their implementation.

## **5.5. Deliverables or Activities That Do Not Require Baseline Data Collection**

ECOFISH Project deliverables or activities that do not require baseline data collection or baseline data assessment will no longer be discussed here. The baseline or reference points for these activities are normally pegged at “0”. The project will maintain an accounting system as well as supporting database system (also refer to Section 6.2.) to capture and monitor these deliverables and activities.

## **6. Data Quality Management**

Quality assurance and data management are vital to ensuring the integrity of the data collected for purposes of establishing baseline levels of marine fish stocks and habitat quality. The Fisheries and Coastal Resources Management Specialist will be responsible for data quality and management. He will be supported by the science team of MERF, the GIS-KIM Specialist, and the PMP Specialist. This section describes protocols for quality assurance and database management.

### **6.1. Quality Assurance Protocols**

Quality assurance protocols for baseline assessment include procedures to monitor data quality on daily, weekly, and monthly basis. These protocols cover handling of data and monitoring baseline team performance, which include the following:

- Prior to any field activities, a briefing will be held with baseline assessment teams to review methods and protocols and answer any questions relevant to baseline assessment.
- Raw data will be reviewed and checked weekly and transcribed onto data sheets for database entry.
- Datasheets will be submitted weekly for entry into the database.
- Briefings with baseline assessment teams, including enumerators, will be held to check for deviations from prescribed methodology.
- Review and initial analysis of data sets will be done monthly to look for possible errors and gaps.
- The baseline assessment methodology will be reviewed monthly.
- Review and final analysis of data sets will be made towards the end of each data collection cycle.

## 6.2. Performance Monitoring Database

Data and information collected during baseline assessment, and later during special monitoring events (2015 and 2017), will be stored in a database designed specifically for performance monitoring. The database will be used not only to manage information and data, but also to analyze trends and produce standardized performance monitoring reports.

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## **Appendix 1. EAFM Benchmarking for LGUs in the ECOFISH MKBAs**

EAFM as a process has already been practiced in the region. In the East Asia region as a whole, management of fisheries has been attempted at various ecological scales such as large marine ecosystems (LMEs), bays, gulfs, and other spatially defined seas. In many instances, specific fish or invertebrate species in these ecological scales have been the focus of management but due to the multi-species and multi-gear nature of fisheries the management approach has always been on multi-species scale. What have been lacking are the understanding of the interaction among the various components of the ecosystem that could have been a crucial input to management interventions and the establishment of a governance system or at least effective institutional mechanisms that implement management interventions.

As an ecosystem approach, EAFM tends to be complex. To make it workable, it is best for it to be disaggregated into its practical elements with corresponding expected results. At the national level, EAFM activities may only be limited to policy formulation, enactment of laws, or agreements on number and areas of geographies subject to fisheries management. At the site level, however, EAFM activities and expected results can be more specific. Below is a set of recommended generic results at the LGU and clusters of LGUs used during the FISH Project that can also be applied by ECOFISH.

Generic results at the MKBAs include:

1. Delineated ecosystem boundaries that reflect institutional and political elements to manage the ecosystem as one management unit.
2. Determined the habitat need of important harvestable organisms that constitute the “significant food web”.
3. Incremental understanding of the components of the ecosystem and the dynamics of the entire ecosystem.
4. Developed and set in place a functioning network of MPAs.
5. Developed indices of ecosystems’ health as targets for management.
6. Assessed how removals affect the stock size, harvest, and trophic structure and gradually achieve an appropriate overall fishing effort restrictions or configuration.
7. Assessed institutional elements of the ecosystem which most significantly affect fisheries and developed appropriate institutional mechanisms to effectively implement management interventions.
8. Developed and implemented strategies such as management planning, zoning schemes, gear/species-specific management, registration & licensing, law enforcement, and temporal and permanent no take zones.
9. Established governance system that is responsive to ecosystems approach (it should cover the boundary, scale and scope of the fishery system)
10. Developed and instituted monitoring schemes used for fisheries management.

These generic results were used as guide in developing specific benchmarks that cover as many EAFM elements as possible. This benchmarking follows the system developed by CRMP’s monitoring and evaluation guidelines for municipal/city CRM (DENR-CMMO 2003) and the proposed template for the development of a municipal fisheries management benchmarking

system in the Philippines (FISH Project, 2010). The levels of the benchmarking system follow the orders of governance outcomes described in Olsen (2003) wherein each level corresponds to the order of governance. Only in this case, levels 3 and 4 were lumped together. Each level is likewise considered a building block to subsequent levels.

The purpose of setting the benchmarks is to provide a framework to guide implementors, particularly the fisheries managers, in effectively implementing EAFM programs primarily by providing guideposts for the various stages of their implementation. The benchmarks are subdivided into two major groups: (A) Basic requirement and (B) Site specific requirement. The first (A) covers the basic requirements and can be implemented across all priority geography sites, and the second (B) are site specific and may only be carried out in specific priority geographies. The EAFM Benchmarks are given in the table below (Table 1) followed by the detailed benchmarks description at various levels of implementation (Table 2).

**Table 1. EAFM Benchmarks**

	<b>Benchmark</b>	<b>Level 1 Programs Established</b>	<b>Level 2 Programs Functional</b>	<b>Level 3 Programs Sustained and Results Realized</b>
<b>A. Basic Requirements</b>				
1	Ecosystem boundaries established	Ecosystem boundaries drawn and established	Formal agreement on ecosystem boundaries	Ecosystem boundaries legally recognized by the national government
2	Coastal marine habitat monitoring and management planning established	Coastal marine habitat baseline assessment conducted and habitat profile developed	Coastal marine habitat monitoring conducted regularly and feedback to stakeholders and resource users	Results of coastal marine habitat monitoring used in formulation of marine habitat management actions
3	Fisheries monitoring and early fisheries management planning established	Fisheries baseline assessment conducted and fisheries profile developed	Fisheries monitoring conducted regularly and feedback to stakeholders and resource users	Results of monitoring used in formulation of fisheries management plans and actions
4	Fisheries Law enforcement team and program established	Fisheries law enforcement team and law enforcement program established	Fisheries enforcement operations regularly conducted and enforcement database established	Fisheries enforcement operations sustained and enforcement effectiveness evaluated Collaborative enforcement with other participating local governments conducted (e.g. joint enforcement)
5	Comprehensive fisheries management plan conducted and regularly updated	Comprehensive fisheries management plan developed and adopted	Comprehensive fisheries management plan implemented (with corresponding legal and policy instrument) and programs in the plan continuously funded	Fisheries management plan revised or updated based on the monitoring results

6	Fisheries management office established and operational	Fisheries management office in each local participating government established with corresponding mandate and staff	Coordination among offices within the local government, institutional partners, and other participating local governments established	Leveraging support of programs with institutional partners and collaborative endeavors with participating local governments within the ecosystem boundary established.
7	Fisheries registration and licensing system established	Fishers, boats and fishing gears registration and licensing system established	Fishers, boats, and fishing gears registration and licensing system implemented and enforced	Fishers, boats, and fishing gears registration and licensing system implementation sustained and information from the database for fishing effort control and regulations
8	Network of Marine Protected Areas (MPA) established	Individual MPA or MPAs established, baseline data collected, MPA management plan implemented, and monitoring system established	Individual MPA or MPAs sustained and MPA network arrangements established	MPA network arrangements implemented, enforced and sustained
9	Fisheries use zoning plan established	Fisheries and other uses identified and zoning plan developed	Fisheries use zoning plan implemented (with corresponding legal or policy instrument) and monitored	Fisheries use zoning plan improved, sustained and objectives attained (e.g. conflict reduced)
10	Local constituencies for fisheries management organized and actively involved	Local constituencies for fisheries management organized	Local constituencies for fisheries management actively participated in program development and implementation	Local constituencies for fisheries management sustained and expanded
11	Multi-institutional collaboration on coastal and fisheries resources management (CFRM)	Multi-institutional collaboration on CFRM established	Multi-institutional collaboration on CFRM effectively implemented programs and services	Multi-institutional collaboration on CFRM sustained and showing positive impacts
<b>B. Site Specific Requirements</b>				
12	Species-specific management measures established	Species that constitute the “significant food web” identified and baseline assessment conducted	Species-specific management measures developed, enforced and monitored	Species-specific management measure sustained and monitoring results show impacts
13	Gear-specific management measures established	Gear-specific management measure identified and baseline assessment conducted	Gear-specific management measures developed, enforced and monitored	Gear-specific management measure sustained and monitoring results show impacts

14	Mangrove management area established	Mangrove management area established and baseline data collected	Mangrove management plan developed, implemented and monitoring system established	Mangrove management sustained and monitoring results show impacts
15	Seagrass management area established	Seagrass management area established and baseline data collected	Seagrass management plan developed, implemented and monitoring system established	Seagrass management sustained and monitoring results show impacts
16	Revenue generation established	Revenue generation system on CRM/fisheries management initiated	Revenue-generating measures effectively implemented and enforced	Revenue-generating measures sustained showing positive impacts
17	Coastal environment-friendly enterprises established	Coastal environment-friendly enterprises initiated	Successful coastal environment-friendly enterprises expanded	Coastal environment-friendly enterprises sustained showing positive impacts

**Table 2. Description of the EAFM benchmarks at various levels**

	<b>Benchmark</b>	<b>Benchmark Description</b>
1	Ecosystem boundaries established	<p><b>Level 1:</b> Ecosystem boundaries drawn and established</p> <ul style="list-style-type: none"> <li>Ecosystem boundaries drawn incorporating institutional and political consideration</li> </ul> <p><b>Level 2:</b> Formal agreement on ecosystem boundaries</p> <ul style="list-style-type: none"> <li>Ecosystem boundaries agreed upon by the participating local governments through a memorandum of agreement or other form of policy instrument</li> </ul> <p><b>Level 3:</b> Ecosystem boundaries legally recognized by the national government</p> <ul style="list-style-type: none"> <li>Ecosystem boundaries recognized by the national government as part of its Coral Triangle Initiative</li> </ul>
2	Coastal marine habitat monitoring and management planning established	<p><b>Level 1:</b> Coastal marine habitat baseline assessment conducted and habitat profile developed</p> <ul style="list-style-type: none"> <li>Marine habitat profile developed through compilation of secondary data and baseline assessment of the status of coral, seagrass, and mangrove habitats</li> <li>Issues and opportunities pertaining to coastal habitats, socio-economic, governance and other related issues identified</li> <li>Key indicators for habitat, socio-economic and governance aspects developed as part of the future monitoring and evaluation</li> </ul> <p><b>Level 2:</b> Coastal marine habitat monitoring conducted regularly and feedback to stakeholders and resource users</p> <ul style="list-style-type: none"> <li>Key habitat data collected analyzed and compared to baseline</li> <li>Analyzed monitoring results presented to stakeholders and resource users</li> </ul> <p><b>Level 3:</b> Results of coastal marine habitat monitoring used in formulation of marine habitat management plans and actions</p> <ul style="list-style-type: none"> <li>Baseline and monitoring results analyzed and results used to formulate habitat management options</li> <li>Habitat management options presented to stakeholders for formulation of habitat management plan or improvement of existing habitat management plan</li> <li>Habitat management plans enacted</li> </ul>
3	Fisheries monitoring and early fisheries management planning established	<p><b>Level 1:</b> Fisheries baseline assessment conducted and habitat profile developed</p> <ul style="list-style-type: none"> <li>Fisheries profile developed through compilation of secondary data and baseline assessment of the status of fishery resources, fishers, and fishing effort (boats and gears)</li> <li>Issues and opportunities pertaining to fisheries, socio-economic, governance and other related issues identified</li> </ul>

		<ul style="list-style-type: none"> <li>• Key indicators for fisheries, socio-economic and governance aspects developed as part of the future monitoring and evaluation</li> </ul> <p><b>Level 2:</b> Fisheries (catch and effort) monitoring conducted regularly and feedback to stakeholders and resource users</p> <ul style="list-style-type: none"> <li>• Key fisheries data collected analyzed and compared to baseline</li> <li>• Analyzed monitoring results presented to stakeholders and resource users</li> </ul> <p><b>Level 3:</b> Results of fisheries monitoring used in formulation of fisheries early action plans</p> <ul style="list-style-type: none"> <li>• Baseline and monitoring results analyzed and results used to formulate initial fisheries management options</li> <li>• Fisheries management options presented to stakeholders for formulation of specific fisheries management intervention or improvement of existing fisheries management interventions</li> </ul>
4	Fisheries Law enforcement team and program established	<p><b>Level 1:</b> Fisheries law enforcement team and law enforcement program established</p> <ul style="list-style-type: none"> <li>• Members of the fisheries law enforcement identified, trained and deputized</li> <li>• Law enforcement program developed and funded</li> <li>• Law enforcement assets (boats, radios, GPS, etc. procured)</li> </ul> <p><b>Level 2:</b> Fisheries enforcement operations regularly conducted and enforcement database established</p> <ul style="list-style-type: none"> <li>• Fisheries law enforcement operation planning (Oplan) regularly conducted</li> <li>• Results of enforcement operations documented in a form of data base</li> <li>• Coordination mechanism with agencies (police, navy, coast guard) having coastal and fisheries law enforcement mandates established</li> </ul> <p><b>Level 3:</b> Fisheries law enforcement operations sustained and enforcement effectiveness evaluated. Collaborative enforcement with other participating local governments conducted</p> <ul style="list-style-type: none"> <li>• Fisheries law enforcement operations continuously funded</li> <li>• Training of fishery law enforcement team regularly updated</li> <li>• Effects of fisheries law enforcement evaluated and operations improved</li> <li>• Joint enforcement with other participating local governments conducted</li> </ul>
5	Comprehensive fisheries management plan conducted and regularly updated	<p><b>Level 1:</b> Comprehensive fisheries management plan developed and adopted</p> <ul style="list-style-type: none"> <li>• Comprehensive fisheries management plan laid out programs and activities in response to issues identified in the baseline assessment and profile</li> <li>• Comprehensive fisheries management plan incorporates habitat management plans and early fisheries management plans</li> <li>• Draft comprehensive fisheries management plan presented to stakeholders</li> </ul> <p><b>Level 2:</b> Comprehensive fisheries management plan implement and programs in the plan continuously funded</p> <ul style="list-style-type: none"> <li>• Comprehensive fisheries management plan adopted through enactment of enabling policy instrument or legislation (ordinance)</li> <li>• Programs and activities in the comprehensive fisheries management plan funded by the local governments</li> </ul> <p><b>Level 3:</b> Fisheries management plan revised or updated based on the monitoring results</p> <ul style="list-style-type: none"> <li>• Comprehensive fisheries management plan reviewed, updated and revised following the results of the regular coastal marine habitat and fisheries (catch and effort) monitoring schemes</li> <li>• Programs and activities in the comprehensive fisheries management plan regularly funded</li> </ul>
6	Fisheries management office established and operational	<p><b>Level 1:</b> Fisheries management office in each local participating government established with corresponding mandate and staff</p> <ul style="list-style-type: none"> <li>• Fisheries management office with mandate to implement and coordinate fisheries management activities established</li> <li>• Fisheries management office allocated with human and financial resources to perform mandated activities</li> </ul> <p><b>Level 2:</b> Coordination among offices within the local government, institutional partners, and other participating local governments established</p> <ul style="list-style-type: none"> <li>• Staff of fisheries management office trained to effectively perform mandated activities</li> <li>• Linkages between fisheries management office, offices within the local government and institutional partners developed</li> </ul>

		<ul style="list-style-type: none"> <li>• Linkage between the fisheries management office and other participating local governments within the defined ecosystem established</li> </ul> <p><b>Level 3:</b> Leveraging support of programs with institutional partners and collaborative endeavors with participating local governments within the ecosystem boundary established.</p> <ul style="list-style-type: none"> <li>• Fisheries management office able to leverage financial and services support of programs with institutional partners and other government agencies</li> <li>• Collaborative activities between the fisheries management office and other participating local governments in developing common fisheries management policies, common ordinance and joint management planning established</li> </ul>
7	Fisheries registration and licensing system established	<p><b>Level 1:</b> Fishers, boats and fishing gears registration and licensing system established</p> <ul style="list-style-type: none"> <li>• Fishers, fishing boats, and fishing gear registration procedure established</li> <li>• Registration and licensing initiated</li> <li>• Fisheries registration and licensing data base developed</li> </ul> <p><b>Level 2:</b> Fishers, boats, and fishing gears registration and licensing system implemented and enforced</p> <ul style="list-style-type: none"> <li>• Registration and licensing database functional and registration and licensing data stored and analyzed</li> <li>• Registration and licensing system fully functional</li> </ul> <p><b>Level 3:</b> Fishers, boats, and fishing gears registration and licensing system implementation sustained and information from the database for fishing effort control and regulations</p> <ul style="list-style-type: none"> <li>• Database fully functional and information used to determine and monitor fishing effort</li> <li>• Fisheries and registration and licensing information used to revise and improve plans and policies on fisheries management.</li> </ul>
8	Network of Marine Protected Area (MPA) established	<p><b>Level 1:</b> Individual MPA or MPAs established, baseline data collected, MPA management plan implemented, and monitoring system established</p> <ul style="list-style-type: none"> <li>• MPA site identified, boundaries delineated, zones (no-take and buffer zones) established</li> <li>• MPA baseline information (live hard coral cover, reef fish biomass, diversity, etc.) collected</li> <li>• MPA management plan and adopted (preferably supported by legal instrument), management body and enforcement team trained and organized</li> <li>• Enforcement protocol operational, enforcement infrastructure established and enforcement assets procured and utilized</li> <li>• Management body and enforcement team conducted regular implementation and enforcement activities with funding support from local government</li> <li>• MPA monitoring regularly conducted and compliance monitored</li> </ul> <p><b>Level 2:</b> Individual MPA or MPAs sustained and MPA network arrangements established</p> <ul style="list-style-type: none"> <li>• Activities of the MPA Management body and enforcement team sustained</li> <li>• Implementation and enforcement activities funded by local governments</li> <li>• MPA monitoring sustained and impacts regularly presented to stakeholders</li> <li>• Components of the MPA network identified and MPA managers organized</li> <li>• Implementation and coordination arrangements established</li> <li>• Enforcement and monitoring protocols harmonized and agreed</li> </ul> <p><b>Level 3:</b> MPA network arrangements implemented, enforced and sustained</p> <ul style="list-style-type: none"> <li>• MPA network management plan developed</li> <li>• Coordination meeting among MPA network management bodies regularly conducted</li> <li>• Programs in MPA network management plan implemented and funded</li> <li>• MPA bodies of members of the MPA network conduct collaborative MPA monitoring activities</li> </ul>
9	Fisheries use zoning plan established	<p><b>Level 1:</b> Fisheries and other uses identified and zoning plan developed</p> <ul style="list-style-type: none"> <li>• Existing and potential municipal water uses identified and mapped,</li> <li>• Interaction among the various activities evaluated and conflicting uses identified and resolved</li> </ul>

		<ul style="list-style-type: none"> <li>Proposed zonation map developed and regulatory mechanisms formulated</li> </ul> <p><b>Level 2:</b> Fisheries use zoning plan implemented (with corresponding legal or policy instrument) and monitored</p> <ul style="list-style-type: none"> <li>Fisheries use zoning plan presented to a broader stakeholder and resource users for approval</li> <li>Enabling policy or zoning ordinance enacted and management and enforcement arrangement established</li> </ul> <p><b>Level 3:</b> Fisheries use zoning plan improved, sustained and objectives attained (e.g. resource use conflict reduced)</p> <ul style="list-style-type: none"> <li>Fisheries use zoning plan updated and revised</li> <li>Implementation and enforcement zoning regulations sustained</li> <li>Resource use conflict reduced</li> </ul>
10	Local constituencies for fisheries management organized and actively involved	<p><b>Level 1:</b> Local constituencies for fisheries management organized</p> <ul style="list-style-type: none"> <li>Fisheries management concerned organization formed</li> </ul> <p><b>Level 2:</b> Local constituencies for fisheries management actively participated in program development and implementation</p> <ul style="list-style-type: none"> <li>Fisheries management concerned organizations involved in policy formulation and review of management plan</li> <li>Fisheries management concerned organization participated in program implementation and monitoring of results</li> </ul> <p><b>Level 3:</b> Local constituencies for fisheries management sustained and expanded</p> <ul style="list-style-type: none"> <li>Fisheries management concerned organizations actively lobby for the development of management measures and implementation of the programs in the fisheries management plan</li> </ul>
11	Multi-institutional collaboration on coastal and fisheries resources management (CFRM)	<p><b>Level 1:</b> Multi-institutional collaboration on CFRM established</p> <ul style="list-style-type: none"> <li>Potential partners from LGUs, NGAs, NGOs, academe, private sector and funding institutions identified</li> <li>Potential arrangements among neighboring LGUs that form the ecosystem identified</li> <li>MOAs and other instruments adopted through municipal legislative action or signed by collaborating partners and planning, implementation coordination and monitoring arrangements established</li> </ul> <p><b>Level 2:</b> Multi-institutional collaboration on CFRM effectively implemented programs and services</p> <ul style="list-style-type: none"> <li>Multi-institutional CFRM program identified and plans for their implementation drafted</li> <li>Multi-institutional CFRM activities coordinated, implemented, enforced and monitored</li> </ul> <p><b>Level 3:</b> Multi-institutional collaboration on CFRM sustained and showing positive impacts</p> <ul style="list-style-type: none"> <li>Multi-institutional CFRM program implementation sustained with measurable positive impacts to collaborating LGUs and coastal communities</li> <li>Multi-institutional collaborative mechanisms reviewed and improved contributing to effective management of coastal and fishery resources</li> </ul>
12	Species-specific management measures established	<p><b>Level 1:</b> Species that constitute the “significant food web” identified and baseline assessment conducted</p> <ul style="list-style-type: none"> <li>Economically important species that constitute to significant portion of the food web based on the fisheries profiling process identified</li> <li>Focus group discussion to identify early and immediate management action for identified economically important species conducted</li> <li>Baseline assessment of identified species conducted</li> </ul> <p><b>Level 2:</b> Species-specific management measures developed, enforced and monitored</p> <ul style="list-style-type: none"> <li>Species-specific management options for identified species drafted</li> <li>Consultations on species-specific management options conducted</li> <li>Selected species-specific management measure implemented (supported by legal instrument)</li> <li>Fisheries monitoring protocol for identified species developed</li> </ul> <p><b>Level 3:</b> Species-specific management measure sustained and monitoring results show impacts</p> <ul style="list-style-type: none"> <li>Enforcement of species-specific management measure established and sustained</li> <li>Fisheries monitoring of species-specific management intervention sustained and</li> </ul>

		results regularly presented to stakeholders and resource users
13	Gear-specific management measures established	<p><b>Level 1:</b> Gear-specific management measure identified and baseline assessment conducted</p> <ul style="list-style-type: none"> <li>• Gear specific issues based on the fisheries profiling process identified</li> <li>• Focus group discussion to identify early and immediate management action for identified fishing gears conducted</li> <li>• Baseline assessment of identified fishing gears conducted</li> </ul> <p><b>Level 2:</b> Gear-specific management measures developed, enforced and monitored</p> <ul style="list-style-type: none"> <li>• Gear-specific management options for identified fishing gears drafted</li> <li>• Consultations on fishing gear-specific management options conducted</li> <li>• Selected gear-specific management measure implemented (supported by legal instrument)</li> <li>• Fisheries monitoring protocol for identified fishing gears developed</li> </ul> <p><b>Level 3:</b> Gear-specific management measure sustained and monitoring results show impacts</p> <ul style="list-style-type: none"> <li>• Enforcement of species-specific management measure established and sustained</li> <li>• Fisheries monitoring of gear-specific management intervention sustained and results regularly presented to stakeholders and resource users</li> </ul>
14	Mangrove management area established	<p><b>Level 1:</b> Mangrove management area established and baseline data collected</p> <ul style="list-style-type: none"> <li>• Mangrove management site identified, boundaries delineated, zones (rehabilitation zones, aquasilviculture zones, etc.) established</li> <li>• Mangrove baseline information (mangrove species, mangrove cover, fish and invertebrate species, human activities) collected</li> <li>• Mangrove management plan and adopted (preferably supported by legal instrument), management body and enforcement team trained and organized</li> </ul> <p><b>Level 2:</b> Mangrove management plan developed, implemented and monitoring system established</p> <ul style="list-style-type: none"> <li>• Enforcement protocol operational, enforcement infrastructure established and enforcement assets procured and utilized</li> <li>• Management body and enforcement team conducted regular implementation and enforcement activities with funding support from local government</li> <li>• Mangrove monitoring regularly conducted and compliance monitored</li> </ul> <p><b>Level 3:</b> Mangrove management sustained and monitoring results show impacts</p> <ul style="list-style-type: none"> <li>• Activities of the mangrove management body and enforcement team sustained</li> <li>• Implementation and enforcement activities funded by local governments</li> <li>• Mangrove monitoring sustained and impacts regularly presented to stakeholders</li> </ul>
15	Seagrass management area established	<p><b>Level 1:</b> Seagrass management area established and baseline data collected</p> <ul style="list-style-type: none"> <li>• Seagrass management sites identified, boundaries delineated, zones (rehabilitation zones, rabbitfish protection zones, etc.) established</li> <li>• Seagrass baseline information (seagrass species, seagrass cover, fish and invertebrate species, human activities) collected</li> <li>• Seagrass management plan and adopted (preferably supported by legal instrument), management body and enforcement team trained and organized</li> </ul> <p><b>Level 2:</b> Seagrass management plan developed, implemented and monitoring system established</p> <ul style="list-style-type: none"> <li>• Enforcement protocol operational, enforcement infrastructure established and enforcement assets procured and utilized</li> <li>• Management body and enforcement team conducted regular implementation and enforcement activities with funding support from local government</li> <li>• Seagrass monitoring regularly conducted and compliance monitored</li> </ul> <p><b>Level 3:</b> Seagrass management sustained and monitoring results show impacts</p> <ul style="list-style-type: none"> <li>• Activities of the mangrove management body and enforcement team sustained</li> <li>• Implementation and enforcement activities funded by local governments</li> <li>• Seagrass monitoring sustained and impacts regularly presented to stakeholders</li> </ul>
16	Revenue generation established	<p><b>Level 1:</b> Revenue generation system on CRM/fisheries management established</p> <ul style="list-style-type: none"> <li>• Potential revenue-generating coastal and fishery management programs assessed and identified</li> <li>• Revenue-collection program established with clear purpose and implementation arrangements of how the funds will be used in coastal and fisheries management activities</li> <li>• Specific-revenue ordinance enacted, or revenue clause (indicating use of funds)</li> </ul>

		<p>should be part of enacted fishery ordinance</p> <p><b>Level 2:</b> Revenue-generating measures effectively implemented and enforced</p> <ul style="list-style-type: none"> <li>• Revenue-collection program implemented and compliance monitoring activities conducted</li> <li>• Revenues collected monitored, and program implementation evaluated and modified/adjusted if necessary</li> </ul> <p><b>Level 3:</b> Revenue-generating measures sustained showing positive impacts</p> <ul style="list-style-type: none"> <li>• Revenue-collection program sustained implementation of revenue-generating measures</li> <li>• Revenue collection program and schemes for their use in the fisheries management program are already established components of the local government's Annual Investment Plan</li> </ul> <p>Revenues from fisheries related interventions are plowed back to fisheries management activities</p>
17	Coastal environment-friendly enterprises established	<p><b>Level 1:</b> Coastal environment-friendly enterprises initiated</p> <ul style="list-style-type: none"> <li>• Non-fishing livelihoods, low-impact mariculture, ecotourism established for fisherfolk/coastal communities to augment incomes</li> <li>• Involvement and management arrangement defined</li> <li>• Socio-economic baseline and monitoring indicators established</li> <li>• Environmental carrying capacity</li> </ul> <p><b>Level 2:</b> Successful coastal environment-friendly enterprises expanded</p> <ul style="list-style-type: none"> <li>• Environmental carrying capacity established and monitoring and control mechanisms set in place</li> <li>• Livelihood and enterprise development programs expanded employing fisherfolk/coastal communities in nonfishing livelihoods</li> </ul> <p><b>Level 3:</b> Coastal environment-friendly enterprises sustained showing positive impacts</p> <ul style="list-style-type: none"> <li>• Livelihood and enterprise development programs sustainably sustained.</li> <li>• Monitoring resulted in measurable socioeconomic benefits to fisherfolk/coastal communities</li> </ul>