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FISH PHILIPPINES

The FISHERIES IMPROVED FOR SUSTAINABLE HARVESTS Project

BASELINE ASSESSMENT PLAN

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List of Abbreviations and Acronyms

BAT	Baseline Assessment Team
CPUE	catch per unit effort
CRM	coastal resource management
DA-BFAR	Department of Agriculture-Bureau of Fisheries and Aquatic Resources
FBAT	Fisheries Baseline Assessment Team
FISH	Fisheries Improved for Sustainable Harvests
FPR	FISH Project Result
GRP	Government of the Republic of the Philippines
LGU	local government unit
MPA	marine protected area
NGA	national government agency
PR	performance indicator
USAID	United States Agency for International Development

1.0 Introduction

Tetra Tech EM Inc. (Tetra Tech) received United States Agency for International Development (USAID) Contract No. 492-C-00-03-00022-00, the Fisheries Improved for Sustainable Harvests (FISH) Project in September 2003 to provide technical assistance to the Government of the Republic of the Philippines (GRP), Department of Agriculture–Bureau of Fisheries and Aquatic Resources (DA-BFAR), other national government agencies (NGAs), local government units (LGUs), and other national and local stakeholders in fisheries and coastal resource management. The FISH Project is a seven-year technical assistance project consisting of a five-year base period extending from 22 September 2003 to 21 September 2008 and a two-year option period extending from 22 September 2008 to 21 September 2010.

1.1 FISH Project Overview

The FISH Project is expected to result in an *increase in marine fish stocks by 10% compared to baseline conditions in four focal areas by 2010.* The project will provide technical assistance and catalytic support to:

- improve national and local capacities in fisheries and coastal resource management (CRM);
- improve national policies supporting sustainable fisheries; and
- build a constituency of informed, disciplined and cooperative stakeholders engaged in fisheries management.

Growth, control, and maintenance mechanisms for fisheries and CRM will be highlighted as key strategies to achieve the overall project result. Illustrative activities for these three management mechanisms are listed in Table 1.

Table 1. Illustrative management interventions for FISH Project.

Management Mechanism	Intervention
Growth mechanisms: to enhance fisheries production and marine ecosystem integrity	• Establish networks of marine protected areas (MPAs) to protect critical habitats, spawning areas, migration routes, populations of mature fish, endangered species and other resources • Encourage environment-friendly economic development and revenue-generating mechanisms, such as marine ecotourism, user-fee systems and appropriate aquaculture
Control mechanisms: to allocate access to fisheries and coastal resources	• Train coastal law enforcement units to enforce fisheries and other coastal resource-related laws • Register fishers and issue licenses for fishing vessels and gears (municipal and commercial) based on sustained yields of fish stocks • Identify restrictions on fishing gear, fish size limits, fishing areas and seasons to achieve sustainable fishing
Maintenance mechanisms: to improve institutional capacity for fisheries and CRM	• Strengthen LGU capacity in CRM • Establish interagency and multisectoral collaborative mechanisms for planning, implementation and enforcement • Assist stakeholders in integrating population/reproductive health programs and fisheries management

These management measures and others will be implemented in close collaboration with national and local stakeholders.

1.2 Purpose of Baseline Assessment Plan

This baseline assessment plan describes the methodology that will be used to establish baseline conditions for key performance indicators that describe the condition of marine fish stocks and habitats at the start of the project. This plan, together with the Performance Monitoring Plan (FISH Document No. 03-FISH/2004), establishes the project's result framework and methodologies for collecting and analyzing data to evaluate progress and impact of the project interventions over the life of the project.

The methodologies described in this plan were developed in part through interactions between the FISH Project staff, an independent baseline contractor hired by USAID to evaluate the baseline procedures of FISH, and USAID. This document is organized into seven sections including this introduction. A description of project implementation areas is provided in Section 2.0. Performance indicators are described in Section 3.0. Sections 4.0 and 5.0 detail the baseline assessment methodologies for marine fisheries and marine protected areas, respectively. Section 6.0 describes data management and quality assurance procedures. Section 7.0 provides a bibliography of relevant works used in assembling the baseline assessment plan.

2.0 Local Implementation Areas

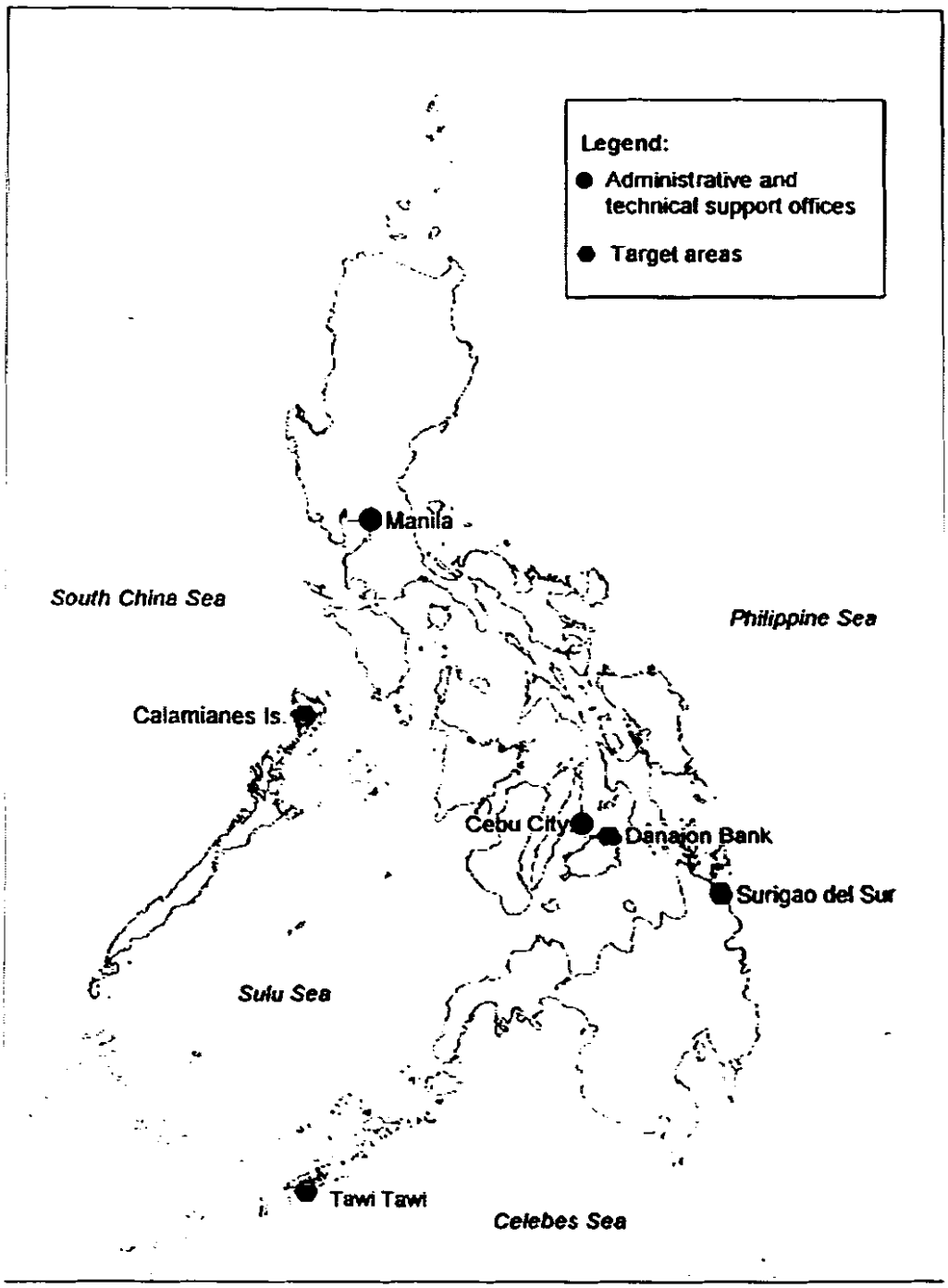
Local implementation will be conducted at two levels: target areas (Figure 1) and focal areas. This section provides a brief description of the target areas and the criteria used to define focal areas for baseline assessment and project implementation.

2.1 Target Areas

The FISH Project was designed to work in four target areas including the Calamianes Islands (Palawan), Danajon Bank (Cebu, Bohol, Southern Leyte and Leyte), Surigao Del Sur and Tawi Tawi. Initial profiles of these target areas are provided in Target Area Profiles (FISH Document No. 04-FISH/2004). Target areas span large geographic areas characterized by multimunicipal, nearshore and offshore marine environments, and in the case of Danajon Bank, multiprovincial and multiregional jurisdictional regimes. FISH Project implementation activities in the target areas will consist of the following key activities:

- building alliances and constituencies of stakeholders for coastal law enforcement, public-private sector partnerships, and other actions requiring multisectoral collaboration , and
- developing a fisheries and coastal resources profile and management framework for each target area.

Figure 1. Target areas and office locations of the FISH Project.



2.2 *Focal Areas*

Focal areas are smaller, spatial subsets of the target areas. Management interventions listed in Table 1 (growth, control and maintenance mechanisms) will be concentrated in the focal areas to effect positive and measurable change over the life of the project. One focal area was selected within each of the four target areas using a screening process that considered resource condition, human exploitation patterns, geopolitical aspects, and feasibility of project implementation.

Each target area was subdivided into candidate focal areas each covering contiguous water areas of two to five municipalities. Candidate focal areas were defined considering the following:

- geopolitical aspects of the area (municipal, provincial, region boundaries, as necessary);
- exploitation patterns including municipal and commercial fishing;
- common fish stocks and marine organisms in the area;
- dominant habitats of each area; and
- dominant human activities within each area.

Candidate focal areas were screened based on feasibility of implementing field activities. Feasibility criteria used to screen candidate focal areas included:

- availability of physical communications;
- security issues and political support;
- institutional readiness; and
- degree of management control.

Final selection of a focal area within each target area favored areas with fisheries and coastal resources condition still in good condition but with high degree of threats to those areas as follows:

- coastal habitat conditions/threats, and
- fisheries resource conditions/threats.

Qualitative rankings of the candidate focal areas were conducted by FISH Project staff and invited experts. The results of focal area screening are provided below for each target area.

Calamianes Islands

Five candidate focal areas were considered in the selection process for the Calamianes Islands target area (Figure 2). These include the waters off:

1. Coron Bay (covering part of the municipalities of Busuanga, Coron and Culion),
2. Busuanga-Culion,
3. West Culion,
4. Northern Busuanga-Coron and
5. Linapacan.

The results of focal area screening are shown in Table 2. Coron Bay was selected as the focal area.

Table 2. Qualitative ranking of candidate focal areas in Calamianes Islands target area.

Criteria	Candidate Focal Areas Ranking*				
	1	2	3	4	5
Operational feasibility					
a. Physical/communications accessibility	4	4	3	4	1
b. Security/political support	4	3	3	3	3
c. Institutional readiness	4	3	3	3	3
d. Degree of management control	4	3	2	2	2
Resource condition/threat level					
a. Coastal habitat condition/threat level	4	3	-	-	-
b. Fisheries resource condition/threat level	4	3	-	-	-

*See text and Figure 2 for definition of candidate focal areas; ranking level: 1 - low; 2 - low to medium; 3 - medium to high; 4 – high.

Danajon Bank

Three candidate focal areas were considered in the selection process for the Danajon Bank target area (Figure 3). These include the waters off:

1. Talibon, Bien Unido, Ubay and Carlos Garcia;
2. Inabanga, Buenavista and Getafe; and
3. Loon, Calape, Tubigon and Clarin.

The results of focal area screening are shown in Table 3. The waters off the four municipalities of Talibon, Bien Unido, Ubay, and Carlos Garcia were selected as the focal area for the Danajon Bank target area.

Table 3. Qualitative ranking of candidate focal areas in Danajon Bank target area.

Criteria	Candidate Focal Area Ranking*		
	1	2	3
Operational feasibility			
a. Physical/communications accessibility	4	4	4
b. Security/political support	4	3	2
c. Institutional readiness	4	3	2
d. Degree of management control	4	2	3
Resource condition/threat level			
a. Coastal habitat condition/threat level	4	4	-
b. Fisheries resource condition/threat level	4	3	-

*See text and Figure 3 for definition of candidate focal areas; ranking level. 1 - low; 2 - low to medium; 3 - medium to high; 4 – high.

Figure 2. Candidate focal areas and selected focal area (shaded) within the Calamianes Islands target area.

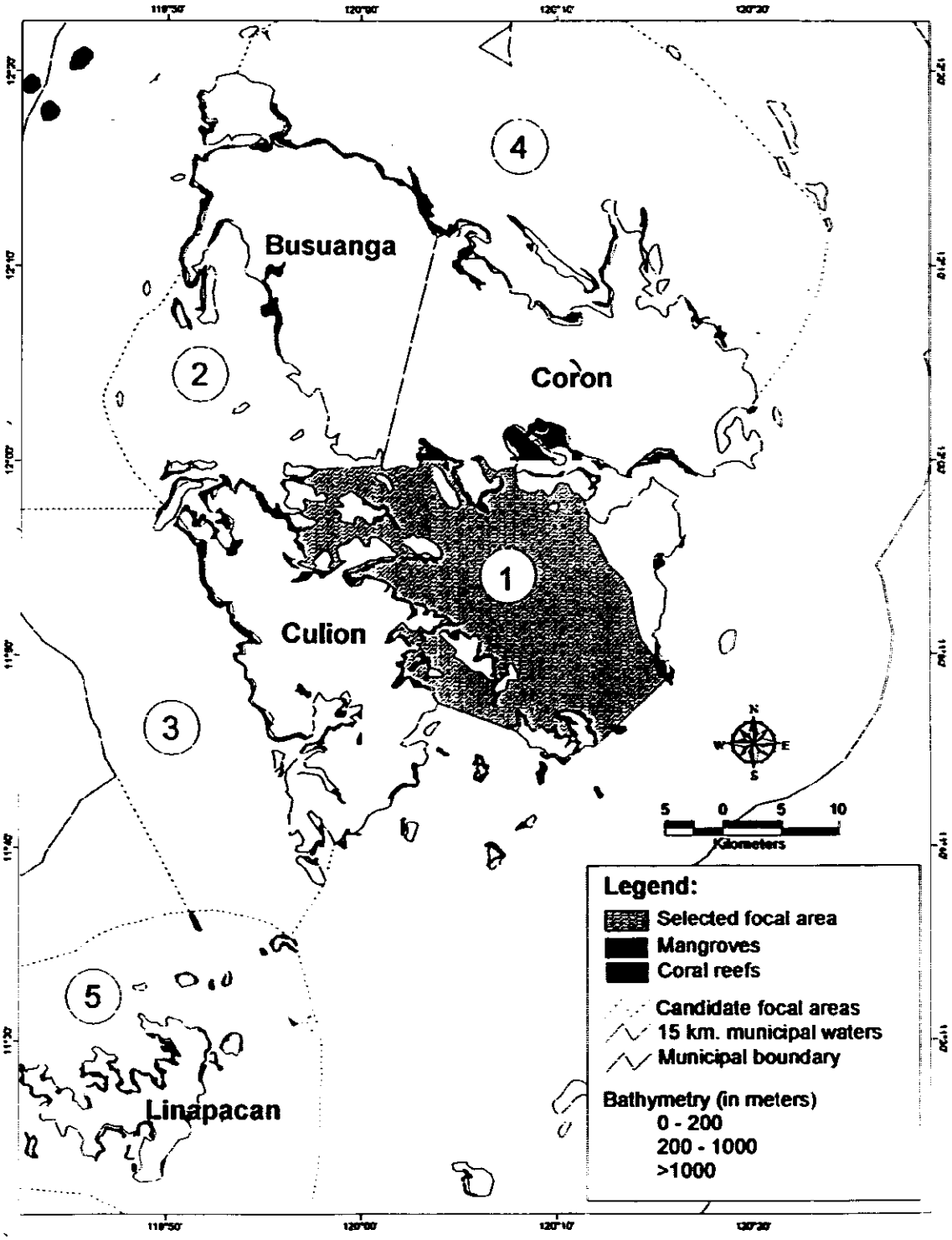
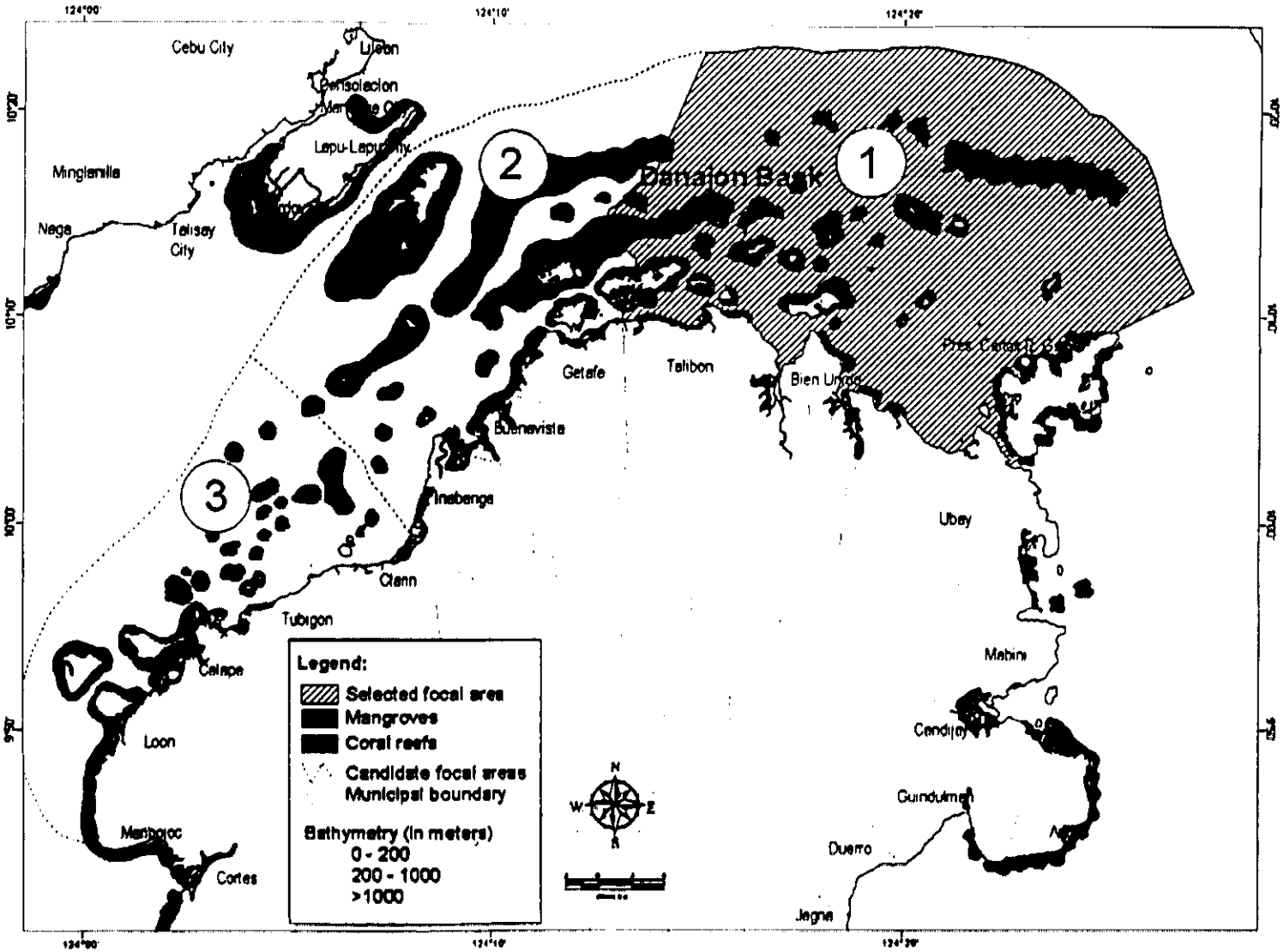


Figure 3. Candidate focal areas and selected focal area (shaded) within the Danajon Bank target area.



Surigao del Sur

Three candidate focal areas were considered in the selection process for the Surigao del Sur target area (Figure 4). These include the waters off:

1. Carrascal southward to Cortes,
2. Tandág southward to Marihatag and
3. San Agustin, Lianga and Barobo.

The results of focal area screening are shown in Table 4. The waters off Carrascal southward to Cortes were selected as the focal area within the Surigao del Sur target area.

Table 4. Qualitative ranking of candidate focal areas in Surigao del Sur target area.

Criteria	Candidate Focal Area Ranking*		
	1	2	3
Operational feasibility			
a. Physical/communications accessibility	4	3	2
b. Security/political support	4	3	2
c. Institutional readiness	4	4	3
d. Degree of management control	4	4	3
Resource condition/threat level			
a. Coastal habitat condition/threat level	4	3	-
b. Fisheries resource condition/threat level	4	3	-

*See text and Figure 4 for definition of candidate focal areas; ranking level: 1 - low; 2 - low to medium; 3 - medium to high; 4 – high.

Tawi Tawi

Four candidate focal areas were considered in the selection process for the Tawi Tawi target area (Figure 5). These include the waters off:

1. Bongao, Panglima Sugala and Simunul;
2. Panglima Sugala and Sapa-Sapa;
3. Bongao and Languyan and
4. Tandubas and South Ubian.

The results of focal area screening are shown in Table 5. The waters off the three municipalities of Bongao, Panglima Sugala and Simunul were selected as the focal area for the Tawi Tawi target area.

Figure 4. Candidate focal areas and selected focal area (shaded) within the Surigao del Sur target area.

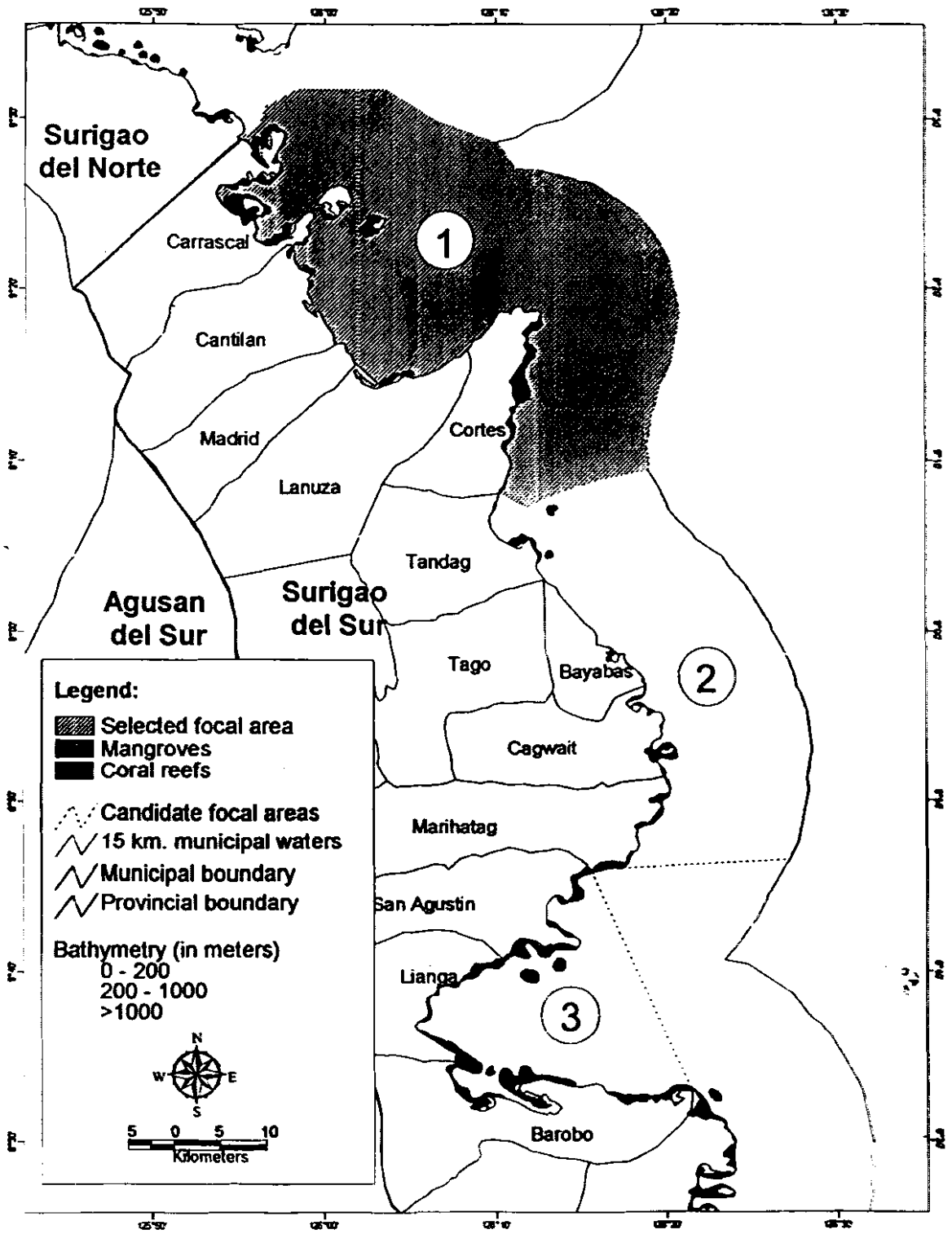


Figure 5. Candidate focal areas and selected focal area (shaded) in Tawi Tawi target area.

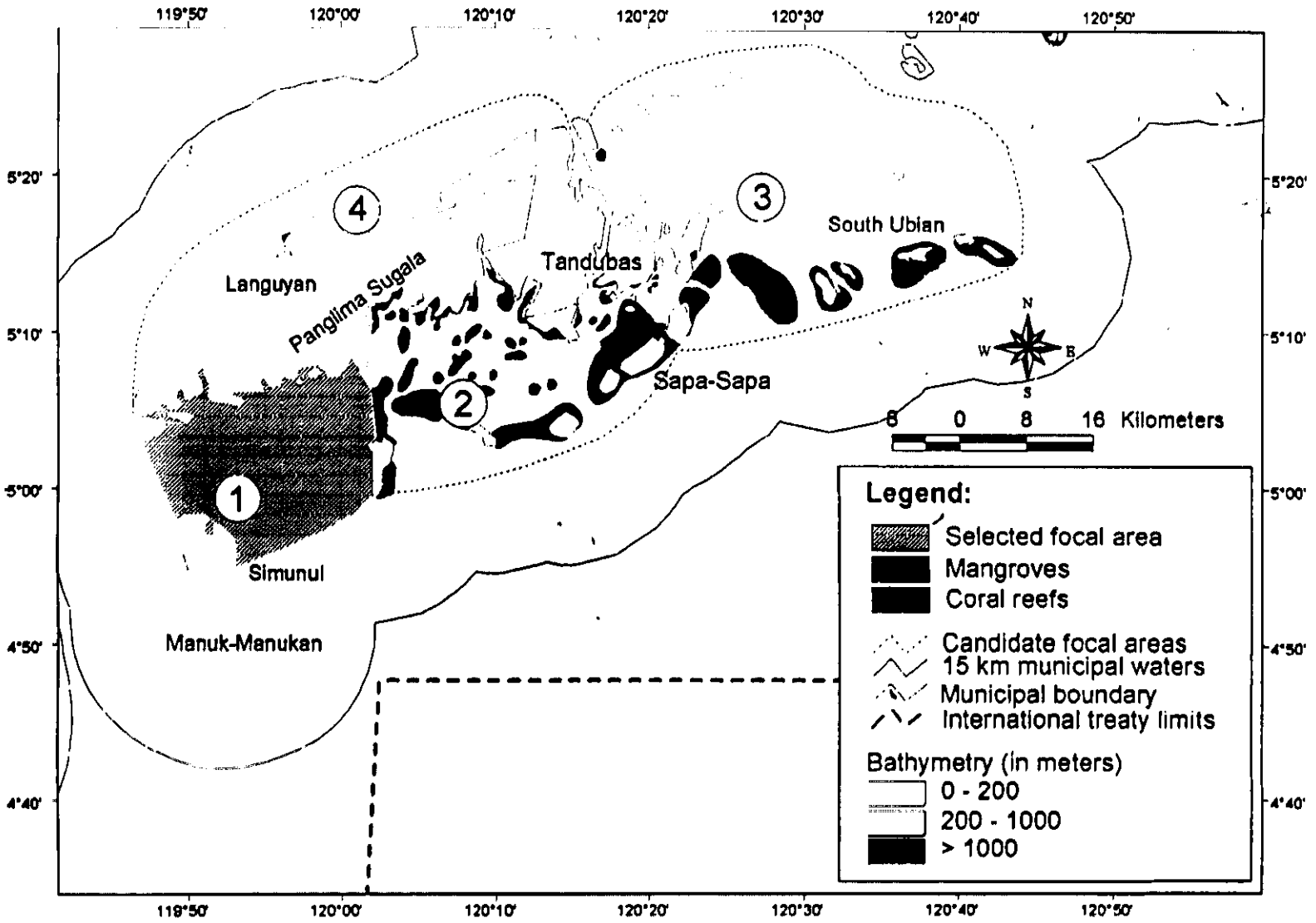


Table 5. Qualitative ranking of candidate focal areas in Tawi Tawi target area.

Criteria	Candidate Focal Area Ranking*			
	1	2	3	4
Operational feasibility				
a. Physical/communications accessibility	4	2	2	1
b. Security/political support	4	2	3	2
c. Institutional readiness	4	2	3	1
d. Degree of management control	4	2	3	1
Resource condition/threat level				
a. Coastal habitat condition/threat level	4	-	3	-
b. Fisheries resource condition/threat level	4	-	3	-

*See text and Figure 5 for definition of candidate focal areas; ranking level: 1 - low; 2 - low to medium; 3 - medium to high; 4 – high.

3.0 Performance Indicators and Monitoring

FISH Project performance will be assessed by measuring the change in marine fish stocks compared to baseline levels established in 2004 in the four focal areas. A 10% increase in marine fish stocks is targeted by the year 2010 as the overall FISH Project result. A unique aspect of the FISH Project design is the provision to characterize biophysical conditions at the beginning of the project and to monitor changes resulting throughout project implementation. The baseline assessment will establish fisheries and habitat conditions in the four focal areas for 2004. Special monitoring events will be conducted in 2006, 2008 and 2010 to assess project performance in comparison to 2004 baseline levels. Four performance indicators will form the primary basis for measuring progress toward achieving the FISH Project result (Table 6).

Table 6. Performance indicators for baseline assessment.

Project Result	Performance Indicator
FPR: Marine fish stocks increased on average by 10% compared to baseline in focal areas by the year 2010	PR1: Catch rate of selected fisheries in focal areas (average percentage change in catch per unit effort (CPUE) compared to baseline based on fishery-dependent methods) PR2: Abundance of selected fisheries resources in focal areas (average percentage change in CPUE compared to baseline based on fishery-independent methods) PR3: Reef fish density within and adjacent to selected MPAs in four focal areas (average percentage change in reef fish abundance per 500 m^2 compared to baseline) PR4: Benthic condition inside and adjacent to selected MPAs in four focal areas (average percentage change in living coral cover compared to baseline)

An example of the method for averaging across focal areas and indicators is provided below in order to gain an appreciation of the performance indicators and determination of the overall FPR. This example is preliminary and will be refined during the baseline assessment. A detailed description of the analysis and reporting of indicators for the purpose of performance monitoring is described in the Performance Monitoring Plan (FISH Document No. 03-FISH-2004).

This example uses the first special monitoring event scheduled for the year 2006 for the purpose of illustration. The measurement of performance indicators (PR1, PR2, PR3) from the four focal areas (fa1, fa2, fa3, fa4) will be calculated as percentage change compared to baseline (base04). For focal area 1 using the results from the 2006 special monitoring event, the percentage change compared to baseline for each performance indicator will be calculated as follows:

$$PR1_{fa1\text{-}06} = [(PR1_{m06} - PR1_{base04})/(PR1_{base04})]*100$$
$$PR2_{fa1\text{-}06} = [(PR2_{m06} - PR2_{base04})/(PR2_{base04})]*100$$
$$PR3_{fa1\text{-}06} = [(PR3_{m06} - PR3_{base04})/(PR3_{base04})]*100$$

The average percentage change in marine fish stocks for any given focal area will be determined as the average of the three performance indicators. For focal area 1, the average percentage change in marine fish stocks in 2006 would be determined as follows:

$$APR_{fa1\text{-}06} = (PR1_{fa1\text{-}06} + PR2_{fa1\text{-}06} + PR3_{fa1\text{-}06})/3$$

These calculations would be repeated for each focal area as follows:

$$APR_{fa2\text{-}06} = (PR1_{fa2\text{-}06} + PR2_{fa2\text{-}06} + PR3_{fa2\text{-}06})/3$$
$$APR_{fa3\text{-}06} = (PR1_{fa3\text{-}06} + PR2_{fa3\text{-}06} + PR3_{fa3\text{-}06})/3$$
$$APR_{fa4\text{-}06} = (PR1_{fa4\text{-}06} + PR2_{fa4\text{-}06} + PR3_{fa4\text{-}06})/3$$

The overall FPR for 2006 will be determined as the average percentage change from all focal areas as follows:

$$FPR_{06} = (APR_{fa1\text{-}06} + APR_{fa2\text{-}06} + APR_{fa3\text{-}06} + APR_{fa4\text{-}06})/4$$

The indicator for benthic habitat improvement will be measured as the percent change in living coral cover compared to baseline (PR4). The percentage change in coral cover compared to baseline conditions will be calculated in the same manner as the other PRs and averaged for any given monitoring event for all focal areas. The benthic habitat indicator will not be used in computing the overall FPR but will be reported separately to show changes in coastal habitat compared to changes in marine fish stocks.

These calculations will be repeated for each focal area and monitoring event (2008 and 2010) always using 2004 baseline assessment data and compared to targets established in the Performance Monitoring Plan. Figure 6 shows preliminary targets for each performance indicator (APR1, APR2, APR3 and APR4) and overall FPR over the life of the project. These targets will be revisited and finalized after completion of the baseline assessments and profiling activities. Actual results from monitoring events will be plotted in comparison with these finalized targets.

Other indicators will also be used to evaluate project performance. These indicators form part of the overall FISH Project Result Framework and are described in the Performance Monitoring Plan (FISH Document No. 03-FISH-04). Figure 7 illustrates the relationship among the project result, performance indicators, intermediate results indicators and project interventions. Baseline

levels will need to be established for some of these indicators which will be collected during fisheries and coastal resources profiling in each target area.

Figure 6. Project result and performance indicator targets.

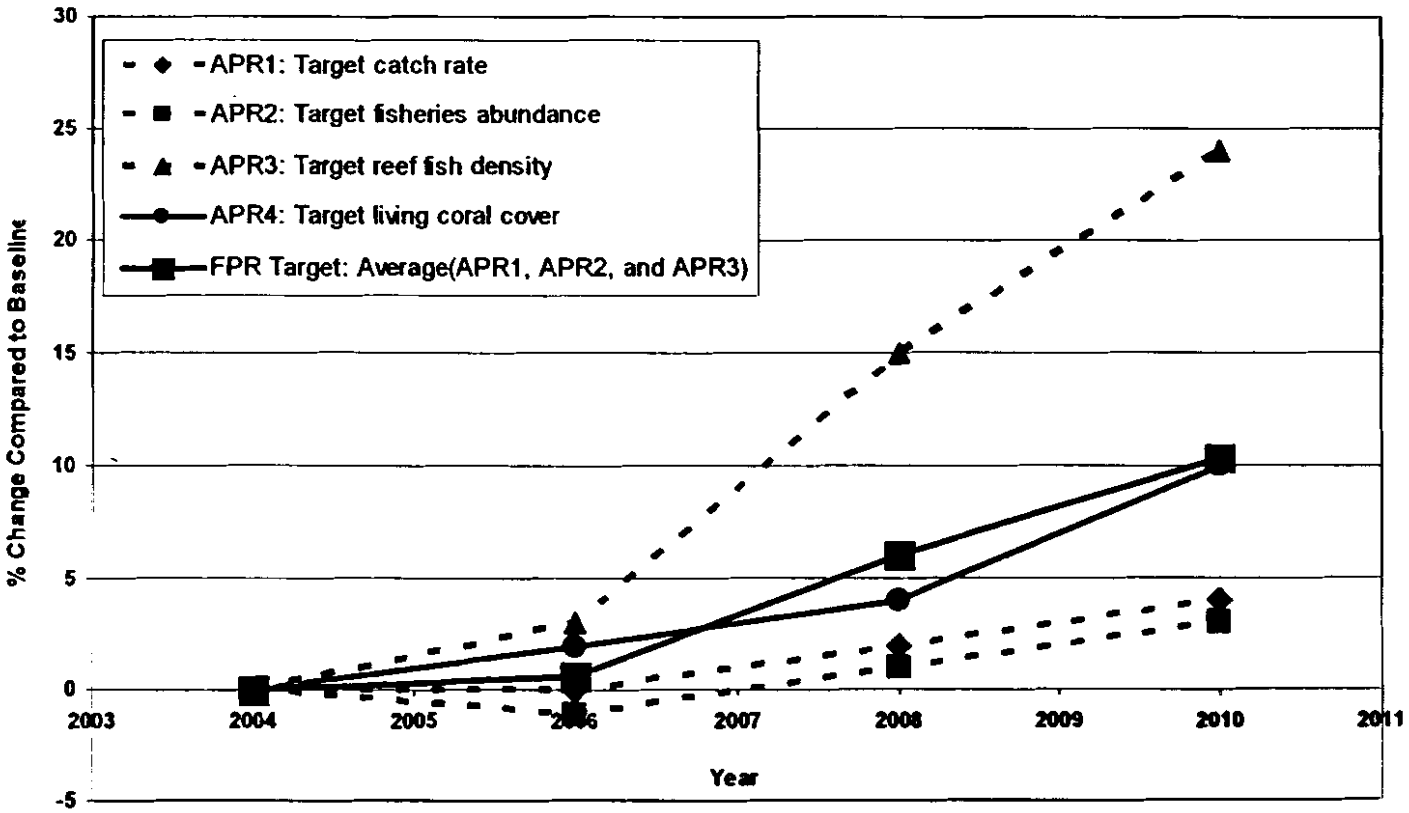
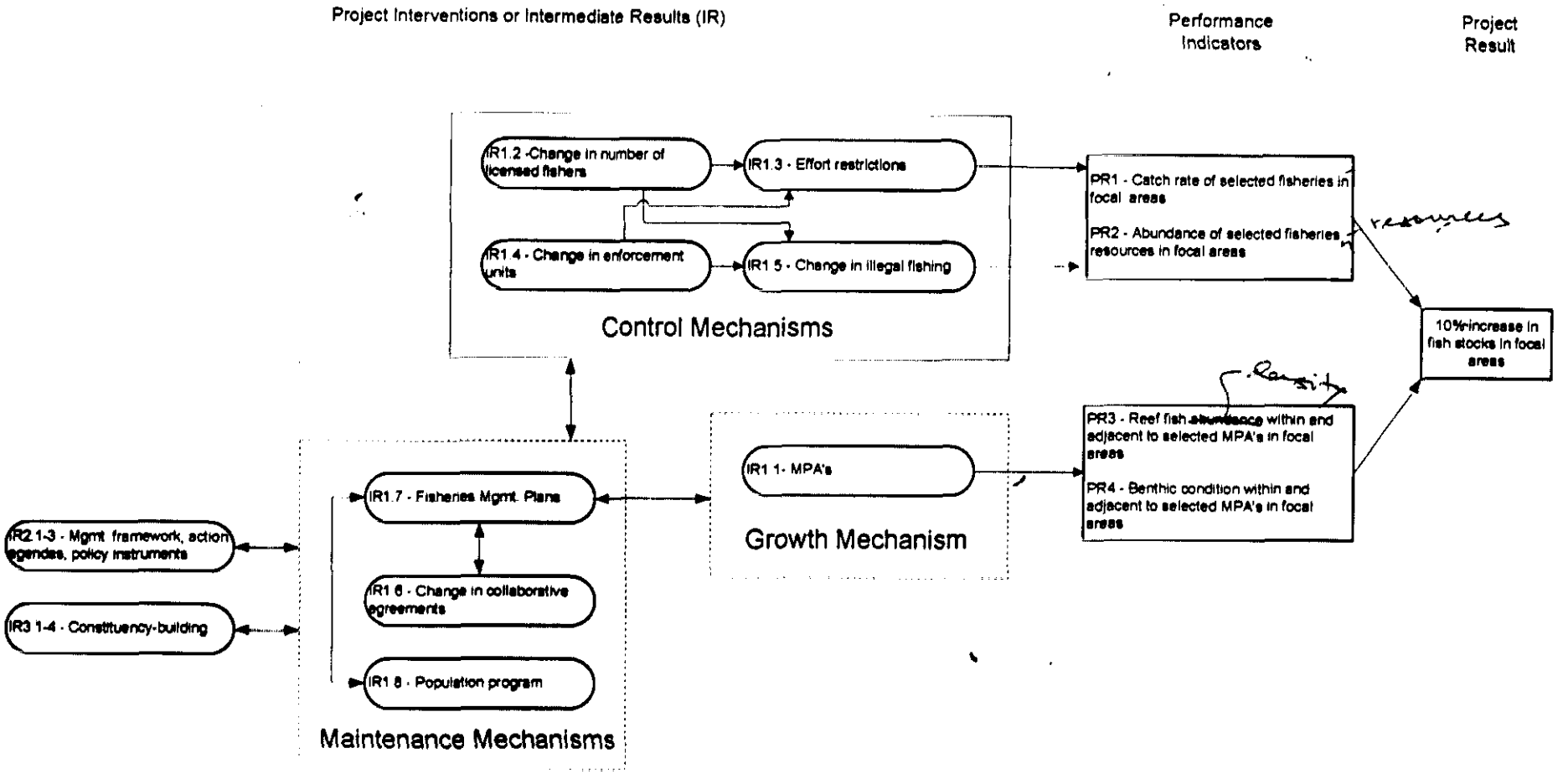


Figure 7. Relationship among project result, performance indicators, and intermediate results.



4.0 Marine Fisheries Baseline Assessment

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

- All potential practical means to measure changes in marine fish stocks will be considered.
- Special monitoring events planned for the years 2006, 2008 and 2010 will be carried out in the same months and sites as the baseline assessment.
- Other fisheries-related parameters will be measured and analyzed to supplement and serve as basis for evaluating the primary project result.
- To the extent possible and without unduly sacrificing the accuracy of results for project performance evaluation purposes, practical methods shall be selected or designed such that these can be carried out by the stakeholders even after the project life.

4.1 Catch Rate of Selected Marine Fisheries (PR1)

This section describes methods that will be used to establish the baseline conditions for performance indicator 1 (PR1). This indicator is:

PR1: Catch rate of selected fisheries in focal areas (percentage change in CPUE, compared to baseline, using fishery dependent methods)

Review of Secondary Information

With the assistance of Site Coordinators, the Fisheries Baseline Assessment Team (FBAT) will assemble and review all available secondary information on the fisheries in target areas and more specifically, in the focal areas. This initial step will give the FBAT a general idea of the fisheries in the target areas, determine information deficiencies, and provide guidance on the appropriate and efficient field data collection protocol for the fisheries baseline assessment in the focal areas.

Catch and Effort Monitoring

A three-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 three straight months. 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. Aside from CPUE, the total monthly landings for the three 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. Nonfishing 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 nonmotorized), 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 FBAT 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. A total of 46 enumerators will be fielded, 13 in Danajon Bank, 9 in Surigao del Sur, 12 in Calamianes Islands and 12 in Tawi Tawi. 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 measured by performance indicator PR1 will be measured as percentage change in the weighted average of CPUEs of the five most important fishing gears operating in each focal area. It will be the weighted average relative to their contribution to the total estimated catch in the focal area.

Key informant interview and focus group discussion

Since actual data collection is limited only to three months 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 chair of peoples organization, barangay captain (especially if he/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 (include seasonality of use), estimated average catch per day (seasonal variation if applicable), and ranking of major species caught (include seasonal variation if applicable).

Boarding arrangements with other fishing outfits operating in the area

Boarding of other fishing outfits shall be conducted as an option. This is very much dependent on the presence of such outfits in the area and the scale of operation. For gillnets, it will depend upon the capacity of the fishing boat to accommodate additional person. For ring nets, boarding will depend upon the area of operation and the duration of fishing operation. Also, boarding may have to be done from major fishing ports where these ring nets are based. Sampling of catch will be more or less similar with that of the trawler after each haul.

4.2 Abundance of Selected Marine Fisheries Resources (PR2)

This section describes methods that will be used to establish the baseline conditions for performance indictor 2 (PR2). This indicator is:

> **PR2: Abundance of selected fishery resources in focal areas (percentage change in CPUE, compared to baseline, using fishery-independent methods)**

Fishing activities shall be initiated to provide baseline measures of fish stocks in selected fishing grounds of the focal areas using fishing gears commonly used within the areas, operated independently in predetermined sampling sites, and controlled as to the scale of fishing effort which can be temporally and spatially replicated. The FISH Project has already a broad idea on the extent of fishing activities in the various focal areas and has already determined the array of possible fishing gears that can be used to conduct independent and systematic fishing to measure the current marine fish stock and for subsequent stock abundance monitoring in the future. Focus is on fishing gears wherein operation and effort can be controlled or quantified so that the catch and effort can be used to measure standing fish and invertebrate stocks. The FBAT will focus on the following independent and systematic fishing operations (but may also consider other fishing gears that may be deemed appropriate as sampling gear to measure marine fish stock density):

- systematic trawl fishing to determine the demersal stock in specific fishing grounds in the focal areas;
- controlled trap fishing to determine fish and invertebrate stock on hard bottom;
- systematic bottom-set longline fishing to supplement demersal fish stock estimates and also to serve as major fish sampling gear in areas where trawling is not possible; and
- systematic beach seine fishing to estimate nearshore fish stocks (optional).

The same gear designs, sampling sites, frequency of sampling, months of the year and lunar phase will be adhered to in monitoring increase or decrease in fish stocks in the future. The data to be collected for each fishing operation shall include total catch (in kg), time and duration of

fishing, species composition in weight and number, and length frequency distribution of all species caught.

This project result will be presented as percentage change in CPUE of trawl (for soft bottom fisheries) and fish trap (for hard bottom fisheries). It shall be expressed as weighted average, proportionate to the area covered by each type of bottom. The bottom-set longline shall be used in focal areas where trawl surveys cannot be conducted.

Trawl

The FISH Project, through its Site Coordinators, is already in the process of making representations with LGUs for the use of various fishing gears for scientific monitoring purposes, particularly in the deployment of trawl fishing gears in municipal waters. During the various courtesy calls and project orientation in the focal areas, the municipal mayors in Danajon Bank and Surigao del Sur expressed their willingness to allow the use of trawling for scientific survey. The team will likewise express the need for a systematic trawl survey to the mayors of various municipalities in Calamianes Islands. Trawl survey, however, cannot be conducted in the focal area in Tawi Tawi. The Director of the Provincial Agriculture Office of Tawi Tawi expressed concern about the use of trawls in the area even for scientific purposes. He claimed that fisherfolks feel strongly against this gear in the area.

A trawl survey for a maximum of four days, consisting of 15 to 20 trawl drags, will be conducted by the FBAT in soft bottom areas in each focal area. A maximum of 20 predetermined fishing tracks will be established and distributed proportionately, relative to the area of each 10-m trawlable depth strata (stratified sampling). Whenever available, a small 16 hp baby trawl will be deployed in the 0-20 m depth strata and a bigger 145-185 hp trawler will be deployed in the 10–50 m depth strata. The 10-20 m depth stratum overlap will be used for standardization purposes of the efficiencies of the trawlers brought about by their difference in size. In the absence of trawlable fishing grounds in the shallow 0-10 m areas, only the bigger trawl shall be used.

Detailed specifications (design, dimension, materials used, mesh size) and schematic diagrams of the fishing crafts and fishing gears used in sampling will be documented. For every fishing operation, details such as the time, depth, exact location (via global positioning system or GPS) of every aspect of fishing operation from start to end, towing speed, towing direction and length of towing warps shall be documented.

The fishing runs will be conducted similar to mesh selection experiment to eliminate the bias brought about by the mesh size selectivity of the trawl fishing gear. The procedure requires covering the cod-end with a much larger bag made of fine-meshed net. Fishes caught in the cod-end will be subject to the same statistical measurements and analyses as those caught in the cover. The procedure has been described in detail by Pope et al. (1975) and Jones (1976). Trawl mesh size selectivity and length at first capture may be determined from this and can be used as correction factor for subsequent surveys, particularly when there is a change in the mesh size of the gears used. Only a 30-minute dragging on each station will be undertaken and used as the standard trawl fishing time for the entire survey. When the net has to be hauled before the 30-

minute fishing time, e.g., during snags or when avoiding obstructions, the catch will be raised to the standard time. Trawl drags less than 20 minutes will not be used in the analysis.

Except for relatively large catches, each whole catch will be considered as the size of the sample. For relatively large hauls, sub-samples will be taken following the sampling procedure described in Hughes (1976). Information to be collected shall include: position at the start and end of dragging, estimated trawling speed, total weight of the catch, species composition by weight and number, and length frequency distribution of abundant species. All length measurements will be based on fork length. Specimens will also be collected and preserved for further laboratory work onshore if necessary.

Fish Trap Survey

Unbaited fish pots will be used to indirectly measure the marine fish stock in the hard bottom. Only fish trap designs commonly used in the area will be used. Five to ten sampling sites will be identified in collaboration with partners among the fisherfolks. Between 10 and 20 fish traps will be deployed in each sampling site. As much as possible stratified sampling will also be adhered to. Depending upon the size of the fish trap, a two-day to five-day soaking time will be considered. Once established, the soaking time will serve as the standard one for subsequent surveys.

For every fishing operation, details such as the time, depth, length of rope, soaking time and exact location (via GPS) of every aspect of fishing operation from start to end shall be documented. For each fishing operation, catch information to be collected shall include total weight of the catch per trap and for the entire set, species composition by weight and number, and length frequency distribution of all species. All length measurements will be based on fork length. Specimens will also be collected and preserved for further laboratory work onshore if necessary.

Bottom-set Longline

In collaboration with partners among the fisherfolk in the area, the FBAT will deploy 6 sets of bottom-set longline in selected sampling sites in each focal area. The bottom-set longline will only be used to supplement demersal fish stock estimates in soft and hard bottom fishing grounds of focal areas in Danajon Bank, Surigao del Sur and Calamianes Islands, but will serve as major fish sampling gear in Tawi Tawi (where trawling is not possible). Each set will have a standard of 1,000 hooks. Hook size and soaking time will depend upon what is commonly used and practiced in the various areas but will be set as standard once established. Bottom-set longline will be rented from fishers in the area and the number of hooks will be set at 1,000 pieces.

Detailed specifications (design, dimension, materials used, hook size) and schematic diagrams of fishing crafts and fishing gear used in sampling will be documented. For every fishing operation, details such as the time, depth, length of rope, soaking time and exact location (via GPS) of every aspect of fishing operation from start to end shall be documented. For each fishing operation, catch information to be collected shall include total weight of the catch for the entire bottom-set longline set, species composition by weight and number, and length frequency

distribution of all species. All length measurements will be based on fork length. Specimens will also be collected and preserved for further laboratory work onshore if necessary.

Beach Seine (optional)

Survey using beach seine fishing will be conducted on an optional basis since the gear will only measure the immediate nearshore demersal stock. The catch is also greatly influenced by the seasonal occurrence of very small pelagic fishes that migrate nearshore.

Detailed specifications (design, dimension, materials used, mesh size) and schematic diagrams of fishing crafts and fishing gear used in sampling will be documented. For every fishing operation, details such as time, depth, exact location (via GPS) of every aspect of fishing operation from start to end, encircling, towing and length of towing warps shall be documented.

Except for relatively large catches, each whole catch will be considered as the sample. For relatively large hauls, subsamples will be taken following the sampling procedure described in Hughes (1976). For each fishing operation, catch information to be collected shall include total weight, species composition by weight and number, and length frequency distribution of all species. All length measurements will be based on fork length. Specimens will also be collected and preserved for further laboratory work onshore if necessary.

4.3 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.

4.4 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 Danajon Bank and Surigao del Sur and the other for Calamianes Islands and Tawi Tawi. A senior researcher will lead each core team supported by one junior researcher and 10-14 enumerators in each focal area. The field schedule for recruiting and fielding baseline assessment teams is shown in Table 7.

Table 7. Schedule for fisheries baseline assessment team in each focal area.

Activities	Month (2004)																															
	Mar				Apr				May				Jun				Jul				Aug				Sep				Oct			
Recruit and brief core team																																
Finalize sampling design (Cebu)																																
Standardize methods, forms (Cebu)																																
Organize field core team for Danajon Bank																																
Organize field core team for Calamianes Islands																																
Organize field core team for Surigao del Sur																																
Organize field core team for Tawi Tawi																																
Prepare final report																																

Catch and effort monitoring will be conducted for a total period of 3 months and all experimental fishing will last for 3 weeks. 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 8.

Table 8. Schedule for conducting fisheries baseline assessment components in each focal area.

Focal Area Activities	Month (2004) Apr	May	Jun	Jul	Aug	Sep
Negotiate gear rental/ construction						
Make representation with LGU for experimental fishing						
Hire enumerators						
Train enumerators and field assistants						
Monitor catch and effort						
Do experimental fishing						
Encode and analyze data						
Prepare final report						

5.0 Marine Protected Area Baseline Assessment

Strengthening and establishing MPAs in each focal area as an MPA network to enhance fisheries production and marine ecosystem integrity is a major management mechanism of the FISH Project. 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, e.g., in aggregation sites, in critical habitats of particular life stages or along chosen points in migratory routes. Baseline assessment will be conducted in existing MPAs or in potentially new areas where MPAs will be established in each focal area.

5.1 Selection of Existing or Potential MPAs to Assess

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 FISH. Some focal areas, such as those in Danajon Bank may contain MPAs that the project could build upon to develop into an MPA network. In other areas, no MPAs currently exist (e.g., Tawi Tawi), thus requiring the identification of potential ones. Table 9 presents the criteria (in a rough order of priority) for selecting MPAs to be monitored.

Table 9. 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 supportive 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

During an initial, 6-day reconnaissance trip, the MPA Baseline Assessment Team (BAT) will conduct informal consultations with selected informants to assess the first three criteria and a manta tow survey to assess the last criterion above. 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. A series of 2-minute observations along a path following the reef slope will be conducted by a diver-observer (with a manta board) towed by the pump boat. Geographical coordinates of each set of observations will be measured by a handheld GPS unit. The observer will estimate cover of live (hard/soft) coral, dead coral, dead coral with algae, abiotics (sand, rocks or water) and others (algal beds, etc.) on a ten-point scale. The results will be superimposed on a map of the focal area to assist in site selection for the surveys. These will also be used during consultations with local fishers.

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 Reef Fish Density Inside and Adjacent to Selected MPAs (PR3)

This section describes methods that will be used to establish the baseline conditions for performance indicator 3 (PR3). This indicator is:

> **PR3: Reef fish density inside and adjacent to selected MPAs (average percentage change in fish abundance per 500 m^2 compared to baseline)**

Reef fish density will be measured in three MPAs within each focal area. Reef fish assemblages will be surveyed using the standard visual census techniques in Uychiaoco *et al.* (2001). A 50-m transect line will be set parallel to depth contours along the reef slope at depths of 7-10 m.

All fish (including juveniles) encountered within 5 m of either side of the line will be identified and counted, and their size (fork lengths) will be estimated to the nearest 1cm. A minimum of five transects will be surveyed inside and another five outside of each selected MPA (or other reef site). This will allow estimates of true variance in parameters within the "no-take" zone and in neighboring fished areas. Geographical coordinates of each transect will be recorded with the use of handheld GPS units. In addition, fabricated concrete markers will be laid at the beginning and end of each transect line to allow resurveying of the same site in the future.

Fish abundance of "visually obvious", "target" and "indicator" species will be separately estimated. Abundance will be expressed as density or number of individuals per 500 m^2. In addition, abundance will be converted to biomass estimates by using length-weight relationships in the literature.

5.3 Benthic Condition Inside and Adjacent to Selected MPAs (PR4)

This section describes methods that will be used to establish the baseline conditions for performance indicator 4 (PR4). This indicator is:

PR4: Benthic condition inside and adjacent to selected MPAs in four focal areas (average percentage change in living coral cover compared to baseline)

The point-intercept transect described by Uychiaoco et al. (2001) will be used to obtain data on life forms that will be the basis for assessing the percentage of living coral cover. In addition, the general characteristics of the reef site will also be noted down, e.g., 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.

5.4 Other Parameters to Measure Inside and Adjacent to Selected MPAs

Below are the other parameters that will be measured in the same 50-m transects used in visual census.

Abundance of Harvestable Invertebrates

All mobile epibenthic macroinvertebrates (e.g., crustaceans, echinoderms, mollusks) within 2 m of either side of the transect line will also be counted and identified. Abundance will be expressed as number of individuals per 500 m^2.

Number of Target Species

That MPAs allow fish to thrive can be observed in the increase in fish biomass and possibly the reappearance of fish species-- particularly "target" ones—that have "disappeared" (or reduced to such low numbers that they are unlikely to be recorded during fish visual census) due to heavy exploitation. Thus, as part of baseline assessment, it is useful to have a record of the number of target species (per 500 m^2). The number of species is easily obtained from the data generated by fish visual census and benthic condition assessment.

5.5 Activities and Schedule

The MPA BAT will be composed of two members who will conduct fish visual census and four members who will survey benthic lifeforms. The field schedule for conducting MPA baseline assessment is shown in Table 10.

Table 10. Field schedule for marine protected area baseline assessment.

Activity	Month (2004)																							
	Apr				May				Jun				Jul				Aug				Sep			
Team organization and initial preparation	■	■																						
Calamianes Islands																								
Reconnaissance trip			■																					
Survey proper				■	■																			
Data processing						■																		
Surigao del Sur																								
Reconnaissance trip							■																	
Survey proper								■	■															
Data processing										■														
Tawi Tawi																								
Reconnaissance trip											■													
Survey proper												■	■											
Data processing														■										
Danajon Bank																								
Reconnaissance trip															■									
Survey proper																■	■							
Data processing																		■						
Report preparation																			■	■	■	■	■	■
Report submission																								■

6.0 Data Quality and 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 team leaders for the fisheries and MPA baseline assessments are responsible for data quality and management. 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 bases. 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 daily 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 weekly to look for possible errors and gaps.

- The baseline assessment methodology will be reviewed weekly.
- Review and final analysis of data sets will be made monthly.

6.2 *Performance Monitoring Database*

Data and information collected during baseline assessment, and later during special monitoring events, 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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