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RAPID PARTICIPATORY RESOURCE AND SOCIO-ECONOMIC ASSESSMENT OF ALBAY GULF

Executive Summary

Farming and fishing although serving as the country's lifeline in assuring food security are the top sectors with alarming poverty incidence. Studies attribute this to big family size and low educational level among farmers and fishers. A large proportion of Bicolanos are directly or indirectly involved in the fishing industry where the majority are small-scale fishermen. Depletion of fish stocks and the continuing deterioration of the state of coastal habitats have also been demonstrated to be the cause of dismal trend of economic status of fisherfolk families. To address these alarming trends, the Department of Agriculture's Bureau of Fisheries and Aquatic Resources (DA-BFAR) launched the Fisheries, Coastal Resources and Livelihood (FishCORAL) Project. This United Nations Fund for Agricultural Development (UN-IFAD)-funded project prioritized 11 target fishing grounds for the development goal of enabling coastal communities sustainably manage their fishery and coastal resources and generating livelihood benefits for fishing households. Consistent to the objectives of FishCORAL Project, the rapid Participatory Resource and Socio-Economic Assessment (PRSA) for Albay Gulf was implemented.

The objective of the PRSA specifically for Albay Gulf is to update the status of the aquatic ecology, habitats and capture fisheries of the fishing ground; come up with the status of its basic water quality; update the socio-cultural, economic and institutional/policy characteristics; and establish a working database for the PRSA data. The assessment was implemented in Albay Gulf covering the Provinces of Albay and Sorsogon. The research covered the local government units (LGUs) of Bacacay, Sto. Domingo, Rapu-Rapu, Manito and Legazpi City for Albay and the Bacon District of Sosogon City and Prieto Diaz for the province of Sorgoson. The assessment areas were divided into five major project components namely, (i) Socio-cultural, economic and institutional/policy assessment; (ii) Aquatic ecology and coastal habitat assessments; (iii) Water quality assessment; (iv) Capture fisheries resources assessment; and (v) Databasing and GIS mapping. Led by a Study Leader, each component took charge in the planning, field sampling, data collection, processing and the subsequent analysis to comply with the targeted output.

Albay Gulf has not been a beneficiary of comprehensive national fisheries management programs unlike its neighbouring fishing grounds. These are the Fishery Sector Program (FSP), the Fishery Resource Management Program (FRMP), and the Integrated Coastal Resource Management Program (ICRMP), which were responsible for the repeated comprehensive monitoring the nearby Lagonoy Gulf, Sorsogon Bay, San Miguel Bay and Ragay Gulf of Camarines Province and Asid Gulf of Masbate. In case of Albay gulf, some initiatives were noted but these are minimal, sporadic and could not suffice for a gulf-wide management to cover critical ecological habitats and other rich resources.

In 1997, the Tambuyog Development Center, a Non-Government Organization (NGO) and the then Bacon Local Government Unit have undertaken the monitoring of the status of the ecological habitats of certain sectors for marine protected area establishment. But still, technical information to guide future development and management initiatives were scant and elusive. In 2002, the Sustainable Management of Coastal Resources (SUMACOR) was implemented which resulted to the establishment of the Marine Protected Areas (MPAs) in

Polique Bay of Legazpi City and Sto. Domingo, Albay. Another NGO, the Coastal Core in 2008 through its project on participatory community profiling and development planning for selected Barangays of Bacon District, captured concerns along fisheries productivity and sustainability. Bicol University and Sorsogon City LGU partnered in 2010 in a rapid resource and social assessment of the Bacon District. The Department of Environment and Natural Resources Region V (DENR-V), through its coastal resources management program had a productive partnership with Prieto Diaz in the early 1990s resulting in the establishment of its MPA.

The gulf-wide management intervention, emanating from a sound technical information is deemed urgent in the face of recent developments posing direct threat to the resilience of the rich but fragile resources of Albay Gulf. Worse is there are no available baselines to compare from, that is why the ecological impacts of any disturbance that may happen is hard to assess. This is alarming since many non-fishing uses have been emerging in the gulf which are potential to disrupt its ecological integrity. Poorly planned ecotourism projects have been one of these uses. To mention a few, the emergence of ecotourism projects integrating many land and sea-based activities to promote tourism, mining activities in both Batan and Rapu-Rapu Islands, the geothermal energy-harnessing project of Manito and Bacon areas, the emerging industries, and the growing port of Legazpi City are enough reasons to cast doubts to the productivity and carrying capacity of the gulf. Likewise, the increasing load of potential pollutants from ballooning households, the reported trend of overfishing and the continued denudation of the surrounding vegetation are adding burden to hundreds of families that are dependent to the bounty of the gulf.

The reports compiled in this PRSA offers the first gulf-wide comprehensive technical information in Albay Gulf. They are presented here per project component.

Project 1: Socio-Cultural, Economic and Institutional/Policy Assessment

Specific for Albay Gulf, Project 1 was responsible in verifying the socio-cultural, economic and institutional/policy characterization covering the households in the gulf area. The research compiled the socio-demographic, economic, institutional, and policy baselines of households situated in coastal barangays along Albay Gulf. The data on the socio-demographic characteristics of respondents revealed that the sector clearly has an ageing labor force, while majority of the households were composed of young members. Literacy is not an issue in the gulf's fishing households, as in terms of educational attainment, there were members who were able to finish college and in rare cases, some were able to even pursue post baccalaureate degree. However, a large disparity can be observed in terms of the roles performed by male and female household members in fishing and farming activities as the sector is still gender biased. Although, the data suggests that female participation in economic activities can be increased through education and training. Access to safe drinking water, however, is yet to be solved as majority of households derive their drinking water from contamination-vulnerable sources such as groundwater and surface water.

Fishers seldom sell fish in the market, and if they do they receive the lowest price. It was not surprising that majority of the fishing households interviewed were low-income class and poor. Income from fishing was further found out to be insufficient to meet at least the basic food needs of each family member. Fishing households spend most of their income on food, electricity, and education and least on recreation and amortization. This means that households earn to meet at least their basic needs. Recreation, although necessary for welfare, is not a priority among fisherfolks.

The access to formal credit providers, among fishing households was less evident. Requirements set by lending institutions usually hinder them to access to capital. Results of which, impel members to borrow from relatives, neighbors, and friends. However, money borrowed from these non-institutional credit arrangements are only limited and can only be used to finance immediate needs such as food items and not as a working capital. Thus, opportunities for income generating activities and value adding are also hampered.

Public awareness of the existing coastal resources and management policies and ordinances are yet to be intensified as most of the households heavily depend on the resources found in Albay Gulf. If the residents lack the knowledge of proper management and sustainable use of coastal resources, time will come that marine ecosystem will be incapable of sustaining the food needs of the population. On top of public awareness, community participation was also low. Because of this gap, more effort needs to be done to achieve the intended ends of regulating the fisheries through coastal resource management.

In terms of livelihood in the coastal communities, most of the full-time fishers are male members of the household. This is followed by respondents who are fishers when there is abundant supply in fish while working as construction/carpenter/laborer during lean fishing months. The livelihood that fishermen usually engage in are fish capture, processing/drying of fish, mending of nets and other gears, gleaning, mari-culture, aquasilvi culture, seaweed farming, lobster culturing and bagoong production. Crop and animal production, and other income generating activities such as small-scale business, handicrafts, marine-based income generating projects (IGP), and pay for work engagement are some of the none fishing-related activities. All of which are dominated by men.

Both government and non-government agencies aid to develop the livelihood of the residents either to increase and improve the fishing capacity of the residents or provide additional livelihood opportunities to them, like the Bureau of Fisheries and Aquatic Resources, Department of Labor and Employment, Local Government Unit, and Sunwest Corporation. The livelihood assistance provided includes the provision of fishing gears, boat making, boat releasing, training on *paitlogan, negosyo*, ice making, *tilapiahan, bigasan*, fishpond, lapu-lapu fish caging, recycling of materials, fish processing, *pagbibigay ng hikot, paggawa ng pangke, gulayon*, mangrove plantation, sandal making, rice retailing and fishpond project. When evaluated based on effectiveness, the fishing livelihood assistance of the BFAR was considered as very effective, that includes the *paitlogan*, giving of fish net and *hikut-hikot* and boat making. Found to be moderately effective were the *negosyo* and boat releasing. Effective were the ice making program, provision of *banwit, tansi* and nylon; Ineffective was the *tilapiahan;* and, very ineffective was the *bigasan*, and fishpond. Other livelihood assistance from by other agencies, which were evaluated as very effective were the giving of nets, lapu-lapu fish cage, recyclable materials, and assistance in making pangke; moderately effective was the giving of boats; effective was sandal making; and very ineffective were the *palaisdaan* and fish processing.

Project 2: Assessment of Aquatic Ecology and the Conditions of Ecological Habitats

Project 2 includes the assessment of coastal habitats such as coral reefs, seagrass and seaweed beds and mangroves. Tools employed for coral reef assessment was the line intercept transect (LIT) method, while the fish visual census (FVC) was used to characterize the associated reef fish species. The line quadrat method (LQM) was used to assess seagrass and seaweeds and the line plot (LP) method was employed for mangroves. All these methodologies are outlined by English, et al (1997).

Status of Corals and Coral Reef Fishes of Albay Gulf

The assessment was the first ever comprehensive assessment of coral reefs (2.22% of the entire gulf area) and the associate reef fishes in Albay Gulf. Bulk of these reef systems were inside MPAs while non-MPA reefs were also assessed in Legazpi City and Rapu-Rapu, Albay for comparison purposes. These MPAs offer protection to just 0.88% of the entire coastal water of the gulf. No coral reef for Bacacay was assessed as the MPA of this municipality is located on the other side (Lagonoy Gulf). The reef systems in the gulf were generally found to be in different state of health, mostly in fair condition while some are in poor and good conditions. From the stations surveyed in Legazpi and Rapu-Rapu, non-MPA reefs are interestingly in better condition than those reefs inside the MPA. The inferior coral condition inside MPAs may not necessarily be reflective of inadequacy of management. Natural disturbances to MPA sites such as storms and massive siltation due to its proximity to rivers, and the intense fishing activity expended to the reefs prior to their protection may have contributed to this condition. Commonly observed in all reefs surveyed were macro algal growth over dead corals, which in effect will have some serious implication to coral recovery. The artificial reef installed in Sto. Domingo, Albay were already in bad state. The concrete dome-like "coral beads" were mostly buried in sand flat and colonized with macroalgae and some recruits of branching corals. Puffers, pomacentrids and scorpionfish were observed in these artificial reef modules.

A very variable diversity (15 to 43 species) in the reef fishes in at least 11 MPA and non-MPA reef areas were observed. Of the six MPA reef systems surveyed, Sto. Domingo MPA registered the biggest biomass of 56.12 mt/km^2 followed by Bacon District with 41.04 mt/km^2 and Caracaran, Rapu-Rapu with 33.8 mt/km^2. In terms of feeding habit, most of the fishes encountered are carnivores (61%). There seem to be an imbalance now as this group is significantly outnumbering those that are at the lower trophic level, such as herbivores and omnivores which represent 21 and 19% respectively. The very low count of herbivore fishes will directly connect to the significant elimination of grazers, which partly could have caused macro algal growth.

Crown of thorns were seen in all reef areas surveyed, but are more frequently encountered in the Legazpi, Bacon District and Manito reef systems. Ghost (abandoned) fishing gears such as entangled fish nets and bottom set long line are seen in all reef systems except in Prieto Diaz. Evidence of coral bleaching are seen in Sto. Domingo, Rapu-Rapu and Denson Reef of Legazpi City. Although some of them have recovered, some bleached coral recruits in Caracaran in Rapu-rapu and the shallow part of Maslog (in Legazpi) reef have failed to recover. The highlighted overgrowth of microalgae is also everywhere but more pronounced in Rapu-Rapu, Bacon District and Prieto Diaz.

Status of Seagrass and Seaweed Habitat in Albay Gulf

The seagrass and seaweed beds assessment in Albay Gulf covered a total of six LGUs in the provinces of Albay and Sorsogon. There were nine stations surveyed in the different barangays of Legazpi City, Sto. Domingo, Manito and Rapu-Rapu, for Albay, while a total of five stations were visited in Prieto Diaz and Bacon District for Sorsogon. It was found out that Albay Gulf had 10 species in six genera of seagrasses. These were *Cymodocea rotundata*, *Cymodocea serrulata*, *Halodule pinifolia*, *Halodule uninervis,* and *Syringodium isoetifolium* of family Cymodoceaceae and *Enhalus acoroides*, *Halophila ovalis*, *Halophila minor*, *Halophila decipiens*, and *Thalassia hemprichii* from family Hydrocharitaceae. Among the 36 seaweeds species, 11 genera were noted under Chlorophyceae, five from Phaeophyceae, and

seven belong to Rhodophyceae. Species richness vary in the municipalities bordering this gulf due to differences in the physical condition in the area such as substratum. *Thalassia hemprichii* was the most abundant seagrass found in Prieto Diaz among others followed by *Syringodium isoetifolium* in Bacon District and Sto. Domingo. *Cymodocea rotundata* dominated other seagrass species in Manito, while *Halodule uninervis* were abundant in Rapu-Rapu. *Enhalus acoroides* was found to have the least abundant but had high percentage cover in Legazpi. The seagrass and seaweed habitat condition in Sto. Domingo was excellent while those in Prieto Diaz, Manito, Bacon District were good. Legazpi and Rapu-Rapu areas had fair seagrass and seaweed bed conditions. *Enhalus acoroides* gained the highest biomass of 261.28g/m^2 measured in Manito. Parallel to its abundance, *Thalassia hemprichii* had the highest biomass in Prieto Diaz and *Syringodium isoetifolium* in Bacon District. *Acetabularia, Halicoryne, Halimeda*, *Neomeris*, *Padina*, and *Sargassum* were commonly found in most of the stations with *Halimeda* sp., *Sargassum* and *Padina* species comprising high biomass. Associated macroinvertebrates such as sponges, sea cucumbers, cowrie, sea urchins and starfishes were noted.

The seagrass and seaweed beds status was influenced generally by natural phenomena, like seagrass wasting decomposition and anthropogenic activities, which were aquaculture, fishing, recreational activities and other developments. Areas near human settlement and establishments were vulnerable to physical disturbance that may affect this kind of ecosystem.

Status of Mangroves in Albay Gulf

Location of mangrove areas were determined by generating GIS images from Landsat data. The mangrove maps were then ground truthed by actual onsite inspection. Final sampling stations were then identified and determined for comprehensive assessment. The mangrove habitat condition was evaluated using the Habitat Criteria Rating Chart for Mangroves outlined in the Participatory Coastal Resource Assessment (PCRA) guideline. The assessment revealed that a total of 11 species were encountered belonging to six families of true mangrove species. This is comparably lower than the recorded 47 true mangrove species in the Philippines. The low species count can be due to rampant illegal cutting activities in the distant past and the rehabilitation initiatives that heavily relied on propagule-producing Rhizophora species. The latter practice in mangrove rehabilitation would disrupt the right zonation pattern, eliminate other species, and result in luxuriant growth of a low number of species. Five associated mangrove species were also encountered. The mangrove area in Talisayon (Prieto Diaz) and Bato, Bacon had the most number of encountered mangrove and associated species. Overall, the mangrove areas of Bacon and Diamante in Prieto Diaz were in excellent condition, while the one in Talisayon of Prieto Diaz, the stations in Manito, Legazpi, and Batan Island were in good condition. The mangroves of Poblacion in Rapu-Rapu were in fair state, while the one in Buhatan of Sto. Domingo was in poor state. Mangrove area development and conversion to varied economic uses, solid wastes, and improper rehabilitation practices have yielded these different states/condition of the habitat.

R. apiculata appeared as the most dense in many areas surveyed because it was chosen as the reforestation species. Bulk of mangrove stations surveyed were considered secondary, which means they were no longer old growth forests. Some areas had few mangrove species but with high percentage density of species occurrence because they truly dominated the entire stand with choices. Some of mangrove stations surveyed were natural stands with few human interventions. They were found in Bacon and Talisayon, both in the province of Sorsogon. Efforts to replant mangrove species were for rehabilitation, whose purpose was primarily to

increase the mangrove area but not to restore the original stand following the natural zonation pattern. The regeneration capacity of the mangrove areas varied significantly. Sorsogon mangroves have very high regenerative capacities based on the abundance of saplings and seedlings, exceeding 50% of counted tree stands. Batan mangroves also have high regenerative capacity, while the rest have poor capacities based on the same criteria.

Project 3: Water Quality Assessment

There were 13 water quality stations identified in Albay Gulf, which were prioritized based on the locations of MPAs, aquaculture, mariculture, near discharge zones and areas with important geographical locations. In-situ parameters such as pH, dissolved oxygen (DO), total dissolved solids (TDS), temperature, salinity and conductivity were measured using Hannah multiparameter water quality meter, while water samples were collected from the identified water quality stations for nitrates, phosphate, total suspended solids and fecal coliform determinations.

The assessment revealed that the present temperature profile of Albay Gulf (28.11 to 29.09°C) is within the range value ideal for coastal marine water of 26-30°C as set by the DAO 2016-08. Salinity in all stations is considered high despite some are proximal to river discharge areas. There were no standards set for the allowable limits of salinity measurements required in DAO 2016-08. However, salinity values normally range from 34-36 psu. It can be noted that the measured salinity values among the stations in Albay gulf were within this range. Normal values were also observed DO levels in the gulf with a narrow range of 6.09-6.58 ppm. These values even surpassed the 6 ppm DO levels as set by the standard. This is an indication of good water condition to support essential survival of all aquatic organisms. Recorded values for TDS exhibited slight variations ranging from 22.62 - 23.77 ppt. There was no standard limit set for TDS in DAO 2016-08. However, a concentration of total dissolved solids that are too high or too low may limit the growth and may lead to death of many aquatic organisms. In terms of pH, it is almost similar in all stations which ranged from 8.10 to 8.25. This range is normal, in which ocean water is nearly alkaline because of numerous dissolved ions that most are alkaline in nature. All recorded values are within the standard allowable pH value for Class SB marine waters. Thus, an indication of good condition and buffering capacity of the gulf water. If the pH of water is too high or too low, the aquatic organism living within the area would be seriously affected. Apart from this effect, pH can also affect solubility and toxicity of chemicals and heavy metals present, if any, in water.

Nitrate levels in Albay gulf ranged from 11.6- 16.10 mg/L ppm, the highest of which was recorded in a station fronting Misibis and the lowest from near MPA in Manito. Comparing these obtained values with the standard limits set by DAO 2016-08, it can be deduced that majority of the identified water quality stations exceeded values for SB-type of coastal and marine water. Like dissolved oxygen, temperature and pH, the amount of nitrate concentrations in water is determined by both natural processes and human interventions. On the other hand, the phosphate levels measured along the water quality stations ranged from 0.14 – 5.04 mg/L (ppm). These values suggest strong variation among the stations with the station near opening of river in Puro as the highest (5.04 mg/L). Majority of the stations exceeded the phosphate concentration limits for class SB water which is 0.5 mg/l. Phosphorous generally gets into the water through urban and agricultural settings. It tends to attach to soil particles or simply dissolved form and move into surface water bodies from run-off. This excess phosphates in water, as can be observed from the values obtained for the water quality stations near opening of rivers in Puro, can affect water quality by excessive algae growth.

In terms of fecal coliform, the water quality station near the opening of river in Puro, Legazpi City has the highest fecal coliform (FC) levels followed by the station near the Yawa river opening in San Roque, Legazpi City. Fecal coliform has been widely used as standard indicator of sewage pollution and potential health hazard associated with fecal pollution. Though in general not harmful, FC indicate the possible presence if pathogenic (disease causing) bacteria, viruses, and even protozoans that also live in human and animal digestive systems. Majority of the alarming values obtained from the sampling stations in Albay gulf exceeded the limits set by DAO for SB classification except for stations near marine protected areas. FC may be linked to human population and anthropogenic activities as observed from the highest recorded values of FC from opening of rivers within Legazpi City area. The presence of FC bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of animals or even by man. FC bacteria can enter these rivers through discharge of waste, from agricultural and storm runoff, and from untreated human sewage. Agricultural practices such as allowing animal wastes to wash into nearby streams during the rainy season, spreading the manure and fertilizer on fields during rainy periods, and allowing livestock watering in streams can all contribute fecal coliform contamination. Likewise, unsanitary disposal of human waste and poor design of septic tanks may also contribute, either through surface or submarine ground discharge mechanisms.

Generally, the water in Albay Gulf is compliant to the standards set by DAO 2016-08, based only on the values for each basic physical (temperature and salinity) and chemical (pH and DO) parameters obtained by *in situ* measurement. However, the nitrate, phosphate and the fecal coliforms recorded within some stations obviously surpassed the limits for class SB for these parameters. The high nitrate concentration can be ascribed from agricultural runoff in addition to the natural nutrient load of the seawater. On the other hand, the disparity on the fecal coliform values from the identified stations compared to the limits can be attributed to sources like runoffs, waste discharge of growing coastal communities, domestication of animals, and poor sanitation compliance along coastal areas.

Project 4: Capture Fisheries Resources Assessment

Capture Fisheries Resources Assessment was carried out in 82 barangays along Albay Gulf. Key informant interview (KII) was employed to gather vital information pertaining to the number of fishing gear units, fishing frequency and seasonality of fishing operation of various fishing gears. Catch and effort data were obtained through a recall interview of key informants. BFARMC officials and/or key fishers who are knowledgeable on fishing practices and dynamics in their area were the primary source of catch and effort data. Result of data validation was used to estimate the overall production of fishing gear types. The production per type of gear was determined by identifying the product of catch rate per specific gear unit multiplied by the product of fishing frequency and number of specific gear unit.

The capture fisheries resources assessment showed that fishers in Albay Gulf utilize a total of thirty-one (31) distinct type of fishing gears ascribing a multi-gear fishery. These fishing gears can be classified into seven gear categories namely entangling nets, handlines, longlines, barriers and traps, impounding nets, spear, and miscellaneous hand instruments. These multi fishing gears are dominated by handlines and entangling nets. The gulf is generally characterized as multi-species fisheries. Highlighting some of the fishing gears commonly caught, “bolinao” (*Encrasicholina sp*.) was recorded to be the usual catch of fishers using basnig. Catch rates of most fishing gears were found to vary widely ranging from 0.25 kg/trip (*bigawnan, tina-tina, buyod-buyod, og-og, bunuan, bintol-kasag, flashlight, pamana, and pagtagati/panagun-has*) to as high as 350 kg/trip (basnig).

In terms of annual production, a total of 11,756.46 MT was estimated based on the fishing gears contributions along the gulf and resulted to a catch per unit area of 15.27 MT/km^2 relative to 770 km^2 area of the gulf. The production contribution per municipality showed that Rapu-Rapu dominates by contributing 26.61% (3,128.72 MT), followed by Bacon District of Sorsogon City 25.88% (3,042.60 MT), Legazpi 16.25% (1,910.83 MT), Manito 14.47% (1,700.65 MT), Sto. Domingo 7.67% (901.44 MT), Bacacay 5.73% (673.27 MT), and Prieto Diaz with the least share of 3.39% (398.95 MT). Almost all fishing gears are being operated year-round except the trap and lift net for lobster with no operations during the third to early fourth quarter of the year due to scarcity of the target species. Other operations such as trip frequency and production contribution of fishing gears are greatly influenced by temporal seasonality.

Project 5: Databasing and GIS Mapping

This component took charge of database development, data encoding and summary sheet and descriptive statistics generation. GIS maps were rendered reflecting RSA generated information (i.e., habitat occurrence and condition, socio-economics, seasonality and changes to area of fishing operation, etc). Project 5 aimed to design infographics and factsheets based on the summary reports submitted by different project components. A total of four (4) infographics and six (6) factsheets were designed and presented before the stakeholder's meeting. It was observed that stakeholders are interested both in the system for dissemination to the community and infographics as IEC campaign materials. Some have suggested to allow them to access the system and download the materials. The development of the system provided an opportunity to have a reliable and systematic information storage, archiving and management system for fisheries and coastal resource management. Test cases were tested and successfully passed the provision for user acceptability, interactivity and error messages. The system successfully designed the interfaces for socio-economic, aquatic ecology, water quality, and capture fishery components. System access was successfully tested and provided security procedures for user requests.

Recommendations

Based on the above discussion highlights by project components, the recommendations presented below would provide opportunities for Local Government Units, other government agencies and other stakeholders in Albay Gulf to look into solutions that will address the problems confronting the fisheries of the gulf.

1) Based from the socio-demographic and economic profile of fishing households, female participation can be increased in farming activities to augment the household income. This can be through seminars and training and the introduction of value-adding of the fisheries products to fishing households as this will not only increase income of members but also the quality of fishery products.
2) Coastal resources management efforts as primary responsibility of local communities should be participatory rather than centralized. LGUs must likewise be capacitated first to address the policy and institutional gaps identified through technical expertise and budgetary support from the national government. In like manner, the use of Information, Education, and Communication (IEC) can increase public awareness, participation as well as promoting environmental advocacies.

3) The identified livelihood assistance/interventions must be sustained to provide income to fishing households. Proposed alternative livelihood projects should be anchored on the availability and accessibility to resources. Implementation of livelihood projects must be issue-based and with respect to resources availability and the capability of the fisherfolks to implement. Higher involvement of women must be observed to empower them and aid in the increase in income generation.
4) Revalidation of the location and expanse of the MPAs, as some are right in front of the mouth of rivers, like the Kabunturan and Manito MPAs. With the presence of nearby other reef systems which are in better condition, expansion of this preexisting MPA can be considered.
5) Networking of the MPAs. The MPAs in Albay Gulf are in isolation with each other and are managed at varied scales. Since all of them are within one ecological setting, their functionality could better serve the intended purpose of habitat and biodiversity protection if their operational and management mechanisms follow the same standards.
6) Careful rehabilitation efforts and curbing coral ecosystem disturbances. Coral restoration in some areas which has the poor reef health status can be explored to improve and restore the diversity of the said habitat. As solid and especially liquid wastes are the main killers of coral reefs, they introduce unnecessary high level of nutrient to supposedly oligotrophic reef ecosystem.
7) Restrain the continued encroachment of human settlement, coastal development and other forms of disturbances that would compromise the ecological and economic benefits of mangroves and capture mangrove communities in the protection and management programs for coastal-marine environment of the LGUs. Likewise, the implementation of regulatory procedures by enforcing mangrove laws and the application of natural regeneration or restoration ecology instead of just rehabilitation to maintain diversity.
8) A more stringent water quality monitoring should be done. This can be undertaken through regular monitoring as guided by regulatory guidelines. In addition, the high levels of nutrients such as nitrates and phosphates in some of the water quality stations within the gulf which can be attributed mainly to agricultural contributions, calls for a need for the LGUs to revisit its conditions and management for sustainable agriculture. The solid waste management and proper household and industry sanitation initiatives of the municipalities along Albay Gulf should also be enhanced taking into consideration the seemingly alarming fecal coliform levels on areas near rivers and ecotourism facilities.
9) The inclusion of Albay Gulf in future capture fisheries monitoring/assessment is strongly recommended.
10) A more comprehensive data gathering scheme should be introduced to capture a wider range of parameters that affect coastal habitat and fisheries in different season, use of data mining to analyze the reports of socio-economic trends and other components depending on given or acquired data sets, and develop a real-time collection of data through system integrated hardware devices.