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# Establishing a marine protected area network in the Western Danajon Bank Bohol, Central Visayas, Philippines

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## Abstract

The formation of coastal alliances or the Marine Protected Area network is one of the management efforts that are being practiced in the Philippines. Most of these alliances, however, fail to work due to political changes in leadership, lack of technical support, and sources of operating funds. Hence, a different network design was employed in the formation of the marine protected area network in the Western Danajon Bank Marine Key Biodiversity Area. The design of the management body was the bottom-up approach − the decision-making body was all local stakeholders; local academic institutions as technical partners and source of the fund was ensured through a municipal ordinance. Such an approach was employed with the hope of continuity of MPA networking in the entire Bohol Island. Although this management design is different from the typical alliances in the Philippines, evaluation of the network's performance is necessary to determine the effectiveness of such a management approach.

Key words: marine protected area network, Danajon Bank, bottom-up management

## INTRODUCTION

Danajon Bank is the only double barrier reef in the Philippines. It is one of the three sites in the Indo − Pacific (Pichon, 1977) and one among the six in the world. It has an overall area of 272 km$^2$ (Samonte et al. 2016, Armada et al. 2009) covering 17 municipalities in the four provinces including Bohol, Cebu, Leyte and Southern Leyte. It is located in the northern part of Bohol extending from the municipality of Pres. Carlos P. Garcia up to the western side down to the municipality of Tubigon. This double barrier reef is a combination of about 40 small islands − three large reefs and clusters of small reefs (Samonte et al. 2016) which form the inner and the outer reefs. The Caubyan reef (outer barrier reef) is consist of continuous large reefs while the Calituban reef (inner barrier reef) is less continuous with a single large unit in the central part (Grobe et al. 1985). Such unique underwater topography likely contributes to the high production in terms of marine resources and other marine products in Bohol and the neighboring islands.

Over the years, the coastal resources of Danajon Bank have been subjected to heavy exploitation due to the ever-growing population and high demands of marine products (e.g. seaweeds, mollusks, fish for the aquarium trade, etc.). The relatively high fisher density (Christie et al. 2006), coupled with unsustainable and destructive fishing activities (e. g. dynamite and cyanide fishing), (Armada et al. 2009) have contributed to faster decline in production and depletion of resources around the Danajon Bank, posing a threat to both biodiversity and human food security. As such, this area has been identified as one of the priority areas of both international and local Non-Government Organizations (NGOs) for the conservation of reef fishes, corals, mangroves, and mollusks (Green et al. 2004). These organizations, together with the active participation of the Local Government Unit (LGU) and the coastal communities around the Danajon coast, established marine protected areas to address these issues.

Marine protected areas or sanctuaries are globally used to recover the stock of target species (Roberts et al. 2005), protect genetic variability (Bohnsack, 1996), protection from

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the effects of human exploitation and activities (Marcos et al. 2021) while safeguarding social and economic development (Laffoley et al. 2008). When properly designed, managed and with close monitoring, it is hoped that such efforts will eventually lead to increased catches and improved biodiversity. Such benefits may be more realizable if individual MPAs were grouped to form a network of ecologically functional and linked sites managed by an organized network of local managers.

Marine protected area establishment in the Philippines started as early as the 1970s (Cabral et al. 2014) through the Sumilon Island in Cebu. Since then, the establishment of marine protected areas increased (Arceo et al. 2013). As of 2011, a total of 1, 620 locally managed MPAs have been established in the country (Cabral et al. 2014) of which, 11% (182 MPAs) of these are from Bohol Island. This figure is the most numerous established MPAs in any province in the country. However, it only covers a total area of 2, 590.99 has (4%) of their municipal waters since only 26% of the established MPAs have an area measuring > 20 hectares and above.

Regardless of this effort, illegal and destructive fishing are still rampant in Bohol. Thus, an Executive Order (E.O. #1 Series of 2015) was signed by the Provincial Governor to further improve the law enforcement and guarding of the marine protected areas. With this, Bohol Island was divided into 8 functional clusters with local chief executives as the chairman of the different clusters. This effort, however, only concentrates on the law enforcement aspect and with no defined activities on other MPA management activities (e.g. PCRA training, monitoring, evaluation, etc). In addition to this, the Provincial Government through the Bohol Environment Management Office initiated the forming of alliances if LGUs and their MPAs along the southern and eastern sides of the island. These include the PADAYON Marine Triangle (Panglao, Dauis and Baclayon), MACOTAPADA (Maribojoc, Cortes, Tagbilaran, Panglao and Dauis) and DuGJan (Duero, Guindulman and Jagna). Of these, only the latter has remained active until the present, due to the change of management/local chief executives of the other two alliances.

Thus, in this paper, a different approach or management structure was applied in the establishment of a marine protected area network in the western part of the Danajon Bank. Such an approach was utilized with the hope of continuity of the network and eventual networking of all marine protected areas in the Danajon Bank and entire Bohol.

## MATERIALS AND METHODS

### Study Area

The establishment of a marine protected area network was conducted in the Western side of Bohol Island covering the municipalities of Tubigon, Clarin, Inabanga, Buenavista, and Jetafe (Fig. 1) from January 2016−February 2017. This area had a total of number 38 established MPAs since 1998. Most of these MPAs are managed by the local community, with clear support from their municipal government. In determining which of these MPAs were to be included in the networking, several criteria were considered such as ecological and management considerations.

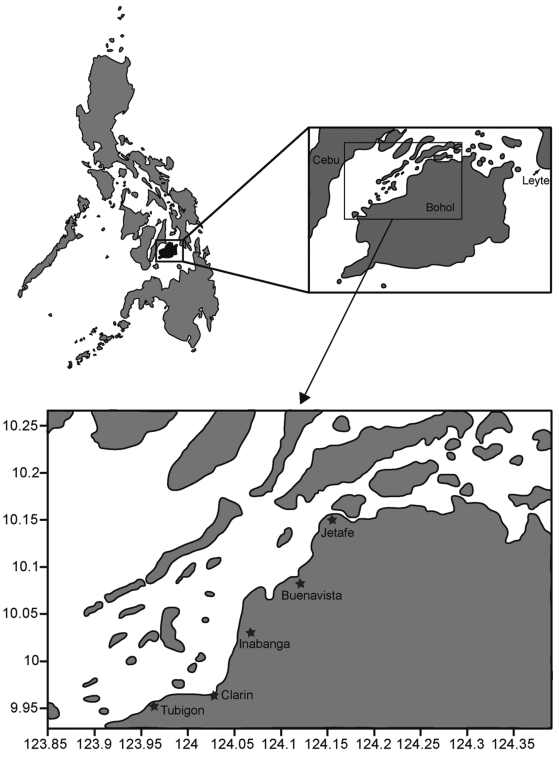


**Fig. 1.** Map showing the five municipalities included in the marine protected area networking in Western Danajon Bank.

### Establishment of the network of MPA and legal recognition

An individual consultation of the identified MPAs was conducted first to determine their current status − whether their management plans were updated if management councils were still active as well as the status of their monitoring team. This information was necessary for determining what suitable workshop or activities to be undertaken before the networking of all MPAs in the five municipalities. Because all of the identified MPAs had no updated management plans and clear management councils, a planning workshop was conducted to draft their management plans for each of the individual MPAs, create the MPA management council and the Municipal MPA networks as well. This was followed by another workshop to present the drafted plan and formulate a one-year action plan

at the municipal level (Fig. 2).

After the finalization of the management and action plans, the management activities of each five municipalities were consolidated into the Western Danajon Action Plan and the Western Danajon MPA Network was then created. The management council of the network was then elected and the majority agreed to draft and pass a Memorandum of Understanding (MOU) between the five municipalities and partner agencies. Thus, MOU was drafted, finalized, and signed. Parallel to this, a participatory coastal resource assessment training (PCRA) was conducted to capacitate MPA monitoring teams and LGU partners.

Since the Memorandum of Understanding does not touch on fund sources, as well the roles and responsibilities of the LGU, another workshop was conducted with the participation of MPA Network's Officers, Municipal Agriculture Officer/ CRM Coordinator, Sangguniang Bayan Members, partner agencies (BEMO, BFAR, ZSL, ECOFISH) and the academe to tackle the idea of institutionalizing the municipal MPA networks, their governing rules, and regulations, the role of BEMO to the MPA Network and other matters related to management effectiveness. During this workshop, a resolution institutionalizing the Municipal MPA Networks and the Western Danajon MPA Network's constitution and by-laws were drafted. A final workshop was conducted to finalize and approve the network's constitution and by-laws.

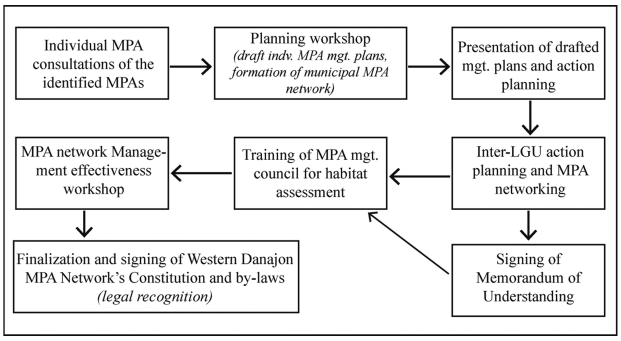


**Fig. 2.** Flow chart showing the marine protected area networking process.

## RESULTS AND DISCUSSION

Based on the hydrography (Villanoy 2006 unpub) and fish and larval abundance (Campos et al. 2006 unpub) studies conducted in Danajon Bank, the area to be covered by the networking activities was set and covered of the Central portion of the Bank (Jetafe) extending westward to Tubigon (Fig. 3). This area is referred to as the Western Danajon Bank in this study and all the subsequent activities were focused on MPAs within the 5 municipalities covered: Jetafe, Buenavista, Inabanga, Clarin, and Tubigon. The study area is consistent with the compartment of the Danajon Reef System and areas to the west (Mactan Island and Northeast Cebu) and east (South Leyte), (Fig. 3). This networking activity, however, was only designed to handle a portion of the existing MPAs in the study area. An initial list including all sites was first drawn, then subsequent screening brought down the number to 21 MPAs: 18 existing and 3 proposed at the time (Fig. 3, Table 1). Initially, all sites with areas less than 20 ha, the target minimum size of MPAs based on previous recommendations of the MPA Support Network, was deprioritized. However, several were reconsidered because of the presence of linked habitats abutting current sites and existing plans of expansion. While the study included only 21 of the 38 MPAs in the 5 municipalities covered, the long-term goal of the Network is to eventually include all the remaining ones, then the rest of the Danajon Bank (i. e., Eastern Bank) in the future. The geographic coordinates, names, areas, and associated habitats in each of the 21 sites are shown in Table 1.

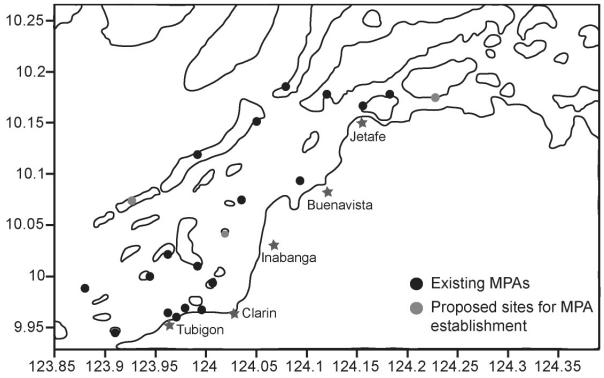


**Fig. 3.** Map showing the 21 MPAs included in the Western Danajon MPA Network from the municipalities of Tubigon, Clarin, Inabanga, Buenavista and Jetafe.

There are five (5) sites in the Central Bank area (Jetafe), eleven (11) in the area of Tubigon and Clarin, and another five (5) sites in between (Fig. 3). Of these, eight (8) sites are smaller than 20 ha (Table1). These were nevertheless included because discussions with the respective Municipal Agriculturist's Offices showed possibilities of extending the present MPA boundaries to include adjacent seagrass and mangrove areas in Pangapasan and the merging of Jandayan Sur and Jandayan Norte MPAs. Similarly, in Cuaming, the merging of two (2) adjacent fish sanctuaries is already being proposed. While there have been no discussions of possible expansions of Bilang-bilangan, Macaas, Tinangnan, and Hambungan, the presence of adjacent reef and grassbed habitats, together with strong recommendations from their respective MAOs were the deciding factors. In terms of habitat representation, seagrass beds and coral reefs are included in all of the proposed MPA sites. Only five (5) of the sites in the

proposed network include mangroves (Table 1).

In terms of management, all existing MPAs in the proposed networks had updated (2014) MEAT (Marine Protected Area Effectiveness Assessment Tools) evaluations, although, in several of them, the management bodies were no longer functional. The Bohol Environment Management Office had initiated a reorganization of management bodies in some of the sites and was continuing the effort during the study. This provided an opportunity for collaboration with the Province.

In addition to existing MPAs, the network also includes three proposed sites for MPA establishment (Fig. 2, Table 1). Of the 5 municipalities included in the network, only three municipalities had identified areas for the establishment of new MPAs. Buenavista and Clarin had no proposed sites. In the case of Clarin, its relatively short coastline and fewer islets (Fig. 4) are the main reason why its few MPAs are all located on the mainland. This is also the reason why only 1 site from Clarin was initially included in the network.

The formulation of the management plans of each of the MPAs is imperative as this serves as a guide for local stakeholders and managers on their day-to-day activities of MPA protection. The plans were formulated by local stakeholders through guided step-by-step discussions by their project staff. By doing so, the generated management activities were suitable and appropriate at the ground level. The workshop to draft the management plans of the 21 MPAs was conducted separately in the five municipalities. The participants included barangay officials, people's organizations, fisherfolks, women' s organizations, and the Municipal Officer/CRM Coordinator. During the workshop, the facilitator presented questions/issues, and participants were then asked to discuss these among themselves and to come up with and agree on answers/solutions to these issues. In general, the management plans include the following important parts: Introduction, MPA profile, vision, mission and goals, management programs, planned activities, MPA management structure, and MPA monitoring and evaluation.

The generated individual MPA management plans were consolidated at municipal and inter-LGU levels forming the

**Table 1.** Geographic locations and habitats covered in each of the existing MPAs and proposed sites for MPA establishment included in the MPA network in Western Danajon Bank covering the municipalities from Tubigon to Jetafe.

| | | Location | | Area | Habitats | | |
|---|---|---|---|---|---|---|---|
| **Municipality** | **MPA site** | **North** | **East** | **(ha)** | **Corals** | **Seagrass** | **Mangrove** |
| Tubigon | Ubay Island Marine Protected Area | 10.02081 | 123.95975 | 27.5 | x | x | - |
| | Pangapasan Marine Sanctuary | 10.0004 | 123.9431 | 6.7 | x | x | x |
| | Batasan Marine Sanctuary | 10.010322 | 123.98936 | 21.0 | x | - | - |
| | Centro Marine Sanctuary | 9.964528 | 123.96194 | 19.1 | x | x | - |
| | Cabulijan Marine Sanctuary | 9.968588 | 123.97671 | 20.83 | x | x | - |
| | Bilang-bilangan Marine Sanctuary | 9.987428 | 123.87887 | 10.5 | x | x | - |
| | Macaas Marine Sanctuary | 9.967887 | 123.99386 | 12.7 | x | x | - |
| | Tinangnan Marine Sanctuary | 9.959958 | 123.96856 | 7.0 | x | x | - |
| | Matabao Marine Sanctuary | 9.944699 | 123.90802 | 52.6 | x | x | - |
| | Mocaboc Marine Sanctuary* | 10.072796 | 123.92551 | 20.0 | x | x | - |
| Clarin | Majigpit Island Fish Sanctuary | 9.994724 | 124.00407 | 23.6 | x | x | - |
| Inabanga | Cuaming Fish Sanctuary | 10.119071 | 123.98989 | 14.3 | x | x | - |
| | Hambungan Marine Sanctuary | 10.074533 | 124.03372 | 14.1 | x | x | - |
| | Bagatusan Marine Sanctuary* | 10.043216 | 124.01815 | 30.0 | x | x | x |
| Buenavista | Asinan Reef Sanctuary | 10.093889 | 124.09193 | 50.0 | x | x | - |
| | E. Cabul-an Marine Sanctuary | 10.151256 | 124.04997 | 50.0 | x | x | - |
| Getafe | Pandanon Marine Sanctuary | 10.18312 | 124.07794 | 25.0 | x | x | - |
| | Jandayan Sur Marine Sanctuary | 10.167015 | 124.15565 | 4.7 | x | x | x |
| | Nasingin Marine Sanctuary | 10.177113 | 124.11841 | 30.0 | x | x | - |
| | Handumon Marine Sanctuary | 10.17976 | 124.18361 | 50.0 | x | x | x |
| | Mahanay Marine Sanctuary* | 10.17407 | 124.22721 | 45.0 | x | - | x |

* denotes proposed sites for MPA establishment

Western Danajon MPA Network Action Plan. This consolidation workshop was also a guided activity that allow the active participation of the local stakeholders. The action plan at the inter-LGU level consists of 8 management programs: fishery law enforcement, livelihood development, information, education and communication, fund sourcing, marine habitat management, infrastructure development, solid waste management, and monitoring and evaluation. Each of these management programs has detailed management activities, corresponding budgets, areas of implementation, and partner agencies who could give possible funding and assistance in the implementation of the activities.

The management body/council of each of the 21 MPAs included in the network is composed of either Barangay Officials, members of People's Organization (P.O's), and or Fisherfolks Association. These management councils are being coordinated by the Municipal Agriculture Officer/ Coastal Resource Management coordinators for their day-to-day MPA management. Before the Inter-LGU MPA Networking, the municipal MPA network of the 5 municipalities was formed first from the officers of the management council of each of the MPAs. Such a set-up should allow more ready coordination of management activities of member MPAs at the municipal level. It is from this set of officers that the management body of the Western Danajon MPA Network was formed (Fig. 4).

The Network's organization follows the typical management body: chairman, vice-chairman, secretary, treasurer, auditor, and board members elected from the officers of the five Municipal MPA Networks. This management structure, however, is unique from other MPA network initiatives in the country as this is primarily composed of barangay or local villagers who are directly affected as well as directly benefit from the management interventions, and are closer to day to day management operations of each MPA. This management approach is a typical bottom-up management style wherein there is active participation by the local stakeholders in drafting management plans, defining rules and regulations (e. g. drafting of the constitution and by-laws), and in decision making. The principal advantage of such structure is that the needs, concerns of each MPA, and the means to address these are defined at the ground level where these are ultimately tackled. In addition, the partnership with a local academic institution (Bohol Island State University) should further ensure the continuity of the network's activities (e.g. training, IEC activities, habitat monitoring).

In most coastal alliances, the management body is made up of either local chief executives (mayors), who have the decision and policy-making authority, or the representatives of Municipal Agriculturist Office (MAO) and or Fisheries Technician. The advantage of this setup is that decisions are supposed to be quick, and LGU funds for fisheries and MPA management are controlled by these officials. Oftentimes though, because of the extensive duties and responsibilities of these officials, MPA management is not always among their priorities. In addition, since the local chief executives have a fixed term of three years, changes in administration and political persuasions have led to the stagnation, and in some cases the break-up of alliances and local partnerships. This has been the major obstacle to the continued operations of alliances.

In the present set-up, the MPA Network is managed by the barangay stakeholders, with the MAOs and the BEMO coordinating activities at the municipal and inter-LGU levels, respectively. The commitment of the LGU is ensured through a municipal resolution, a document institutionalizing LGU

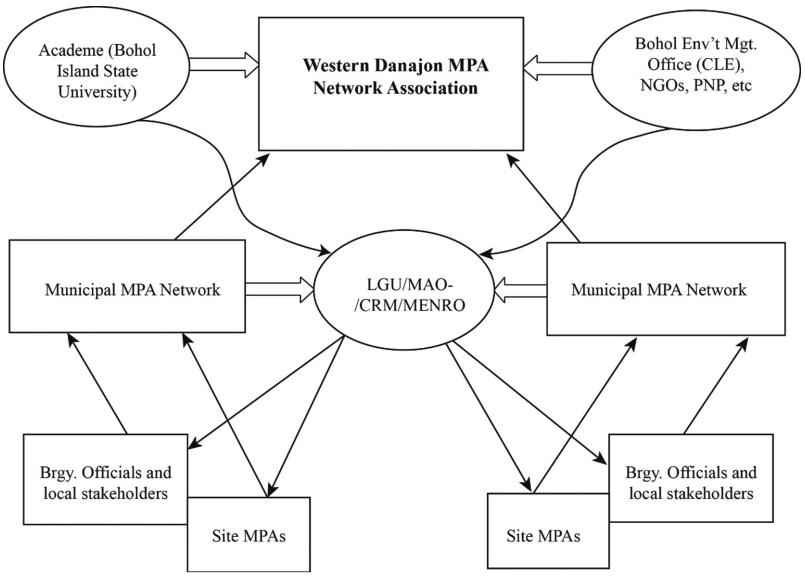


**Fig. 4.** The management structure of the Western Danajon MPA Network Association.

support and funds to the municipal networks, and collectively to the inter-LGU MPA Network.

## CONCLUSION

This paper illustrates the process of MPA Network establishment that employs the bottom-up approach or the local stakeholders as the main decision-making body. Consultation at the level of individual MPAs is the very first activity to determine the current status of their management plans and management bodies. This will aid the facilitators in determining what activities that are most suitable for the networking of activities and managers. The involvement of the local stakeholders in the formulation of the management plan will generate more suitable management activities and will be more complimentary at the ground level.

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## REFERENCES

Arceo H. O., Cazalet B., Aliño P. M., Mangialajo L., and Francour P. 2013. Moving beyond a top-down fisheries management approach in the Northwestern Mediterranean: Some lessons from the Philippines. Mar. Policy. 39: 29-42.

Armada N., White A. T. and Christie P. 2009. Managing fisheries resources in Danajon Bank, Bohol, Philippines: An ecosystem-based approach. Coast. Manage. 37: 308-330.

Bohnsack J.A. 1996. Maintenance and recovery of reef fish productivity. In Polunin N.V.C. and Roberts C.M. (eds) "Reef Fisheries", London Chapman and Hall. pp. 283−313.

Cabral R.B., Aliño P.M., Balingit A.C.M., Alis C.M., Arceo H.O., Nañola C.L. Jr., Geronimo R.C. and MSN Partners. 2014. The Philippine marine protected area (MPA) database. Phil. Sci. Lett. 7(2): 300-308.

Campos W.L., Estremadura D.M., Villanoy C.L. and Armada N.B. 2006. Determining sources and sinks of fish larvae in Danajon Bank. "Unpublished data", Technical report submitted to Fisheries Improved for Sustainable Harvest (FISH) Project.

Christie P., Armada N., White A.T., Gulayan A.M. and De Dios H. H. 2006. Coastal environment and fisheries profile of Danajon Bank Bohol, Philippines. Fisheries Improved for Sustainable Harvest (FISH) Project, Cebu City, Philippines. 63 p.

Green S.J., Flores J.O., Dizon-Corrales J.Q., Martinez R.T., Nunal D.R., Armada N.B. and White A.T. 2004. The fisheries of Central Visayas, Philippines: status and trends. Coastal Resource Management Project of the Department of Environment and Natural Resources and the Bureau of Fisheries and Aquatic Resources of Department of Agriculture, Cebu City, Philippines. 159 p.

Grobe H., Willkom H. and Wefer G. 1985. Internal structure and origin of the double barrier reefs of North Bohol and the Olango reef flat (Philippines). Philipp. J. Sci. 22: 83-94.

Laffoley D., White A.T., Killarski S., Gleason M., Smith S., Llewellyn G., Don J., Hillary A., Wedell V. and Pee D. 2008. Establishing resilient marine protected area networks − Making it happen. National Oceanic and Atmospheric Administration and the Nature Conservancy. Washington, D.C.: IUCN-WCPA, 118 pp.

Marcos C., Diaz D., Fietz K., Forcada A., Ford A., Garcia-Charton J.A., Goño R., Lenfant P., Mallol S., Moullot D., Perez-Marcos M., Puebla O., Manel S. and Perez-Ruzafa A. 2021. Reviewing the ecosystem services, societal goods and benefits of marine protected areas. Front. Mar. Sci. 8: 1-37.

Pichon M. 1977. Physiography, morphology and ecology of the double barrier reef of north Bohol (Philippines) In: Proceedings of the Third International Coral Reef Symposium. Miami, USA. 261-267.

Roberts C.M., Hawkins J.P. and Gell F.R. 2005. The role of marine reserves in achieving sustainable fisheries. Phil. Trans. R. Soc. B. 360: 123-132.

Samonte G.P.B., Eisma-Osario R.L. Amolo R. and White A. 2016. Economic value of a large marine ecosystem: Danajon double barrier reef, Philippines. Ocean Coast Manage. 122: 9-19.

Villanoy C.L. 2006. Numerical simulations of larval dispersal patterns in Danajon Bank. "Unpublished data", Technical Report submitted to Fisheries Improved for Sustainable Harvest (FISH) Project, Marine Science Institute, UP Diliman, Quezon City, Philippines.