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Fisheries *refugia*, marine protected areas, and fisheries use zoning: Some of the tools used in managing fisheries in the Philippines

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Abstract

The issues tackled by many fisheries management interventions are practically the same, namely, a fisheries that is overcapitalized, increasing fishing effort, a resource base that is degraded due to destructive fishing practices, and resource users who are highly dependent on fisheries and its resource base. In response, fisheries managers have resorted to viable interventions that are deemed acceptable to government, resource users, and stakeholders.

This paper highlights approaches and practices in the establishment of fisheries *refugia* in selected sites in the countries surrounding South China Sea, and the establishment of fisheries sanctuaries in the Philippines. It will also touch on the consolidating role of marine spatial planning, particularly of fisheries use zoning, in enhancing fisheries management. These practices are primarily based on experience during the implementation of the UNEP-GEF South China Sea (SCS) Project, USAID's Fisheries Improved for Sustainable Harvest (FISH) Project in the Philippines, and the various interventions by research institutions, non-government organizations, and fisherfolk organizations. These include establishment of fisheries *refugia*, marine protected areas and network of marine protected areas. These initiatives were further enhanced by consolidating them with various interventions through marine spatial planning, specifically through zoning of various fisheries and other marine water uses.

Despite numerous successes, there are still key challenges that need to be addressed, namely, choosing the appropriate spatial scale for a given governance scale, ensuring equitable benefits to the target resource users, and addressing excessive fishing effort (the elephant in the room). There are current initiatives being conducted to 'right scale' fisheries management interventions, namely, to see to it that governance scale is compatible with the spatial scale of ecosystems being managed. Also, ecosystem modeling is being used as tool to right-size fishing effort to be able to address excessive fishing effort. Right-sizing of fishing effort can also be designed to respond to equity issue.

Keywords: Refugia, *MPA, zoning, EAFM, right-sizing, right-scaling.*

Introduction

The issues addressed by many fisheries management interventions are practically the same throughout the Asia Region, namely, a fisheries that is overcapitalized, persistently increasing fishing effort, a resource base that is degraded due to destructive fishing practices, and resource users who are highly dependent on fisheries and its resource base. In response, fisheries managers have resorted to viable interventions that are deemed acceptable to governments, resource users, and stakeholders. Typically, these are measures that are deemed non-threatening to the majority. Fisheries management measures that will result in the reduction of fishing effort are usually not acceptable to both the resource users and the local government executives.

For example, fisheries researchers have shown higher catch rates for stationary fishing gears (fish corrals) deployed at 400 meters or more from each other compared to those between 100 to 300 meters distance from each other in the near shore shallow water fisheries in Sapian Bay, Philippines (Fig. 1). A consensus to set the minimum distance of 500 meters between stationary gears was arrived at after a series of consultation with stakeholders. However, the management initiative failed primarily because pegging the minimum distance to 500 meters meant reduction of gears that can be deployed. Stakeholders and local governments sharing the bay could not agree on the actual limits in number of allowable fishing gears and their allocation. Both are threatened by the initiative - resource users fear losing their livelihood and the elected local government executives fear losing the political support of their constituents. Other initiatives to reduce gears also suffer similar fate.

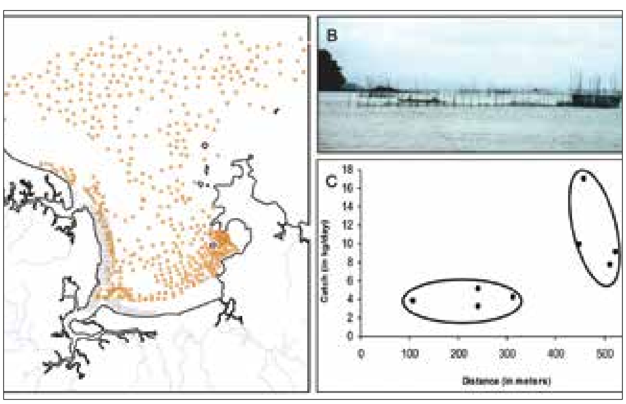


Fig. 1. Stationary fishing gears in Sapian Bay Philippines. (A) Spatial distribution of stationary fishing gears, (B) Example of stationary fishing gears (fish corrals), and C. Average catch rates of stationary fishing gears relative to their distances from each other.

In response, fisheries resource management practitioners in the Philippines have deliberately focused on non-threatening initiatives, particularly on the establishment of fisheries *refugia* and marine protected areas. These initiatives are further enhanced and made more effective through consolidating interventions like marine spatial planning, specifically through fisheries use zoning.

This paper highlights approaches and practices in the establishment of fisheries *refugia* in selected sites in the countries surrounding South China Sea, and the establishment of fisheries sanctuaries in the Philippines. It also examines the consolidating role of marine spatial planning, particularly of fisheries use zoning, in enhancing fisheries management. These are primarily based on experience from the implementation of the UNEP-GEF South China Sea (SCS) Project (UNEP, 2007, 2009) and USAID's Fisheries Improved for Sustainable Harvest (FISH) Project in the Philippines (FISH, 2010).

Fisheries *refugia*

The fisheries *refugia* concept as developed by the SCS project was based on the use of area-based or zoning approaches to fisheries management aimed at maintaining the habitats upon which fish stocks depend, as well as minimizing the effects of fishing on stocks of important species in areas and at times critical to their life cycle (UNEP, 2007). The fisheries *refugia* concept promotes sustainable use of fish stocks and their habitats. It focuses on fish life cycle and critical habitat linkages as the criteria for site selection. The common understanding is that fisheries *refugia* relate to specific areas of significance to the life cycle of particular species, and that they should be defined in space and time, and serve to protect spawning aggregations, nursery grounds, and migration routes.

A good example of the process of fisheries *refugia* establishment was the monthly spatial closure of selected seagrass areas in the FISH Project area during the lunar cycle spawning of rabbitfish (particularly *Siganus calaniculatus, S. spinus,* and *S. virgatus*). These rabbitfish species are observed to move among different marine habitats during the different stages in their life cycle, in coral reefs and in seagrass areas in particular. For *S. canaliculatus*, breeding or spawning seasons are estimated to occur from February through September as indicated by the high gonadosomatic index (GI) peaks during these months (Alcala and Alcazar, 1979). The highest peaks are found to occur during summer months of March-April and July-August. As with many other seagrass and reef fish species, rabbitfish show a prominent lunar rhythm. Takemura *et al.* (2004) found the biorhythm of rabbitfishes to follow the lunar cycle. Spawning appears to occur around the new moon, as indicated by mean GIs that are highest during the new moon of the lunar cycle. Spawning usually takes place at night or early morning, and coincides with outgoing tides.

During various consultation meetings, resource users and various stakeholders in the FISH Project sites shared a general perception of decline of rabbitfish in their catch. This was attributed to uncontrolled fishing, destructive fishing practices, and destruction of seagrass habitats. A consensus to manage the fisheries was arrived at. A series of activities was set into motion including a cross visit to model areas with successful rabbitfish management, literature review and sharing of information on the biology and life history of rabbitfish, and consultation workshops to generate possible management strategies for the specific species of rabbitfish found in the various areas.

Crucial in the consultation process was the resource-use mapping that identified the major fishing operations that exploit rabbitfish, their catch rates, fishing seasons, and fishing grounds. Also important was the fishers' observations on the spatial and temporal patterns of the occurrence of not only of adult rabbitfish spawning in the area, but also of the temporal pattern of the appearance of the juveniles as well. The information generated from the various activities served as basis for further discussion on specific policies and actions to ensure the sustainable use of the rabbitfish resource. The resource users and stakeholders themselves identified related issues, suggested possible management strategies, and outlined corresponding recommendations to address them. A common agreement was the adoption of a temporary fishing closure in seagrass areas during identified peak spawning period of rabbitfish, i.e. during the week of the new moon. However, the agreed duration of the fishing closure varied from one area to another, and this was heavily influenced by local knowledge and observations on the appearance of gravid rabbitfish before and after the new moon as well as the abundance of juveniles thereafter. Because fishing is the major source of income in the area, the duration of closure became a critical issue. In most areas, this was limited to just three days, during the third, fourth, and fifth night after the new moon, which is considered the peak spawning period. Banning fishing during this period entailed a significant sacrifice among the fishers since these are also the nights when their catch rates are high (Fig. 2) particularly due to spawning aggregation.

Considering that seagrass areas play a critical role in the life cycle stages of rabbitfish, mapping of seagrass areas was conducted to specifically delineate the areas to be covered by the seasonal closure. Other issues addressed were the need for uniformity of policy and its implementation across various local government units, the importance of regulating, if not banning the catching of juvenile rabbitfish, and the inclusion of a prohibition on the buying or selling of rabbitfish on declared temporal fishing closures. The final piece of the task was the drafting of a policy or, in most cases, an ordinance to legitimize the management initiative. This was supplemented by a management plan for rabbitfish fisheries.

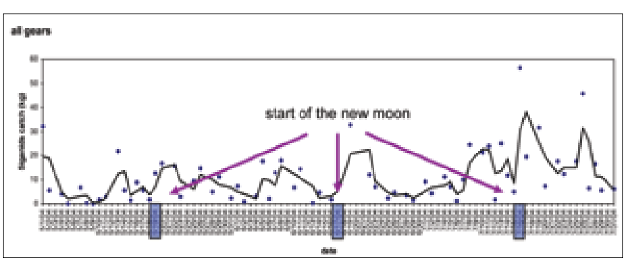


Fig. 2. Catch monitoring data from various gears catching *Siganus canaliculatus* in Danajon Bank, Philippines from May to July 2004, showing a pattern of high catch rates during and shortly after the new moon phases.

Marine protected area and the network of marine protected areas

A typical Marine Protected Area (MPA) or fish sanctuary in the Philippines (Fig. 3) consists of a core zone (typically a strictly no-take zone) and a buffer zone (usually a limited take zone). Fishing using traditional gears such as fish pots and simple hook and lines are normally allowed in the buffer zone. The establishment of a managed marine area is always done with the participation of the community. The process normally includes site selection, determining the state of the habitat and resources to be protected (establishing the baseline), delineation of the area to be protected, development of the management plan, legitimizing the initiative through an ordinance or other policy instrument, and development of strategies for effective enforcement of the allowed and disallowed activities in the zones.

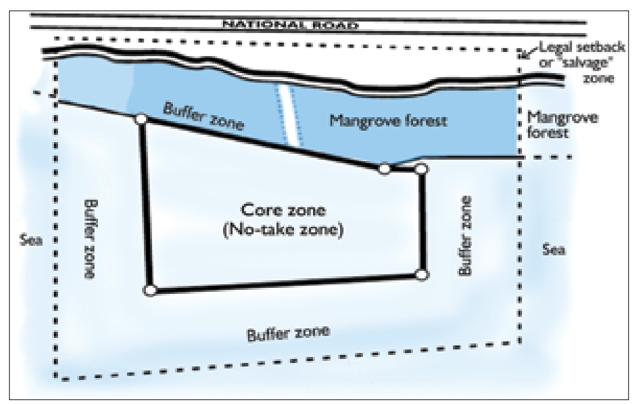


Fig. 3. A typical marine protected area or sanctuary in the Philippines consisting of a core zone and buffer zones (DENR, DA-BFAR and DILG, 2001).

As shown by the *refugia* experience as well as lessons from other fish sanctuary and MPA establishment in the Philippines, ownership of the intervention is a very important element for the sustained implementation and, ultimately, the success of marine managed or protected area initiatives. Ownership may not be achieved through a prescribed set of interventions or patented steps but it helps a lot if necessary elements are in place to ensure higher chances of success. The key elements include:

- Participatory approach (from planning to implementation)
- Information, education and communication (IEC)
- Legal instrument (ordinance, management plan)
- Establishment of an enforcement team
- Adhering to a form of MPA or marine managed area rating system

- Establishment of local MPA monitoring team
- Measuring and communicating the gains

As mentioned earlier, participatory approach, all the way from conceptualization of the idea of protecting or managing a marine area, to the planning, and ultimately to implementation, is the best assurance one can get to ensure success of the initiative. And for this, IEC - information and effectively communicating the information, plays a crucial role. Another key element is the legal instrument to legitimize the intervention. With proper and visible markings of boundaries and rules detailing the use of subsets of the protected or managed areas, resource users will be clearly guided by what was agreed upon during the consultations and planning processes. This, together with the establishment of an officially designated enforcement team, can increase the likelihood of properly implementing the initiative and achieving the desired impact.

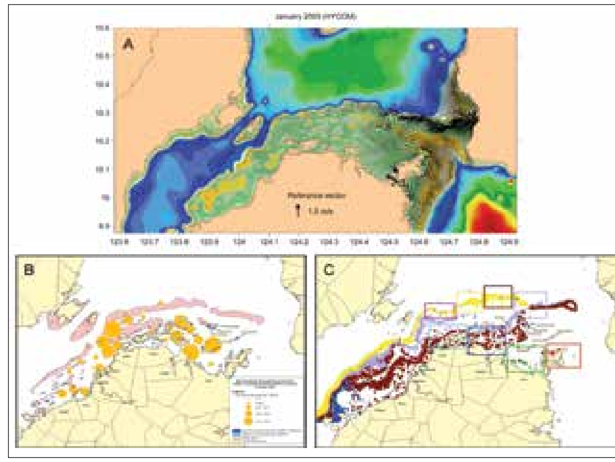


Fig. 4. The process of (A) hydrodynamic modeling (Villanoy *et al.* 2006), B) study on abundance of fish larvae (Campos *et al.* 2006), and (C) simulation of larval dispersal (Villanoy *et al.*, 2006) for the establishment of a network of marine protected areas in the Danajon Bank, Philippines.

Resource managers and resource users would like to see indications of the success of protected or managed area initiatives and this can only be achieved if proper indicators or rating system can be set in place for stakeholders to refer to in the course of the implementation. For this one would need a set of baseline information such as: coral cover, status of benthic community, fish biomass, as well as enabling instruments such as ordinances, management plans, and the establishment of an enforcement body, from which stakeholders can measure the progress of the initiative. This set of information gathering activities will have to be done on a regular basis to monitor progress. Ultimately, the information gathered from this exercise can likewise serve as the basis for communicating the biological and economic gains as a result of the marine protected or managed area intervention.

With the proliferation of MPAs in the country, the idea of setting them in place to form a network of MPAs became the logical next step. Having a scientific basis for the selection of marine protected areas so that they form and function as a network become crucial for the initiative to be effective. Scientific support is usually in the form of hydrodynamic modeling, studies on abundance of fish larvae, and a subsequent simulation of larval dispersal (Fig. 4). The idea was primarily to produce hydrodynamic models for the general circulation patterns within the confines of the area for the network of MPAs to provide an idea of the prevailing current patterns during monsoons and inter-monsoon as well as during prevailing tides. Subsequently, numerical simulations produced dispersal models to find out possible movement or larval drift. Simultaneously, a larval study was conducted to determine distribution and density of larvae. Together, this set of information was used by resource managers, resource users, and other stakeholders to determine ideal sites for planned marine protected areas, taking into consideration possible "sources" and "sinks" projected from the simulation and larval studies. With this set of information, candidate marine protected areas were assessed together with stakeholders and, through a consensus building process, some were rejected and other newly-recognized viable sites, even those not in the initial list, were encouraged.

The ever-increasing acceptance as well as popularity of MPAs and the establishment of a network of MPAs likewise opened up another level of challenge to the resource managers, resource management practitioners and academic institutions in the country. There is an on-going initiative to coordinate and consolidate all MPA and network of MPA activities. An MPA Support Network (MSN) is now in place and its objectives are to coordinate the support of academies, non-governmental organizations, and government institutions MPAs; maintain a database for participating MPAs; advocate continued development of policy for further enhancement of MPA initiatives; and oversee the monitoring and evaluation of MPAs. For the latter, MSN has standardized the MPA rating system through the development and implementation of the MPA Evaluation and Assessment Tool (MEAT).

Fisheries use zoning

The use of marine spatial planning (MSP) has so far been limited to the establishment and management of MPAs. However, there are also attempts in the region to use it on larger scales, for example, initiatives by the Partnerships in Environmental Management for Seas of East Asia (PEMSEA). In fisheries management, MSP or at least its fisheries use zoning component, is an effective tool for consolidating the range of management interventions, particularly in relation to the various marine spatial uses.

Because of the range of existing management paradigms and approaches that have been introduced in the region, it has to be understood from the very beginning that zoning as a tool does not replace any of the coastal and marine management tools already in place. In fact, it has to be highlighted that MSP or its fisheries use zoning component will only attempt to consolidate the various management initiatives by providing the spatial scale. It organizes where human activities can occur in a given coastal and marine space with the objective of encouraging compatibility of uses, reduce conflicts between human activities, and prevent conflicts between human uses and the environment (Ehler and Douvere, 2009). In the coastal and fisheries use context, zoning is meant to reduce conflicts among various capture fisheries activities, between capture fisheries and other sea uses (maritime, tourism and mariculture), and between human activities and marine environment, particularly in key habitats such as mangrove forests, seagrass beds and coral reefs. Some guiding principles adhered to in the process of establishing fisheries use zones included:

- Learning by doing such that it becomes participatory in every step.
- Use of stakeholder's and resource user's knowledge and the process to be adaptive.
- Building on existing initiatives.

Even for bodies of water with more or less similar fishing and water use activities, their development directions still differ from one another and this becomes apparent and crucial in the setting of zoning objectives and prioritization of water use activities. The entire fisheries use zoning activities were carried out following the process of clustering into at least three phases depending upon the technical capacity and pace of the stakeholders:

Phase 1
- Orientation and objective setting
- Mapping of current fisheries and other water uses
- Determining and evaluating interaction among the various uses to identify possible multiple use conflicts and use and habitat incompatibilities
- Mapping of current and future uses taking into consideration the interaction matrix, particularly, the resolution of conflicts

Phase 2
- Field validation with stakeholders and representatives of resource users
- Consultation with local government executives and legislators

Phase 3
- Drafting of activity guidelines
- Finalization of fisheries use zoning map
- Consultation with a broad base of stakeholders and resource users, and
- Legitimizing zoning plans through legislation or other kinds of policy instruments.

Fig. 5 shows an example of various documents resulting from the fisheries use zoning process. Shown are the map of current fisheries and other water uses (Fig. 5A); interaction matrix for the various uses to identify possible multiple use conflicts and use and habitat incompatibilities (Fig. 5B), activity guideline as results of field validation with stakeholders and representatives of resource users (Fig. 5C), and a digitized map incorporating information gathered during field validation and consultation with local government executives and legislators (Fig. 5D). The digitized fisheries use zoning map is also used during consultation with a broad base of stakeholders and resource users and during the drafting and legitimizing zoning plans through legislation, resolutions or other kinds of policy instruments.

The consultation process that accompanies zoning was always conducted in a highly participatory manner and the project saw to it that all sectors of the coastal community and stakeholders were represented. Workshops, that served both for training and consultation, became fora for interaction between decision-makers and resources-users, primarily the sustenance fisheries sector. This became staging points and opportunities for sustenance fishers to air their appeals and grievance to lawmakers and decision makers. It also became the forum for fisheries managers to exchange experiences with their colleagues. Likewise, in the process of developing fisheries management interventions, fishers' indigenous knowledge became significant inputs to the process of crafting the policy or, specifically, the ordinance that legitimizes the initiative.

Key challenges and the way forward

Managing the fisheries using an ecosystem approach

In the Philippines, the need to manage fisheries as an ecosystem is recognized by various sectors at different levels, from the community, resource users, fisheries management practitioners, academics, and hierarchy of the government. However, the country's legal framework entitles the local governments (municipalities or towns) to have jurisdiction over the waters from their coastlines to 15 km offshore. This complicates the implementation of an ecosystem approach to management since addressing an ecosystem issue or setting in place a broader intervention will mean dealing with multi-jurisdictional boundaries. On the other hand, it is also clear to most stakeholders that managing the fisheries and its resource base at the municipal level will not be enough since the spatial distribution of most harvestable fish and invertebrate stocks are beyond the political boundaries of the municipalities and therefore requires inter-local government cooperation. Unfortunately, the success of an inter-local government management initiative is dependent upon the cooperation of all local executives. A failure of one is a threat to the success of the entire initiative. In working towards an ecosystem approach, fisheries management interventions should always consider a defined ecosystem boundary as resource management unit. This leads us to the next challenge, spatial scale with a corresponding governance system.

Right-scaling

The USAID funded FISH Project experiences in the Philippines showed that in working towards an ecosystem approach there is a need for a governance system that addresses the various issues and implements the host of interventions for a chosen spatial scale or ecosystem. In the case of fisheries, it is a governance system that can support an ecosystem approach to controls and limits in fisheries resource exploitation activities in a defined boundary. For example, in the case of the Danajon Bank, Philippines (Fig. 6), the ecosystem approach was initiated with four municipalities as foci (the smallest rectangle), gradually expanded to nine municipalities, and further expanded to cover the rest of the 17 municipalities (bigger rectangle) constituting the Danajon Bank Double Barrier reef system (Armada *et al.,* 2009).

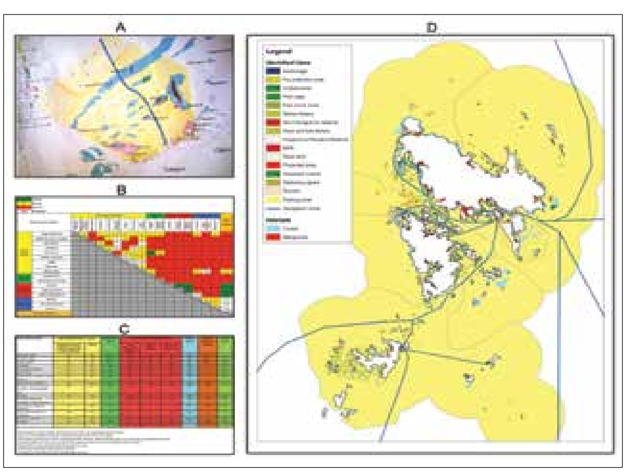


Fig. 5. Fisheries use zoning results into the development of: (A) current use map, (B) interaction matrix, (C) activity guideline, and (D) zoning map.

Scaling up the initiatives at an ecosystem level of the entire reef system was not just a challenge but also an opportunity to find out at what scale it will still be appropriate. However, expanding the ecosystem scale to cover the entire Camotes Sea (biggest rectangle) proved to be no longer feasible. The diversity of issues brought about by the increase in the spatial scale reached a point that it can no longer be addressed by a viable governance system. Due to the large area involved it became clear that the Camotes Sea ecosystem has to be subdivided into three sub-systems for a viable management scale or governance to work. It is quite obvious that the match between the spatial range of the ecosystem and the governance system is a very important consideration.

Equity for intended beneficiaries

Some initiatives, in particular those supported by the FISH Project, were able to show that a set of planned fisheries management interventions, with fish sanctuaries or marine protected areas playing pivotal roles, can result in an increase in overall harvest. However, this increase did not necessarily benefit the intended beneficiaries of the interventions, namely, the small-scale fishers. For example, the catch monitoring activities of the FISH Project in Danajon Bank, Philippines showed that harvests have increased in subsequent years, relative to the 2004 base period (Fig. 7). However, the increases in harvest were mostly due to increase in catch rates by relatively large-scale fishing gears using fine-meshed nets like the Danish seine, fish corral, stationary lift net, and round haul seine. These are also the fishing gears that require higher initial capital investment as well as maintenance. On the other hand, small-scale fishing gears like the multiple handline, bottom-set longline, and bottom-set gillnet did not benefit from the improved fish stock. Putting in place a governance mechanism by which small-scale fishers can really benefit from interventions still remains a challenge. Preferential use-right for small-scale fishery resource users is stated in many legislations around the region, but putting them into action, especially in the marine fisheries sector, still remains a challenge.

Right-sizing of fishing effort

Despite the various initiatives that specifically address conserving fish stocks and the resource base that support them, it appears that we still have failed to address the "elephant in the room"- the excessive fishing effort. Fishery management conferences and meetings always arrive at a consensus that there is excessive fishing effort and there is an urgent need to address this issue. Primarily, the way forward is to focus the ultimate thrust of fisheries management initiative on how to address this. There is an on-going attempt by the ECOFISH Project, a carry-over of the FISH Project, to address this issue. The main objective is to determine the right-size of fishing

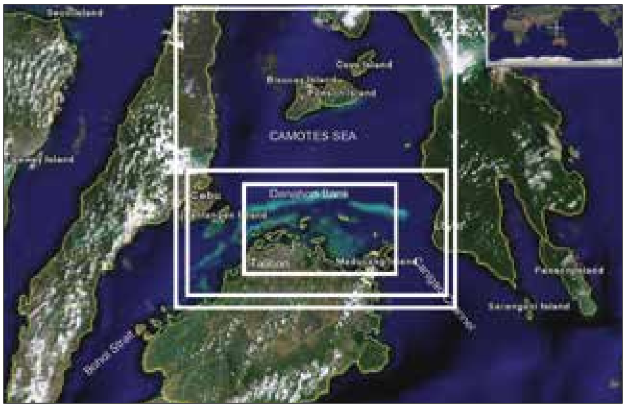
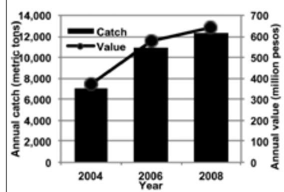


Fig. 6. Various spatial scales of FISH Project's fisheries management interventions in Danajon Bank, Philippines.

Annual landed catch (tons) in four municipalities in Danajon Bank, Philippines.

Municipalities	2004	2006	2008
Talibon	3,666	4,940	4,644
Bien Unido	1,968	2,626	4,426
Ubay	989	1,729	1,428
C.P. Garcia	413	1,571	1,873
TOTAL	7,037	10,867	12,370



Estimated annual landings (tons) of most often used fishing gears in four municipalities in Danajon Bank, Philippines.

Fishing gears	2004	2006	2008
Increased harvest:			
Drift gillnet	522	992	2,070
Hook and line	536	2,357	1,297
Danish seine*	634	1,496	1,271
Fish corral*	261	267	302
Stationary liftnet*	8	79	253
Round haul seine*	145	128	218
Decreased harvest:			
Multiple handline	185	381	15
Crab pot	137	150	64
Bottom-set longline	288	502	125
Bottom-set gillnet	726	546	484

* Active and fine-meshed fishing gears

Fig. 7. Result of catch monitoring of various fishing gears in four municipalities in Danajon Bank, Philippines.

Table 1. Distribution of the number of various fishing gears in the four municipalities in Danajon Bank, Philippines and estimation of appropriate numbers for purposes of allocation to establish the right size of fishing effort.

Fishing gear	Municipalities					Total	Ideal	Remarks
	Talibon	Trinidad	B. Unido	Ubay	CPG			
Blast fishing	14		33		8	55	0	ban
Bottom-set gillnet	133		42	282	208	665	600	reduce
Crab gillnet	484	5	177	164	256	1,086	1,000	reduce
Drift gillnet	37		36	164	179	416	420	ok
Spear w/compressor	96		25	28		149	150	ok
Danish seine	6		70	4		80	0	ban
Crab pot	97		38	74	34	243	210	reduce
Set gillnet w/plunger	41	10	77	68	12	208	210	ok
Beach seine	4		35	10		49	40	reduce
Simple hook and line	295	44	298	292	518	1,447	1,500	ok, possible increase
Otter trawl	7		28			35	0	ban
Crab liftnet	156	3	55	170	20	404	200	reduce
Fish corral	248	59	51	38	43	439	220	reduce
Bottom set longline	18		113	114	232	477	400	reduce
Drive-in gillnet	78		41	14	3	136	140	ok
Multiple handline	26		30		51	107	110	ok, possible increase
Fish trap	67		31	17	69	184	100	reduce
Trammel net	164	5	27	8		204	60	reduce
Encircling gillnet			14	8	15	37	40	ok
Handspear	289		32	35	34	390	200	reduce
Round-haul seine	4					4	0	ban
Stationary liftnet	4	1		52		57	20	reduce

effort that can be sustainably supported by a fisheries or an ecosystem. First, the process involves the development of an ecosystem model using Ecopath with Ecosim (Christensen *et al.,* 2005) for a given spatial and governance scale. This is followed by simulating the various scenarios with stakeholders to arrive at the appropriate number and allocation of the fishing gears among the various local government units and developing and implementing a process of allocating the appropriate fishing gear mix among the various local governments. To sustain the intervention, the allocations are incorporated into the fisheries management plans and legitimized through legislation or other policy instruments. The initiative has to be tied to other directly relevant initiative like registration and licensing and enforcement to ensure the success of their implementation. Currently, in the ECOFISH Project sites fishery data collection and inventory of fishing gears have been conducted, ecosystem models for a number of ecosystems have been constructed, and simulation to determine the appropriate number and mix of fishing gears is being conducted. Resulting from simulation, Table 1 provides example of the distribution of the number of different fishing gears in the four municipalities in Danajon Bank, Philippines and an estimation of appropriate numbers of fishing gear units for purposes of allocation to establish the right size of fishing effort. This model will be further refined through a process of validation and allocation with the various local government units. As with other management interventions mentioned above, a participatory approach and learning by doing, all the way from conceptualization of the idea of right-sizing of fishing effort, to planning, and ultimately to implementation, is the best approach to ensure success of the initiative.

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