CHAPTER 5

SYNTHESIS OF THE COGTONG BAY EXPERIENCE

This section summarizes the experience of two coastal villages along Cogtong Bay in Bohol, Philippines. It provides a historical perspective of the contextual variables that have shaped incentives and collective action situations. Moreover, it presents the integrated t-test results and multiple regression findings on the outcomes of co-management over time in two coastal villages.

Contextual Variables. Cogtong Bay is located in the Central Visayas region of the Philippines. Two municipalities, Mabini to the north and Candijay to the south, share the Bay's 10,000 hectares of municipal waters. Limestone hills and a thin fringe of mangroves are found at the outer portions of the Bay. The inner portion has extensive mangrove stands bordered by rice fields and coconut lands. Out of 2,000 hectares of mangrove forest, 1,400 hectares are still intact. Of these, about 275 hectares in the islands of Lumislis, Kati-il, Tabondio and Calanggaman were declared as mangrove wilderness by the national government. These are characterized by secondary bushy growth, having been cut repeatedly in the past. The rest of the mangrove areas, comprising about 600 hectares, have been converted to fishponds.

Historically, Cogtong Bay has been marked by open access, where unrestricted entry to the waters and free-for-all harvesting of coastal products prevailed until the mid-1980s (Box 8). The Bay has no customary rights of tenure to the fishery. For the mangrove areas, however, some form of informal management and tenurial rights have existed for three generations of residents in Cogtong, Candijay. Some 25 families informally took care of small mangrove areas of one hectare or less per family. Informal tenurial rights were passed on to the succeeding generations. Eventually, these rights became formal when the third generation applied for mangrove stewardship contracts in the latter half of the 1980s.

The coastal villages of Cogtong, Candijay and Marcelo, Mabini are inhabited by native Boholanos and other Visayans from neigboring provinces. The village residents are fairly homogeneous in terms of ethnicity, religion, and occupation. About 3/4 of the village population relies on coastal resources for survival and livelihood (Box 9), indicating a high degree of dependence on coastal resources. Aside from fish, most families gather crabs, shellfish, algae and other marine products for subsistence as well as for sale to local markets.

The Cogtong Bay fishery is multi-species, multi-gear, and mainly artisanal. Fishing operations are generally done with small, non-motorized boats in dispersed fishing grounds, both outside and within the Bay. Small pelagic species, including sardines and mackerel, are caught offshore. Rabbitfish, mullet, trevally, wrasse, scad and snapper are caught within the Bay. The types of fishing gear used are gillnets, handlines, fish corrals, spears, fish traps, squid jiggers and Danish seine.

Box 8. Physical, technical and biological attributes: Cogtong, Candijay and Marcelo, Mabini

Indicator	Cogtong, Candijay	Marcelo, Mabini
Boundaries	• Open access fishery, except the area covered by the newly-established fish sanctuary (1997) • Open access mangrove areas until the late1980s when DENR issued Certificates of Stewardship Contracts to mangrove planters; ban on cutting mangrove trees in mangrove wilderness reserve found in Lumislis, Kati-il, Tabondio and Calanggaman • Municipal waters delineated (inner portion of the Bay has been equidistantly divided) since 1992, but not strictly enforced • Unclear political boundaries (1970s to early 1990s)	• Open access fishery, except the area covered by the new fish sanctuary (1995) • Municipal waters delineated since 1992. Non-Mabini fishers are required to secure permits before they can fish in Mabini waters, but this is not strictly enforced • Open access mangrove areas until the second half of the 1980s when DENR first issued CSCs to mangrove planters; ban on cutting mangrove trees in Lumislis (Mabini side of the island) • Unclear political boundaries (1970s to early 1990s)
Single or multiple fishery	• Multi-gear fisheries: 9 distinct gear types (i.e., gillnets, simple handlines, longlines, squid jiggers, fish corrals, fish pots, spearguns, bagnets, and Danish seine)	• Multi-gear fisheries: 5 distinct gear types (i.e., gillnets, simple handlines, longlines, squid jiggers, and spearguns)
Artisanal or industrial fishery	• Mainly artisanal • Fishing vessels are generally less than 3 GT and mostly non-motorized	• Similar to Cogtong
Level and mix of technology	• Mix of technology: traditional/non-destructive (fish corrals, gillnets, handlines) and destructive (e.g., use of dynamite) • Minimal fish processing at the village level (fish drying and fish paste making for household consumption)	• Non-destructive (i.e., gillnets, handlines, longlines) and destructive (i.e., blast fishing) • Minimal fish drying at the village level
Dispersed or localized fishing patterns	• Year-round fishing, particularly for gillnet fishing operations and fish corrals. Seasonal fishing for simple handlines, longlines and squid jiggers. • Dispersed fishing grounds: inside Cogtong Bay (78%) and outside the Bay (22%)	• Year-round fishing, particularly for gillnet fishing operations and speargun. Seasonal fishing for simple handlines, longlines and squid jiggers • Dispersed fishing grounds: inside Cogtong Bay (90%) and outside the Bay (10%)
Multi-species or single species fishery	• Multi-species fishery : demersal (goatfish, mullet, hairtail, parrotfish, breams, snappers, groupers, slipmouth, rabbitfish, shrimps, crabs and lobsters) and pelagic (sardines, anchovies, mackerels, fusiliers and squids) .	• Multi-species fishery: similar to Cogtong

Indicator	Cogtong, Candijay	Marcelo, Mabini
Migratory or sedentary fishery resources	• Both sedentary and migratory species	• Both sedentary and migratory species
Level of stock exploitation	• Declining catch rates, particularly for gillnets, simple handlines, squid jigger and fish corrals. • Catch rates of the majority is 2-10 kilos per trip/day in 1997, down from 10-20 kilos in the 1960s • Introduction of non-traditional gear types in the 1970s and 1980s (i.e., nylon nets, filter nets); increased competition among gear types • Relative decline in sizes of catch (e.g., prawns or *sugpo*) • Scarcity of high-value fish, such as groupers and snappers	• Declining catch rates, particularly for gillnets and handlines • Catch rates of the majority is 2-10 kilos per trip/day in 1997, down from 10-20 kilos in the 1960s • Introduction of non-traditional gear types in the 1970s and 1980s (i.e., nylon nets) • Relative decline in sizes of catch (i.e., prawns)
Status of habitat	• Relatively poor water transparency at the inner portion of the Bay. • Relatively poor to fair coral condition (11-50% live coral cover); Tagaytay reef has a relatively good (50-75%) coral condition • Relatively low basal area (3.98-6.82 m^2/ha); mangrove reforestation site in Katungkian has the highest basal area • Some mangrove areas were converted to fishponds, particularly near river systems	• Similar to Cogtong

Box 9. Attributes of fishers and fisher community: Cogtong, Candijay and Marcelo, Mabini

Indicator	Cogtong, Candijay	Marcelo, Mabini
Homogeneity/heterogeneity of resource users	• Relatively homogeneous in terms of ethnicity and religion	• Relatively homogeneous in terms of occupation, ethnicity and religion
Dependence on coastal resources for livelihood	• Relatively high dependence on coastal resources (63% of village households rely on coastal resources) • Fishing provides more than half of total household earnings for 78% of fishing households	• High reliance on coastal resources (87% of village households depend on coastal resources) • Fishing provides more than half of total household earnings for 76% of fishing households
Motivation of users	• Subsistence-driven for fisheries until the 1960s and for mangroves, until the 1970s • Market-driven afterwards	• Similar to Cogtong
Attitudes of fishers	• Positive attitudes toward collective action and toward co-management	• Similar to Cogtong
Level of information and knowledge of coastal resource management	• High indigenous knowledge of fishing gear • Low knowledge of mangrove management before the MRCRMP • Improved information exchange on fisheries management and mangrove management after the implementation of the MRCRMP	• Similar to Cogtong

Fishers in Cogtong Bay recalled that fishery resources were abundant and mangrove stands were thick until the 1960s. Resource abundance, together with the use of non-destructive harvesting practices and the predominance of subsistence village economies, enabled the coastal residents to utilize coastal resources without major conflicts in resource use. The next two decades, however, saw a drastic change in the situation due to three major developments. These include: 1) the introduction of fishpond technology from Iloilo, a province in the Western Visayas region; 2) the arrival of commercial fishers and entry of commercial mangrove cutters from neighboring provinces; and, 3) the integration of Cogtong Bay into the heavily market-driven economies of nearby provinces and urban centers, such as Cebu and Tagbilaran. Thay hastened the degradation of the Bay's resources and resulted in conflicts among resource users. The open access resource and lack of vigilant law enforcement efforts fostered the use of illegal fishing practices (i.e., use of fine mesh nets and blast fishing), as well as rampant mangrove cutting for firewood and for fishpond development. The situation was aggravated by the fragmentation of resource management functions among national government agencies and a lack of leadership, giving rise to unclear jurisdiction over coastal resource management. The shift from subsistence village economies to market-driven economies opened new linkages to provincial and regional markets in the Visayas (Box 10), which intensified resource use.

The devastation of mangroves and fisheries posed a serious resource problem and was a source of discontent among coastal residents, whose very survival is intertwined with the Bay's resources. Village fishers became increasingly aware of the decline in their average fish catch over time. Their average catch dwindled from about 20 kilos in the 1960s, to 10 kilos in the 1970s, to approximately 5-7 kilos in the 1980s. The native residents found disturbing the influx of non-coastal residents and outsiders from neighboring provinces who destroyed mangrove areas to make fishponds.

In 1989, a major effort to avert resource degradation in Cogtong Bay and promote a more sustainable coastal resource management (CRM) came through the initiative of ACIPHIL, Inc., a private firm that has actively provided technical assistance to resource management projects in the Philippines, including the Central Visayas Regional Project. ACIPHIL entered into a partnership with the Department of Enviroment and Natural Resources (DENR) to pursue mangrove rehabilitation and coastal resource management as a component of the USAID-funded Rainfed Resources Development Project (RRDP). Inspired by the nearshore fisheries component of the IBRD-assisted Central Visayas Regional Project (1984-1992), the Cogtong Bay project of Mabini-Candijay sought to transform resource users into resource managers who are directly responsible for day-to-day resource decisions. It adopted a co-management approach to address the problem of resource degradation and poverty in coastal villages along Cogtong Bay from 1989 to 1991.

The project featured a set of interventions and a process of empowering coastal villagers to carry out their own development and manage their renewable resources. Community organizers were hired as catalysts to initiate awareness campaigns, strengthen local capabilities, forge linkages with government units and establish village-based fishers' associations for coastal resource management. In line with efforts to improve the condition of coastal resources, the project introduced mangrove management as a major intervention. Complementing mangrove management were other project components, such as community organizing, capability building, environmental education, mariculture (i.e., culture of mussels and oysters), concrete artificial reefs, and project facilities. The Network Foundation, a non-government organization, assisted ACIPHIL in implementing the Mangrove Rehabilitation and Coastal Resource Management Project (MRCRMP) of Mabini-Candijay between 1989 and 1991. Among the project's physical accomplishments were the organization of 13 fishers' associations, issuance of 265 Certificates of Stewardship Contracts (CSCs), rehabilitation of 110 hectares of mangrove areas in Mabini and Candijay, and installation of 265 modules of concrete artificial reefs (ACIPHIL 1991).

Central to project implementation was the provision of secure mangrove tenurial rights to local fishers. Thus, the MRCRMP phase (1989-1991) ushered in the redefinition of access to mangrove areas and the establishment of formal tenurial rights through the issuance of 25-year CSCs. The DENR gave CSC holders the right to manage their mangrove areas and harvest their trees, provided they replant each tree cut. Non-CSC holders were not allowed to cut mangrove trees in CSC-covered areas. This period also saw the need for a clearer delineation of political and legal boundaries to address issues of jurisdiction and resource use. The fragmentation of functions for coastal resource management at that time was manifested in the jurisdiction over mangrove areas by the DENR and in the authority of the Bureau of Fisheries and Aquatic Resources (BFAR) over fisheries.

Box 10. Market Attributes: Cogtong, Candijay and Marcelo, Mabini

Indicator	Cogtong, Candijay	Marcelo, Mabini
Subsistence or market oriented	• Market-oriented for food fish since the 1970s and for mangroves since the 1980s	• Similar to Cogtong
Market structure	• Many sellers and buyers • Existence of *sukis* (credit-marketing relationships) between fishers and buyers	• Similar to Cogtong
Market orientation	• Oriented toward local, provincial and regional markets in the Visayas	• Similar to Cogtong
Value of coastal products	• Low to medium for fish products and mangrove products	• Similar to Cogtong

During project implementation, a closer coordination between the DENR and the BFAR became imperative to resolve conflicting policies on resource use and fishpond development. BFAR at that time was encouraging fishpond development and issuing Fishpond Lease Agreements (FLAs). In some instances, this led to the clearing of well-stocked mangrove forests for fishpond construction. Village residents asked why they were expected to plant new mangroves and refrain from cutting existing trees when outsiders were allowed to come in and destroy mangrove forests (Janiola 1996). The struggle between FLA holders and village fishers was resolved when the DENR ruled that cutting trees in mangrove forests for fishpond development was illegal. In the absence of cutting permits from the DENR, FLA holders could not cut mangrove trees legally.

Recognizing the importance of strict and vigilant law enforcement efforts, the project staff and village fishers' associations linked up with the municipal government of Mabini and Candijay for support in terms of facilities, police officers, and local legislation. The management of Cogtong Bay's resources called for a committed partnership between the government and the village residents. Joint patrol teams regularly guarded their coastal waters and mangrove areas. Although prevention of illegal fishponds was not envisaged as a project activity, the fishers' associations felt that the problem was serious enough to warrant collective action. In many instances, they succeeded in preventing the construction of illegal fishponds and the illegal harvesting of mangroves for commercial sale. They also played an active role in controlling blast fishing in the Bay.

During the post-MRCRMP phase, however, fishers observed a lower level of rule compliance (Box 11). This was due, in part, to weaker law enforcement and lower support from the municipal government that came with a change in political leadership and with budgetary constraints. Consequently, the lack of vigilance and the breakdown in enforcement efforts encouraged illegal fishers to resume their destructive activities in Cogtong Bay. Illegal mangrove cutting, however, was less problematic in areas with formal property rights. The CSC holders, on their own, continued to protect their mangrove areas.

Political boundaries became more distinct when the Local Government Code effected the devolution to local government units of many of the functions previously performed by BFAR and DENR. At present, the municipal government exercises jurisdiction over municipal waters (i.e., waters within 15 kilometers from the shoreline of the municipality) and over the management of community-based forestry projects. Areas beyond the municipal waters as well as those outside of communal forests, however, remain under the BFAR and DENR, respectively.

In recent years, the Village and Municipal Councils of Candijay and Mabini have demonstrated a stronger interest in coastal resource management. They have supported the establishment of a new fish sanctuary at Lumislis Island, pushed for stricter local legislation, and recognized communal mangrove areas for firewood gatherers.

Incentives to Cooperate. The shift from open access to a communal property rights regime for mangrove areas in Cogtong Bay was prompted by several incentives. These include: 1) a common dependence on coastal resources on the part of resource users; 2) heightened environmental awareness as a result of information campaigns and community organizing efforts of the MRCRMP; 3) desire for better coastal resource management on the part of government organizations and non-government organizations; 4) concern for improving the socioeconomic condition of poor coastal residents; 5) legitimacy of property rights; and, 6) realization of the need for collective action against illegal fishing and illegal mangrove cutting to avert further resource degradation.

Disincentives to cooperate, on the other hand, were initially rooted in conflicting government policies and indifference of some local government officials to strict law enforcement. These were eventually resolved when the MRCRMP drew attention to these areas and, together with fishers' associations, pressured appropriate organizations to take action.

The delineation of mangrove property rights, however, led to the displacement of firewood gatherers. The restriction of harvesting rights to CSC holders alienated the firewood gatherers, but this was resolved with the designation of communal mangrove areas for firewood gathering. To prevent the rapid depletion of mangroves, the municipal government passed a local ordinance that banned the sale of mangrove firewood outside of Mabini and Candijay. The intent was to meet only the needs of the domestic market.

Box 11. Decision-Making Arrangements: Cogtong and Marcelo

Indicator	Cogtong, Candijay	Marcelo, Mabini
Leadership/power structure of user groups	• Legitimate, democratic, credible and respectable leaders • Participatory decision-making; majority vote	• Similar to Cogtong
Main types of rules	• Informal operational rules: 1) entry to fishing grounds on a first come-first served basis; 2) distance of 200 meters between fish corrals; 3) distance between nets during fishing operations to avoid entangling of nets • Formal operational rules: 1) mandatory fishing permits; 2) ban on destructive fishing operations, such as blast fishing, use of cyanide or other strong poisons, fine mesh nets (below 3 cm), and Danish seine, among others; 4) ban on commercial fishing boats within 15 km from the shoreline • Collective choice rules: provisions on monitoring and enforcement and on settling disputes as embodied in local legislation, rules of the fishers' association, and DENR regulations • Constitutional rules: 1) Local Government Code, Fisheries Decree of the Philippines, Forest Decree of the Philippines, Presidential Proclamations and other legislation; rules of the fishers' association on the process of rule formation and approval	• Similar to Cogtong
Decision-making process for operational and collective choice rules	• Democratic: marked by public hearings and general assemblies • Majority vote	• Similar to Cogtong
Level of representation of resource users and stakeholders in the decision-making processes at different levels (municipal, provincial, regional, national)	• Village and municipal: high during the project phase; low to medium during the post-project phase • Provincial: low • Regional: low • National: low	• Similar to Cogtong

Indicator	Cogtong, Candijay	Marcelo, Mabini
Relevance of rules	• Medium • Relatively favorable attitude toward rules (i.e., rule-breaking is not acceptable) • Preference for shifting to stricter rules now that are supportive of sound coastal resource management	• Similar to Cogtong
Enforcement of rules and regulations/sanctions	• Medium enforcement during the project phase; low enforcement during the pre-project and post-project phases • Monitoring and enforcement was done by the sea patrol and foot patrol during the project phase; lax enforcement after project completion; inactivity of the association of fishers after project completion; reactivation of the sea patrol in 1995 • Violators of fishery and mangrove laws are generally warned and fined • Resources available for monitoring and enforcement: motorized boat, enforcement personnel, and funds for gasoline and other operating expenses • Level of compliance: medium to high during the project phase; low during the pre-project and post-project phases	• Similar to Cogtong • Deployment of patrol teams in monitoring and enforcement; active involvement of the federation of fishers in patrolling activities during the project phase and after project completion • Violators of fishery and mangrove laws are warned and fined • Resources available for enforcement: similar to Cogtong • Level of rule compliance: similar to Cogtong

Outcomes of Co-Management Arrangements in Cogtong Bay. A post-project mangrove assessment done by ICLARM researchers in July 1997 showed a total basal area of 6.82 m^2ha^{-1} at the project reforestation site. The relatively good mangrove growth seems to have been influenced by the site's relatively shallow depth, protection from waves, muddy substrate and extensive water run-offs. An assessment of coral reef conditions in Cogtong Bay using a manta tow reconnaissance technique indicates a percentage live coral cover of 11-50 percent (poor to fair) on the eastern side of Lumislis Island. Tagaytay reef, which lies near the mouth of the bay, has a higher percentage of live coral cover at 51-75 percent (good). Corals normally grow well in well-oxygenated, warm and clear waters that are free from suspended sediments and pollutants. It is difficult to conclude, however, that the reefs are in a better condition now due to the absence of benchmark biological data. Additional resource assessments are warranted in the future.

To arrive at an integrated statistical analysis of survey data on the two case villages, the data on Cogtong, Candijay and Marcelo, Mabini were combined and subjected to a t-test, principal component analysis, and stepwise multiple regression analysis. A comparison of perceived changes in the pre-project situation to the present situation shows that fishers in the two case villages perceive positive and statistically significant changes in all performance indicators of co-management, except in the overall well-being of coastal resources (Table 47). Larger positive changes were perceived in knowledge of mangroves, information exchange on both mangrove management and fisheries management, control over fishery resources, quickness of resolving community conflicts, and influence over community affairs. The absence of a statistically significant change in the perceived well-being of coastal resources could be explained by lax enforcement efforts and by the return of illegal fishing activities during the post-project phase. The fishers, nonetheless, are optimistic that the future situation will improve. This is evident in the statistically significant results of all performance indicators when the present situation is compared to the situation five years from now.

Between members and non-members of the fishers' associations, statistically significant differences emerged in the perception of seven performance indicators of co-management before the project and now: participation in community affairs, participation in coastal resource management, fair allocation of harvesting rights, satisfaction with mangrove management, benefits from mangrove areas, information exchange on mangrove management, and information exchange on fisheries management ($p<0.01$ and $p<0.05$). Members tended to perceive larger improvements in these indicators than non-members (Table 48). These may be attributed to the deliberate effort of the project to include the participation of fishers not only in project activities but also in community affairs.

For the perceptions today and five years from now, both members and non-members foresee a further improvement in all the indicators. A statistically significant difference between these two groups does not exist, except in the perception of fair allocation of mangrove harvesting rights ($p < 0.05$).

Table 47. Perceived changes in performance indicators before the project and now: Cogtong and Marcelo

Indicator	Member					Non-Member					All				
	Today (T_2)	Before (T_1)	T_2- T_1	P	SD	Today (T_2)	Before (T_1)	T_2- T_1	P	SD	Today (T_2)	Before (T_1)	T_2- T_1	P	SD
a. Participation in community affairs	5.27	2.70	2.57	<0.01	1.66	4.63	2.90	1.73	<0.01	1.45	4.98	2.79	2.19	<0.01	1.62
Participation in coastal resource mgt	5.38	2.67	2.72	<0.01	1.74	4.73	2.81	1.92	<0.01	1.72	5.09	2.73	2.36	<0.01	1.77
b. Influence over community affairs	5.55	2.88	2.67	<0.01	1.96	4.98	2.85	2.13	<0.01	1.67	5.30	2.87	2.43	<0.01	1.85
Influence over coastal resource mgt	5.52	3.15	2.37	<0.01	1.63	4.85	2.83	2.02	<0.01	1.26	5.22	3.01	2.21	<0.01	1.48
c. Control over resources	5.33	2.67	2.67	<0.01	2.03	4.83	2.52	2.31	<0.01	1.57	5.11	2.60	2.51	<0.01	1.84
d. Fair allocation of harvesting rights	5.67	3.03	2.63	<0.01	2.37	5.23	3.60	1.63	<0.01	1.79	5.47	3.29	2.19	<0.01	2.18
e. Satisfaction with mangrove management	5.53	2.85	2.68	<0.01	2.44	7.25	5.58	1.67	<0.01	2.00	6.30	4.06	2.23	<0.01	2.30
f. Benefits from mangrove areas	5.73	3.17	2.57	<0.01	2.47	5.42	3.79	1.63	<0.01	2.31	5.59	3.44	2.15	<0.01	2.43
g. Household well-being	4.77	3.55	1.22	<0.01	2.51	4.58	3.67	0.92	<0.05	2.30	4.69	3.60	1.08	<0.01	2.41
h. Household income	4.72	3.62	1.10	<0.01	1.95	4.79	3.77	1.02	<0.01	1.90	4.75	3.69	1.06	<0.01	1.92
Efficiency															
a. Collective decision making	5.45	2.87	2.58	<0.01	1.95	5.46	3.48	1.98	<0.01	1.83	5.45	3.14	2.31	<0.01	1.91
b. Quickness of resolving conflicts	5.72	3.10	2.62	<0.01	1.76	5.42	3.21	2.21	<0.01	1.38	5.58	3.15	2.44	<0.01	1.61
Sustainability															
a. Overall well being of coastal resources	4.72	4.02	0.70	>0.05	2.75	4.73	4.13	0.60	>0.05	2.46	4.72	4.06	0.66	>0.05	2.61
b. Compliance – mangrove rules	5.22	2.72	2.50	<0.01	1.95	5.31	3.02	2.29	<0.01	1.54	5.26	2.85	2.41	<0.01	1.78
Compliance – fishery rules	5.52	3.13	2.38	<0.01	1.90	5.15	3.42	1.73	<0.01	1.67	5.35	3.26	2.09	<0.01	1.82
c. Knowledge of mangrove	5.97	2.77	3.20	<0.01	2.01	5.63	3.00	2.63	<0.01	1.48	5.81	2.87	2.94	<0.01	1.81
d. Info exchange – mangrove mgt	5.82	2.83	2.98	<0.01	1.76	5.38	3.02	2.35	<0.01	1.42	5.62	2.92	2.70	<0.01	1.64
. Info exchange – fisheries mgt	5.92	3.12	2.80	<0.01	1.73	5.35	3.23	2.13	<0.01	1.52	5.67	3.17	2.50	<0.01	1.67

Table 48. Differences between members and non-members with respect to perceived changes before the project and now: Cogtong and Marcelo

Indicators	Members T_2-T_1	Non-Member T_2-T_1	T-Value	Probability
Equity				
a. Participation in community affairs	2.57	1.73	2.75	<0.01
Participation in coastal resource mgt	2.71	1.92	2.39	<0.05
b. Influence over community affairs	2.67	2.13	1.52	>0.10
Influence over coastal resource mgt	2.37	2.02	1.20	>0.10
c. Control over resources	2.37	2.31	0.99	>0.10
d. Fair allocation of harvesting rights	2.63	1.63	2.44	<0.05
e. Satisfaction with mangrove mgt	2.68	1.67	2.33	<0.05
f. Benefits from mangrove areas	2.57	1.63	2.03	<0.05
g. Household well-being	1.22	0.92	0.64	>0.10
h. Household income	1.10	10.02	0.21	>0.10
Efficiency				
a. Collective decision making	2.58	1.98	1.64	>0.10
b. Quickness of resolving conflicts	2.62	2.21	1.32	>0.10
Sustainability				
a. Overall well-being of coastal resources	0.70	0.60	0.19	>0.10
b. Compliance – mangrove rules	2.50	2.29	0.60	>0.10
Compliance – fishery rules	2.38	1.73	1.88	>0.10
c. Knowledge of mangrove	3.20	2.63	1.66	>0.10
d. Info exchange -- mangrove mgt	2.98	2.35	2.01	<0.05
Info exchange -- fisheries mgt	2.80	2.13	2.13	<0.05

Table 49 shows the results of the principal component analysis (with varimax rotation), a statistical tool that determines if relationships between the indicators were such that they could be reduced to fewer composite indicators for further analysis. Four components or clusters emerged. Performance indicators loading highest on Component 1 are those directly related to resource management, such as perceived changes in knowledge of mangroves, compliance with mangrove rules, information exchange on mangrove management, information exchange on fisheries management, and collective decision-making. Those loading highest on Component 2 are perceptions of material and ecological gains, such as overall well-being of coastal resources and household well-being.

Table 49. Principal component analysis of performance indicators: Cogtong and Marcelo

Performance Indicators	Component			
	One	**Two**	**Three**	**Four**
Knowledge of mangroves	**0.88**	-0.04	0.15	0.09
Compliance with mangrove-related rules	**0.83**	-0.04	0.03	0.01
Information exchange – mangrove management	**0.82**	-0.22	0.16	0.13
Information exchange – fisheries management	**0.67**	0.09	0.25	-0.00
Collective decision-making	**0.53**	0.33	0.32	0.22
Overall well-being of coastal resources	-0.01	**0.83**	-0.06	0.12
Household well-being	-0.22	**0.80**	0.07	0.06
Control over resources	0.19	-0.02	**0.81**	0.18
Satisfaction with mangrove management	0.21	0.03	**0.81**	0.10
Fair allocation of mangrove harvesting rights	0.08	0.19	**0.78**	0.27
Participation in community affairs in general	0.07	0.09	0.19	**0.79**
Participation in coastal resource management	0.06	0.20	0.17	**0.78**
Influence over community affairs	0.01	-0.15	0.14	**0.76**
Influence over coastal resource management	0.38	-0.04	0.46	0.40
Compliance – fishery-related rules	0.35	0.42	0.08	0.20
Variance	*20.85*	*15.08*	*14.25*	*13.05*

Indicators loading highest on Component 3 are all related to resource equity --- perceived changes in control over resources, satisfaction with mangrove management, and fair allocation of mangrove harvesting rights. Finally, those loading highest on Component 4 are indicators of collective/community equity, such as community participation in community affairs, participation in coastal resource management, and influence over community affairs.

Regression analysis using the component indicators as dependent variables. To determine the relationship between the component indicators and the contextual/independent variables as well as to identify the variables that explained most of the variance in each of the four components, a stepwise multiple regression was used. The criterion for entry into the regression equation is alpha < 0.10. Table 50 presents the results.

Out of 22 independent variables, six variables emerged in Component 1. These include: CSC possession, number of project objectives known, length of residence in the village, age, the attitude that rule-breaking is unacceptable (1=unacceptable, 0 otherwise), and length of fishing experience. Together, these variables account for 25 percent of the variance in Component 1 (adjusted $R^2 = 0.254$). The multiple regression equation is statistically significant ($p<0.01$).

Of the six variables in Component 1, CSC possession, length of village residency, and length of fishing experience are associated with larger changes in Component 1, which consists of resource management indicators. This implies that efforts to achieve a perceived improvement in these indicators should focus on the provision of property rights. Working more closely with fishers who have lived longer in the village and who have been engaged in fishing for a longer time would also have a positive effect.

The negative regression coefficients of other variables suggest that those who are more knowledgeable of project objectives, those who are older, and those who feel that rule-breaking is unacceptable tended to score low on Component 1. They perceive smaller changes in rule compliance and information exchange. Most likely, this is due to observed deviations from acceptable practices on the part of other fishers, knowing fully well the goals and requirements of sound resource management.

For Component 2, five variables were entered into the regression equation: perceived pre-project condition of fishery resources as bad, the attitude that fishers and government should share equal responsibility for resource management, length of formal education, fishing as the main income source, and number of project objectives known. They jointly account for 28 percent of the variance in the component. The regression equation is statistically significant ($p < 0.01$). Of the five variables, the perceived pre-project condition of fishery resources and the knowledge of project objectives positively influence perceived changes in Component 2, which comprise material and ecological gains. The negative regression coefficients of other variables imply that those with more education, those who derived their primary income from fishing, and those who felt that responsibility sharing should be equal tended to be more critical of changes in the overall well-being of coastal resources and of the household. They must have been more observant of gaps between ideal and actual resource management situations.

Two variables influence perceived changes in Component 3: CSC possession and knowledge of project objectives. The former is positively linked to changes in the component, while the latter is negatively related. This finding reinforces the importance of secure property rights in achieving perceived changes in Component 3, which comprises resource control, satisfaction with mangrove management, and fair allocation of harvesting rights. It also suggests that those who are more versed in project objectives tended to be more conservative in their assessment of the extent of perceived changes in the component. The regression equation is statistically significant ($p < 0.01$).

Table 50. Regression analyses of performance indicators, Cogtong and Marcelo: with principal components

Dependent Variable: Impact Component One	Standardized Coefficient	T-Value	Probability (2-Tail)
Independent Variables			
Possession of Certificate of Stewardship Contract or CSC (mangrove property rights)	0.389	4.428	0.000
Knowledge of project objectives	-0.251	-2.933	0.004
Length of residence in the village	0.294	2.993	0.003
Age of respondent	-0.245	-2.318	0.023
Attitude that rule-breaking is unacceptable	-0.165	-1.876	0.064
Length of fishing experience	0.165	1.713	0.090
$R = 0.545$; $R^2 = 0.297$; Adjusted $R^2 = 0.254$			
$N = 108$; $F = 6.894$; $p = 0.000$			
Dependent Variable: Impact Component Two			
Perceived condition of fishery resources 15yrs ago	0.370	4.418	0.000
Sharing of responsibility for resource management	-0.245	-2.835	0.006
Length of formal education	-0.200	-2.380	0.019
Fishing as the main source of household income	-0.179	-2.069	0.041
Knowledge of project objectives	0.163	1.936	0.056
$R = 0.559$; $R^2 = 0.313$; Adjusted $R^2 = 0.278$			
$N = 108$; $F = 9.010$; $p = 0.000$			
Dependent Variable: Impact Component Three			
Possession of CSC	0.241	2.550	0.012
Knowledge of project objectives	-0.230	-2.440	0.016
$R = 0.316$; $R^2 = 0.100$; Adjusted $R^2 = 0.082$			
$N = 108$; $F = 5.642$; $p = 0.005$			
Dependent Variable: Impact Component Four			
Land ownership	0.241	2.712	0.008
Attendance at project meetings	0.258	2.885	0.005
Perceived condition of fishery resources 15 years ago	0.225	2.229	0.028
Boat ownership	-0.190	-2.131	0.036
Length of formal education	0.181	2.039	0.044
$R = 0.473$; $R^2 = 0.224$; Adjusted $R^2 = 0.184$			
$N = 108$; $F = 5.702$; $p = 0.000$			
Dependent Variable: Total Component			
Attendance at project meetings	0.543	3.604	0.000
Attitude that rule-breaking is unacceptable	-0.323	-3.962	0.000
Length of residence in the village	0.232	2.801	0.006
Possession of CSC	0.296	2.911	0.004
Influence in project planning	-0.347	-2.348	0.021
Knowledge of project objectives	-0.163	-1.992	0.049
$R = 0.625$; $R^2 = 0.391$; Adjusted $R^2 = 0.354$			
$N = 108$; $F = 10.481$; $p = 0.000$			

For Component 4, five variables were entered into the regression equation: land ownership, attendance at project meetings, perceived pre-project condition of fishery resources as bad, boat ownership, and length of formal education. The regression equation is statistically significant ($p < 0.01$). Land ownership, attendance at project meetings, and length of formal education positively shape perceived changes in Component 4, which consists of participation in community affairs, participation in coastal resource management, and influence over community affairs. This finding suggests that those with longer

education, who attended more project meetings, and who own land tended to perceive larger changes in the component. These variables have enhanced their sense of involvement and influence in the village. Boat ownership, however, has a negative regression coefficient, implying that those who owned boats tended to score low on Component 4, or to perceive smaller changes in participation and influence in village affairs. This may be attributed to their preoccupation with fishing and other activities.

To obtain an overall measure of perceived changes, or total perceived performance (TPP), the component scores were summed up. The correlation of the TPP with the contextual variables was calculated. Those variables exhibiting significant correlation with the TPP were selected during the stepwise multiple regression analysis.

The results show that perceived changes in the TPP are positively shaped by attendance at project meetings, length of residence in the village, and CSC possession. They are negatively influenced, however, by the attitude that rule-breaking is unacceptable, by influence in planning, and knowledge of project objectives. These six variables jointly account for 35 percent of the variance in the TPP (adjusted $R^2 = 0.354$). The multiple regression equation is statistically significant ($p < 0.01$).

These findings suggest that in Cogtong Bay, the provision of formal property rights (through the CSC) partly influences perceived changes in the TPP. Also important is attendance at project meetings, which increased the fishers' awareness of resource availability problems, challenged them to take collective action, and encouraged them to share in the responsibility for coastal resource management. The findings also indicate that those who have lived longer in the village are more likely to perceive larger changes in the TPP, having witnessed the progressive deterioration of Cogtong Bay's resources and the positive effects of co-management arrangements in dealing with the situation.

The negative regression coefficients of influence in planning, knowledge of project objectives, and the attitude that rule-breaking is unacceptable are unexpected. These may be better understood, however, in the context of Cogtong Bay's experience, where the lack of vigilance in law enforcement during the post-project phase hampered the functioning of co-management arrangements and where the level of support from the local government was vulnerable to changes in political leadership and budgetary allocations. In addition, the perceived corruption of law enforcement officers who did not come from the ranks of resource users has adversely affected rule compliance. Consequently, those who have been more heavily involved in project planning, more knowledgeable of project objectives, and more inclined to follow rules felt somewhat critical of the extent of perceived changes in the TPP. Unmet expectations related to desired management arrangements must have influenced their assessment.

Regression analysis without using the component indicators. As a further step in the analysis, the independent variables were regressed against each performance indicator. This was done to identify the key explanatory variables associated with perceived changes in the individual indicator. Table 51 shows the results.

Table 51. Regression analyses with individual performance indicators, Cogtong and Marcelo: without using the components

Dependent Variable: Participation in coastal resource management	Standardized Coefficient	T-value	Probability (2-Tail)
Independent Variables			
Number of fishing gear used	0.284	3.131	0.002
Distribution of resource management responsibility	-0.280	-3.087	0.003
Membership in fishers' association	0.233	2.604	0.011
R = 0.429; R^2 = 0.184; Adjusted R^2 = 0.160			
N = 108; F = 7.650; p = 0.000			
Dependent Variable: Influence over coastal resource management			
Education	0.236	2.503	0.014
Number of known objectives	-0.224	-2.378	0.019
Holder of CSC (Certificate of Stewardship Contract)	0.173	1.825	0.071
R = 0.332; R^2 = 0.110; Adjusted R^2 = 0.084			
N = 108; F = 4.207 p = 0.008			
Dependent Variable: Control over fisheries resources			
Number of known objectives	-0.336	-3.746	0.000
Holder of CSC (Certificate of Stewardship Contract)	0.291	3.233	0.002
Number of ecological characteristics cited	0.242	2.705	0.008
Education	0.184	2.051	0.043
R = 0.461; R^2 = 0.231; Adjusted R^2 = 0.182			
N = 108; F = 6.826; p = 0.000			
Dependent Variable: Overall well-being of coastal resources			
Distribution of resource management responsibility	-0.267	-3.111	0.002
Perceived fishery condition 15 years ago	0.321	3.845	0.000
Education	-0.257	-3.018	0.003
Fishing as the main source of household income	-0.177	-2.029	0.045
Length of fishing experience	0.167	1.950	0.054
R = 0.565; R^2 = 0.319; Adjusted R^2 = 0.285			
N = 108; F = 9.282; p = 0.000			
Dependent Variable: Household income			
Fishing as the main source of income	-0.198	-2.102	0.038
Size of land owned	0.161	1.705	0.091
R = 0.266; R^2 = 0.071; Adjusted R^2 = 0.053			
N = 108; F = 4.007; p = 0.021			
Dependent Variable: Overall household well being			
Fishing as the main source of income	-0.252	-2.685	0.008
R = 0.252; R^2 = 0.064; Adjusted R^2 = 0.055			
N= 108; F= 7.208; p=0.008			
Dependent Variable: Compliance with mangrove rules			
Independent Variables			
Holder of CSC	0.413	4.715	0.000
Number of known objectives	-0.269	-3.076	0.003
Attitude that rule-breaking is unacceptable	-0.219	-2.511	0.014
R = 0.487; R^2 = 0.237; Adjusted R^2 = 0.215			
N = 108; F = 10.588; p = 0.000			
Dependent Variable: Compliance with fishery rules			
Length of residence in the area	0.285	3.092	0.003
Attitude that rule-breaking is unacceptable	-0.203	-2.186	0.031
Perceived fishery condition 15 years ago	0.168	1.819	0.072
R = 0.383; R^2 = 0.147; Adjusted R^2 = 0.122			
N = 108; F = 5.847; p = 0.001			
Dependent Variable: Conflict resolution			
Length of residence in the area	0.316	3.016	0.003
Distribution of resource management responsibility	-0.201	-2.210	0.029
Size of land owned	2.211	2.221	0.029
Age of respondent	-0.196	-1.828	0.070
R = 0.414; R^2 = 0.172; Adjusted R^2 = 0.139			
N = 108; F = 5.234; p = 0.001			

Note: Indicators that did not exhibit statistically significant regression equations (p>0.05) are not included in this table.

The regression relationship indicates that perceived changes in participation in coastal resource management are positively associated with membership in the fishers' association and with the number of fishing gear used, but are negatively linked to the attitude toward responsibility sharing for resource management (1=equal, 0 otherwise). Together, these three independent variables account for 16 percent of the variance in perceived participation (adjusted R^2=0.16). The multiple regression equation is statistically significant ($p<0.01$). The finding implies that association members are more inclined to get involved in coastal resource management, along with those who deploy more fishing gear. This may be due to the actual mobilization of association members in community-based resource management. Fishers who deployed more types of fishing gear also tended to participate more in resource management because of the implications for their livelihood. Those who felt that the distribution of resource management responsibility between the government and the fishers should be equal, however, perceived negative changes in participation. This may be due to observed shortfalls on the part of the government.

Perceived changes in influence over coastal resource management are positively shaped by education and possession of stewardship contracts. More educated fishers and holders of tenurial rights/instruments over mangrove areas, who may be regarded as enjoying a given social status in the village, tended to perceive improvements in influence over resource management. Those who are more knowledgeable of project objectives, however, perceived smaller (or negative) changes in influence. They may have unmet expectations in relation to coastal resource management. The three independent variables mentioned account for only 8 percent of the variance in perceived influence (adjusted R^2=0.084). The multiple regression equation, nonetheless, is statistically significant ($p<0.01$).

The three independent variables that affect perceived changes in influence apply to resource control as well. A fourth variable that underlies positive perceptions of resource control is ecological knowledge. Together, these independent variables account for 18 percent of the variance in perceived resource control (adjusted R^2=0.182). A higher level of ecological knowledge provides indicators of healthy ecosystems, somehow helping fishers assess gains in management efforts and observe concrete results from sound resource management. Consequently, the sense of control over resources is reinforced. The regression equation is statistically significant ($p<0.01$).

Perceived changes in the overall well-being of coastal resources are positively linked to the length of fishing experience and the perceived condition of fishery resources 15 years ago (1=bad, 0 otherwise). The time element that runs through these variables has provided more experienced fishers an opportunity to witness the changing resource conditions and relate these to perceptions of the overall well-being of coastal resources. Those who felt that the fishery was bad 15 years ago perceived improvements in the situation that came with project interventions. Three independent variables, however, negatively affect perceived changes in the resource well-being: responsibility sharing for resource management between the government and the fishers (1= equal, 0 otherwise), education, and fishing as the main source of household income. This finding underscores the importance of equal responsibility sharing in positively influencing perceptions of the overall well-being of the resource. The finding also draws attention to the negative link between heavy dependence on fishing for livelihood and perceived changes in the overall well-being of coastal resources. Less dependence would reduce pressure on resource use and contribute to perceptions of improved well-being. Together, the five independent variables account for 28 percent of the variance in the perceived well-being of coastal resources (adjusted R^2=0.285). The regression equation is statistically significant ($p<0.01$).

Fishing as the main source of household income, likewise, is negatively associated with perceived changes in household income and in household well-being. This suggests that those who derive their income largely from fishing perceived inadequacy in meeting the various needs of their households. This partly explains the need for secondary income sources on the part of fishing households.

Perceived changes in compliance with mangrove rules are positively linked to the possession of stewardship contracts, highlighting the role of user/property rights in encouraging resource users to obey rules. However, they are negatively related to knowledge of project objectives and the attitude that rule-breaking is unacceptable (1=yes, 0 otherwise). As discussed earlier, those who were more versed in project objectives and who expect obedience to rules tended to be more critical in their perceptions of changes in compliance. The regression equation is statistically significant ($p<0.01$). The three independent variables account for 21 percent of the variance in perceived compliance with mangrove rules (adjusted $R^2=0.215$).

For fishery rules, perceived changes in compliance are positively influenced by length of residence in the village and perceived condition of fishery resources 15 years ago as bad, but are negatively affected by the attitude toward rules. These three independent variables account for 12 percent of the variance in perceived compliance with fishery rules (adjusted $R^2=0.122$). The regression equation is statistically significant ($p<0.01$). Thus, those who are long-time residents and who recognize resource problems are more inclined to have positive perceptions of compliance. Fishers whose attitudes toward rules are oriented toward obedience, however, tended to have negative perceptions of compliance. Rule violations by others may have led those who favor strict obedience to rules to feel reservations on the extent of changes in rule compliance.

Lastly, perceived changes in conflict resolution are closely linked to village residency and size of land owned. Those who have lived longer in the village and those who own more land are likely to perceive gains in resolving resource-related conflicts. This implies that in a village where in-migration is relatively recent and where people are basically landless, perceptions of conflict-ridden situations are likely to occur. Moreover, fishers who are younger and who feel that the government and the fishers are not sharing equal responsibility for coastal resource management tend to perceive negative changes in conflict resolution. The four independent variables jointly account for 14 percent of the variance in perceived conflict resolution (adjusted $R^2=0.139$). The regression equation is statistically significant ($p<0.01$).

The experience of Cogtong Bay affirms that the management of coastal resources is not easy. It draws attention to the difficulty of managing coastal resources without the sustained cooperation of the government and the resource users to make rules and regulations work. Gains, nonetheless, are possible in spite of formidable odds if fishers and other resource users have a shared commitment to sound coastal resource management and livelihood protection and are willing to take decisive action.