Community-Based Coastal Resources Management: An Interim Assessment of the Proyek Pesisir Field Site in Bentenan and Tumbak Villages, North Sulawesi, Indonesia

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By

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1. 0 INTRODUCTION

This report provides an assessment of *Proyek Pesisir* activities that have been carried out in the villages of Bentenan and Tumbak during the period between November 1997 and June 2000. The two adjacent villages Bentenan and Tumbak comprise one of three village-level field sites in North Sulawesi, Indonesia where best practices in community-based coastal resources management are being developed. A variety of methods were used for this assessment including a review of project reports and documents, discussions with project staff, interviews with key informants within the village, direct observation at the field site, as well as administration of a survey questionnaire to a random sample of household residents. Adjacent village control sites (Rumbia and Minanga 1) were also used as part of this assessment.

The report provides summary information concerning project activities that have been implemented and changes that have occurred in the community over an approximately three year period since the project started in 1997. Participation and gender issues are highlighted. Where appropriate, it compares project sites with similar information from the control sites. The report summarizes socioeconomic changes in the community, perceptions concerning resource impacts of human activities, perceived quality of life and problems, and the extent to which these changes may be due to project activities. The report serves as an interim benchmark of progress as of June 2000. A final project impact assessment will take place in 2002, the final year of project field activities.

1.1 METHODS USED IN BASELINE AND MONITORING

1.1.1 Introduction

A coastal resource management monitoring and evaluation program involves several distinct data sets—one collected prior to project activities (the baseline) and others acquired sometime after project implementation (monitoring). The baseline should include indicators of expected project impacts (e.g., relative wealth, perceptions of problems and changes in relative well being, attitudes and behaviors with respect to coastal resources, status of the target resources, etc.) as well as general demographic and infrastructure information concerning the project and control communities. The monitoring data set should include the same variables evaluated in the baseline. In addition it should include information concerning project activities, evaluations of the status of these activities, and information concerning non-project related activities and occurrences that could influence expected project impacts (e.g., severe storms, drought, war, macro-economic changes such as recession, inflation, etc.). The monitoring data sets should be acquired at appropriate intervals after the project activities begin; these intervals being at least a year apart to give sufficient time for the project activities to produce some effects.

Ideally, the baseline and monitoring information are acquired from communities where the project is implemented as well as from similar, nearby communities, which will act as controls. The control sites are necessary as a means of sorting out the effects of macro-changes (e.g., climatic, economic, etc.) that can have an impact on expected project impacts. Guidelines for establishing this type of coastal resource management monitoring and evaluation program are outlined in Pollnac and Crawford (2000).

1.1.2 Baseline

Baseline information was acquired in Bentenan and Tumbak during June and July 1997. Data acquisition methods used include:

- a review of secondary data (village profiles, national statistics, etc.),
- interviews with key informants (village chiefs and other officials, as well as local residents, including both males and females practicing the range of productive activities observed),
- observation of human activities along the coast and in the sea,
- a sample survey that included questions concerning indicators of projected project impacts as well as potential predictors of these impacts.

The sample survey was conducted among a random sample of 41 households (31 from coastal sub-villages and 10 from more inland, farming sub-villages) in Bentenan and 40 households in Tumbak (the entire village is coastal). In each household, both a senior male and female were interviewed (Pollnac *et al.*, 1997a).

Unfortunately, the baseline for the control villages of Minanga and Rumbia was not collected until a year later (1998). This was doubly unfortunate since major climatic (el Nino associated drought) and economic events (the Asian economic crisis) occurred in Indonesia as well as the rest of Southeast Asia. As a consequence, a relevant subset of the baseline data was also collected in Bentenan and Tumbak for comparative purposes. The sample survey included 31 randomly selected households in Bentenan, 40 in Tumbak, 26 in Rumbia and 25 in Minanga. Once again, in each household, both a senior male and female were interviewed (Pollnac *et al*., 1998). The 1998 data from the project villages can be used as both monitoring to elucidate impacts of the macro-events that occurred as well as a secondary set of baseline data.

1.1.3 Monitoring

Finally, in June and July 2000, a duplicate data set for monitoring purposes was collected in the project and control communities. Methods used for the baseline were applied once again, and an additional data set including project activities, including both evaluation and participation was acquired. Information on macro-events and other changes in activities and infrastructure of the project and control communities were also obtained. Random samples of 40 households from each of the project villages and 30 from each of the control villages participated in the sample survey. Once again, in each household, both a senior male and female were interviewed. This report makes comparisons across the project and control villages at both time periods (baseline and monitoring times), as well as comparisons across time. Potential impacts of both project and non-project variables are examined.

1.2 PROJECT BACKGROUND

The USAID-BAPPENAS NRM II coastal resources management project, locally known as *Proyek Pesisir*, established a field office in North Sulawesi Province in 1997. This is one of three provincial-level field programs contributing to the program objective to strengthen and decentralize coastal resources management in Indonesia. Three village-level field sites in the Minahasa Regency of North Sulawesi (see Figure 1) were selected

in 1997 for development of models of community-based coastal resources management (Tim Kerja Proyek Pesisir, 1997). Subsequently, socio-economic and environmental baseline surveys and technical studies were carried out at each site (Pollnac *et al*., 1997a, 1997b; Kusen *et al*., 1997; 1999a; 1999b; Mantjoro, 1997a, 1997b; Kasmidi, 1998; Kussoy *et al*., 1999; Crawford *et al*., 1999; Lee and Kussoy, 1999). Surveys were also conducted in villages adjacent to project sites. These villages are being used as control sites (Pollnac *et al*., 1998; Fakultas Perikanan, 1999, 2000) for monitoring and assessment of long-term socio-economic and environmental outcomes.

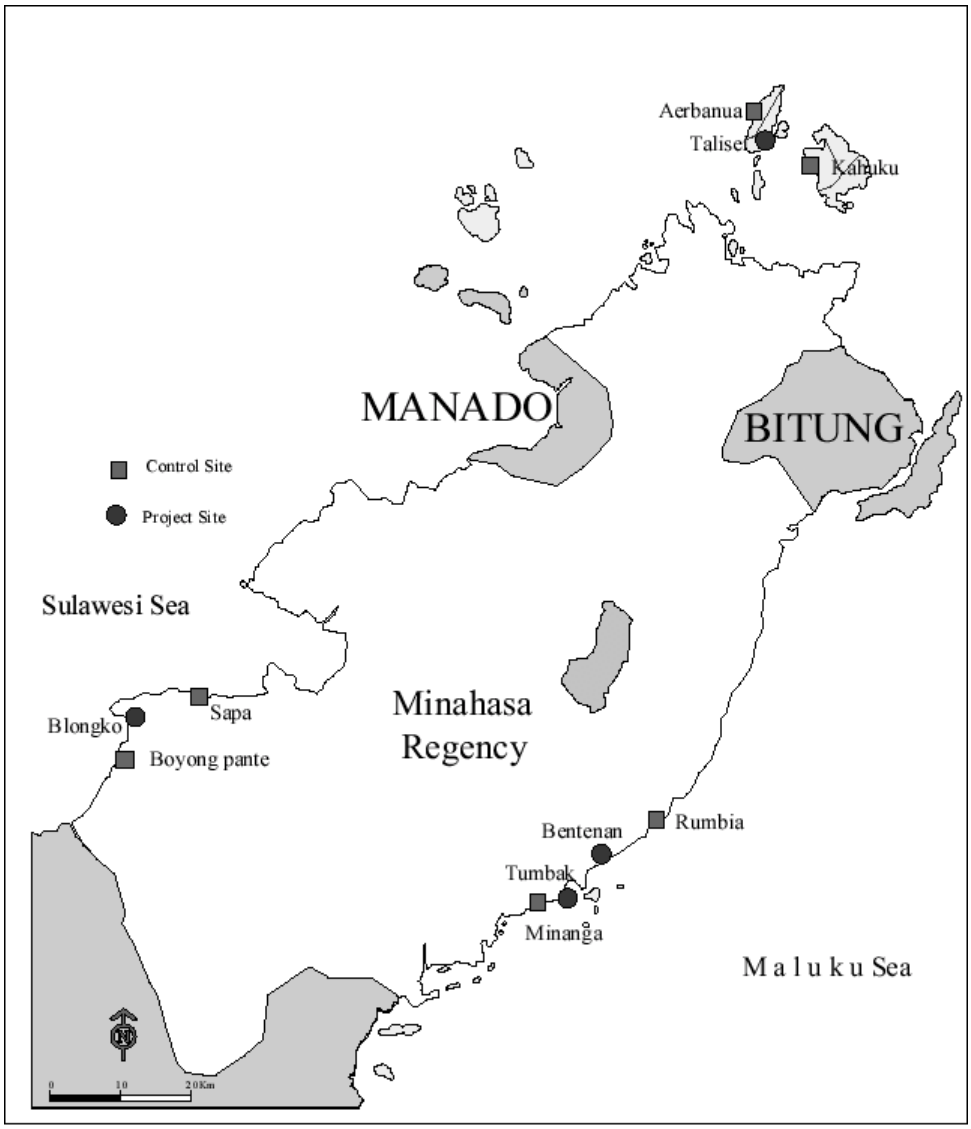

Figure 1. Locations of project and controls villages.

2.0 BENTENAN AND TUMBAK

2.1 OVERVIEW OF PROJECT ACTIVITIES

In December 1997 one extension worker was assigned to work in the villages of Bentenan and Tumbak. The number of extension workers increased to two in March 1998, then decreased to one again in July 1999. In March 1998, a field assistant started working in each of the villages. The field assistants were persons from the villages and worked with the extension officers on a part time basis. The extension officer and field assistant in Bentenan were female while the extension officer and field assistant in Tumbak were male. In July 1998, the female extension officer living in Bentenan assumed responsibility for project activities in both villages with the departure of the Tumbak-based extension officer in July 1999. Total number of person days per month is displayed in Figure 2. From October 1997 until May 2000 extension workers worked in the villages an average of 19 person days per month.

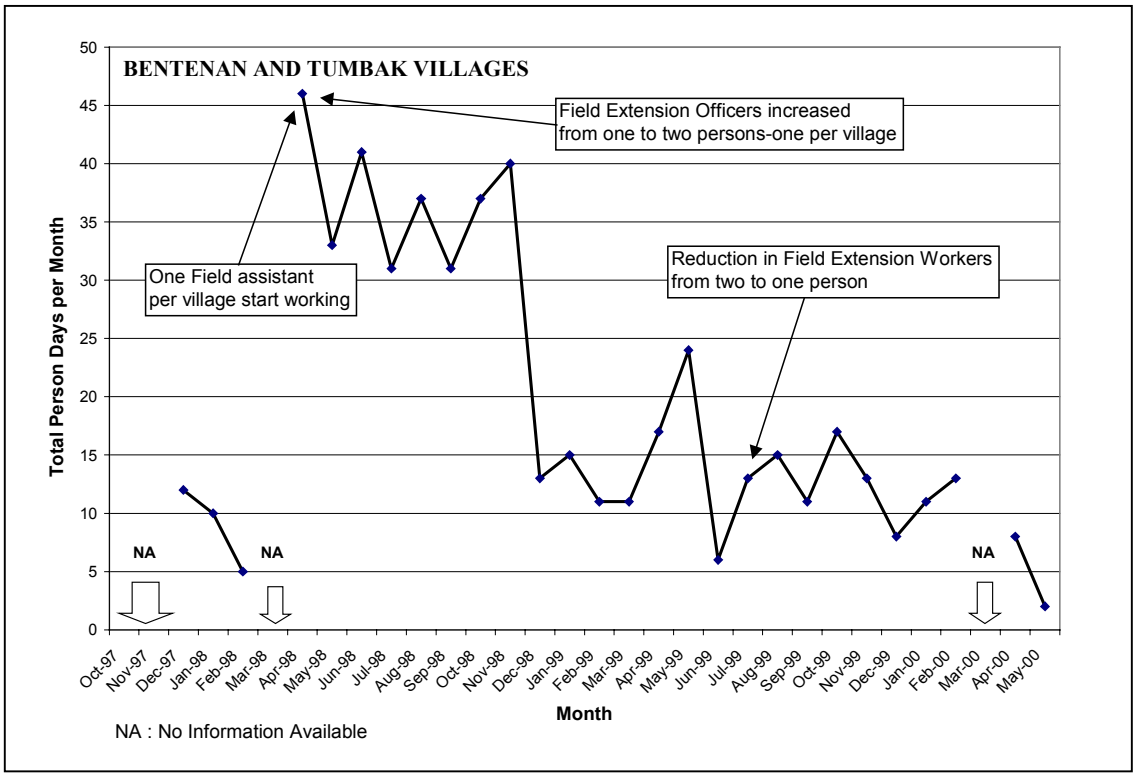

Figure 2. Number of days per month the field extension officers were resident at the project sites.

The initial task of the extension officers over the first few months was to orient the communities to the project objectives and to develop an understanding of the cultural, political, social and economic dynamics within the villages. The project then initiated a participatory process in the villages to develop a profile of coastal resources management issues of concern to the two communities. After the issue identification phase, a coastal resources development and management plan was prepared (Tulungen *et al*., 2000). The management plan was approved by each community and both village governments through a joint village ordinance signed in November 1999, and subsequently endorsed by an interagency task force at the Regency level (Dimpudus *et al*., 1999). In Tumbak, a small scale marine sanctuary (approximately 20 hectares in size) located in front of the

village settlement area was in the final stages of planning at the time the field work for this report was carried out. It was subsequently approved in November 2000.

The project strategy in Bentenan and Tumbak varied from the other two field sites. First, the planning area encompassed two villages as residents from both villages exploited the common marine resources located adjacent to the villages. Secondly, the planning process took priority and the marine sanctuary development in Tumbak was emphasized after the management plan was approved. Additionally, two field workers were assigned to the site since the planning area encompassed two villages, and a field assistant for each village was also hired. While total manpower was greater than the other sites, it was similar in that one extension officer and one field assistant were used per village. The extension worker for Bentenan-Tumbak was also in residence for a longer period of time than for Blongko and was still assigned full time on-site as of June 2000.

2.1.1 Planning and Capacity Building Activities

The community-based planning process has been well documented (Crawford *et al*., 1998; Crawford and Tulungen 1998a, 1998b, 1999a, 1999b; Tulungen *et al*., 1998, 1999, 2000) and will not be elaborated in detail here. The management planning process involved a number of steps as outlined below:

1. Issues Identified and Selected
2. Issues Validated and Prioritized
3. Management Options Developed
4. Management Options Selected and Adopted
5. Implementation Initiated

The management plan is now in the early phase of implementation. Management committees have been appointed and an annual implementation workplan developed. Parallel to these planning steps, capacity building activities as well as implementation of selected actions was initiated. Table 1A is a summary of activities by type carried out in Bentenan and Tumbak as well as activities where Bentenan and Tumbak community members participated as part of an event implemented for participants for all three field sites. A detailed listing of each event implemented in Bentenan and Tumbak is provided in Appendix A. There were more meetings (e.g. for management planning, marine sanctuary, planning, and planning implementation actions) than any other type of event. Almost four thousand people participated in these events, but since many individuals participated in more than one event, this does not tell us how representative the meetings were of all stakeholders, or what percentage of community members participated in project activities. On average, the project target of at least 30 percent female participation was met. Bentenan tended to have slightly higher percentages of female participation than Tumbak. Tumbak had a higher total number of participants in all events combined than Bentenan. More detailed analysis on participation and gender is provided in a later section of this report.

For marine sanctuary development in Tumbak, it involved the following steps that took approximately one year from initiation to formal sanctuary establishment.

1. Community Socialization
2. Public Education and Capacity Building

3. Community Consultation and Village Ordinance Formulation
4. Village Ordinance Approval
5. Implementation

The marine sanctuary rules were being enforced in June 2000 in spite of the fact that the village ordinance had not yet been officially signed. One problem that plagued the sanctuary was the presence of a seaweed farm within the boundaries of the sanctuary – a prohibited activity. Key informants indicated that once the current crop of seaweed was harvested, the farmer had agreed to remove the seaweed farm from within the sanctuary boundaries.

Table 1A. Summary of project activities conducted

Activity	Total Number of Events	Participants				
		Female	Male	Total	% Female	% Male
BENTENAN						
Meeting	24	234	464	698	34	66
Training	7	47	67	114	41	59
Presentation	11	152	130	282	54	46
Environmental Education	2	27	67	94	29	71
Total	**44**	***460***	***728***	***1188***	***39***	***61***
TUMBAK						
Meeting	34	790	1638	2428	33	67
Training	6	19	42	61	31	69
Presentation	1	5	7	12	42	58
Environmental Education	3	107	126	233	46	54
Total	**44**	***921***	***1813***	***2734***	***34***	***66***
GRAND TOTAL (BENTENAN-TUMBAK)						
Meeting	58	1024	2102	3126	33	67
Training	13	66	109	175	38	62
Presentation	12	157	137	294	46	54
Environmental Education	5	134	193	327	41	59
Grand Total	**88**	***1381***	***2541***	***3922***	***35***	***65***
JOINT EVENTS*	10	60	132	192	31	69

* Data on participants by village not available.
Source –Workplan implementation reports.

2.1.2 Implementation Actions

Implementation actions are detailed in Table 1B. As part of the project strategy, implementation actions were initiated while the longer-term planning process was on going. These "early actions" were meant to be simple solutions to readily identified problems within the community. The purpose of the implementation actions were to:

- Build community support for the longer-term planning initiative
- Experiment with mechanisms for community implementation
- Build community capacity for implementation through a learning-by-doing process

These actions differ from planning and capacity building activities such as training, workshops, public education, village meetings and participatory monitoring as they are specific activities to address a particular management problem. The project established a grant-like system whereby communities could submit proposals for funding activities that met certain criteria. These action grants, or practical exercises in implementation, had to

Table 1B. Implementation actions in Bentenan - Tumbak

Name of Proposal		Date of Proposal	Date Approved	Amount (RP) Approved by CRMP	Amount (RP) Approved by BAPPEDA	Date Report Submitted
Bentenan Village						
Water Supply	4 units public toilet & water supply pipe-length 375 M	18-Jan-99	19-Feb-99	1,410,000		Mar-99
Information Center (I)	Permanent building with size 12 x 6 x 72 .meters	12-Nov-98	20-Feb-99		10,000,000	1-Aug-99
Information Center (II)	Additional funds for building	17-May-99	18-May-99	4,234,000		1-Aug-99
Information Center (III)	Additional budget for finishing	15-Sep-99	1-Nov-99	3,625,000		19-Feb-00
Mangrove Planting	Planting 7,500 seedling	21-Mar-00	30-Mar-00	597,500		-
Seaweed Farming	Revolving funds for small seaweed farms (10 persons)	21-Mar-00	31-Mar-00		5,000,000	-
TOTAL IMPLEMENTATION ACTIONS AT BENTENAN				**9,866,500**	**15,000,000**	
Tumbak Village						
Mangrove Planting (I)	Bamboo fence to protect replanted mangrove area	25-Nov-97	25-Mar-98	2,856,250		27-Apr-98
Mangrove Planting (II)	Additional budget for finishing	28-May-98	23-Jul-98	300,000		Sep-98
Water Supply	Additional funds for govt. project to buy boulders	15-May-98	23-Jul-98	1,000,000		16-Aug-99
Dike Construction	600 M length (to prevent road flooding from high tide)	Not available	Mar-99		6,225,000	3-Feb-00
Marine Sanctuary (I)	Marine sanctuary marker buoys 700 M x 300 M	27-Jan-00	15-Feb-00	9,215,000		-
Marine Sanctuary (II)	Additional budget to purchase buoy connector	3-Mar-00	9-Mar-00	3,150,000		-
Boat Engines	Revolving fund for 5 units boat engine (5 HP)	20-Feb-00	23-Mar-00	11,000,000		-
Boat Engine	Revolving fund additional 1 unit	1-Mar-00	31-Mar-00		5,000,000	-
TOTAL IMPLEMENTATION ACTIONS AT TUMBAK				**27,521,250**	**11,225,000**	

Note: US$ 1 = RP 8,500 in June 2000

address a specific coastal resources management issue in the village, have widespread support within the community, and be approved by the head of village. Funds were then provided to the community - an action group - that was responsible for implementation. A final report on the activity and an itemized accounting of funds was required from the community before additional funds were dispersed for new proposals they submitted.

Implementation actions in Tumbak and Bentenan were started in 1997, while village issue-profiling and planning was on going. The community received funds from two sources; either USAID or BAPPEDA project funds. A list of implementation proposals, the amount funded in Rupiah (RP 8,500 = US$ 1 in June 2000), source of funds and date reports were submitted, is provided in Table 1B. A summary assessment of implementation actions in Bentenan and Tumbak is provided in Table 2 (see Crawford *et al*., 2000 for detailed information and assessments of these implementation actions.). Overall, most of the implementation projects have been somewhat successful or successful.

Table 2. A comparison of assessments of implementation actions

Action	Community Rank*	Staff Score**	Assessment Team Ranking
Tumbak			
CoTs clean up (Bentenan & Tumbak)	88	5	Not evaluated
Road flood control dike	66	5	Successful
Marine sanctuary	87	4	Successful
Mangrove reforestation	91	4	Very successful
Water supply system river dike		1	Inconclusive
Boat engines revolving fund	57	N/A	Too soon to evaluate
Crab fattening	75	N/A	Not successful
Bentenan			
Water system	100	3.5	Somewhat successful
Information Center	100	3	Somewhat successful
Mangrove planting	83	2	Unsuccessful
Seaweed revolving fund		N/A	Too soon to evaluate

* Percent of survey respondents ranking the activity as very useful or useful.
** Ranked on a scale of 1-5, 1 = not successful, 5 = very successful, N/A = too soon to evaluate

2.2 CHANGES IN PROJECT AND CONTROL VILLAGES SINCE 1997

2.2.1 Overview

A basic project premise is that coastal management initiatives will eventually lead to improved quality of life within the community as well as improved or stabilized environmental conditions. This is the long-term goal expected from implementation of the marine sanctuary and management plan. The purpose of the baseline surveys and subsequent monitoring in the project and control sites is to determine to what extent project activities are impacting on the quality of life and environmental conditions within the community. However, socio-economic changes are constantly occurring in any community. Macro-economic and large-scale ecological and political factors can often have major influences on socio-economic conditions, which may be greater than those due to project interventions. It is difficult to distinguish between impacts from project initiatives and these larger scale changes without time series information and comparisons between project and non-project locations. Even with such information one cannot conclusively prove causality. However, one may be able to infer with a reasonable degree of certainty that impacts have occurred and possibly quantify the magnitude of the changes. Another challenge for monitoring strategies is that it may take years before a socio-economic impact resulting from project interventions becomes noticeable. Therefore, by monitoring socio-economic changes periodically, one can learn how long it may take before such impacts can be measured using the selected indicators.

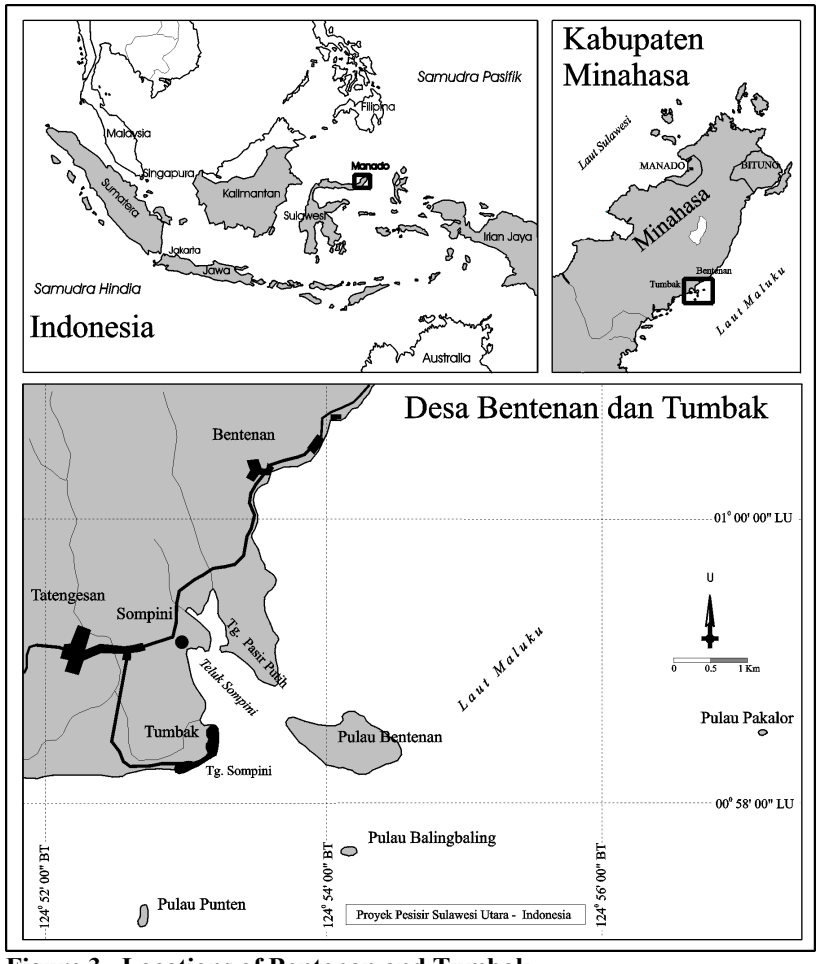

Figure 3. Locations of Bentenan and Tumbak.

Indonesia and North Sulawesi faced several large-scale economic, political and environmental events since the project started in 1997. In the later part of 1997, the whole Asian region, including Indonesia, started to fall into deep recession caused by a large-scale currency devaluation and the banking sector crisis. In Indonesia, the Rupiah fell from approximately 2,500 to the dollar in mid-1997 to over 10,000 to the dollar in the early part of 1998. While many parts of the country were severely affected, especially the banking and manufacturing sectors, the devaluation resulted in large increases in prices paid (Rupiah) to farmers for many export commodities. While inflation for basic commodities and imported goods skyrocketed, prices for many export crops produced in rural communities of North Sulawesi (seaweed, copra, cloves, vanilla) soared (Pollnac *et al*., 1998). Rural communities highly dependent on export commodities did not feel the recession as much as other groups or areas of the country and the devaluation may have been beneficial for them.

This period also saw one of the strongest El Nino events on record. Forest fires swept the country creating a regional haze. Many short-term crops failed in coastal areas of North Sulawesi, and in areas such as the project site in Bentenan, many coconut and clove trees withered and died. Bentenan had almost no rain for 13 months and all the springs that fed water systems in the village ran dry. In 1998, the marine environment was also hit by a strong La Nina event. This triggered elevated sea surface temperatures and widespread coral bleaching in the months of October through November 1998.

This period of time also saw political turmoil in the country. Riots broke out in Jakarta and other locations around the country but North Sulawesi remained calm and peaceful. This turmoil led to the fall of President Suharto, who had ruled the nation for over 30 years. In 1999, violence broke out in neighboring Maluku province and many refugees have poured into Manado and surrounding communities. On the positive side, Indonesia became the third largest democracy in the world with the election of Abdurrahman Wahid in September 1999. Such large-scale events can have major implications for local communities and it compounds the challenge of determining project impacts on socio-economic aspects at our project sites.

2.2.2 Population

During the period of 1997 to 2000, Bentenan and Tumbak have seen changes in addition to the national, regional and global events mentioned above. The population of Bentenan grew at an annual rate of 4.18 percent over this period. This is a bit less than the population growth rates at the control sites that grew at annual rates of 4.58 and 5.97 percent between 1997 and 2000 (Table 3) but is much higher than the national average of less than two percent. Tumbak, however, grew at an annual rate of only 0.53 percent. We find this relatively low rate of change in Tumbak difficult to explain. In-migration is probably a large part of the high growth rates in the other villages, but we do not know what is driving this in-migration. One explanation may be similar to explanations for high population growth rates in some Philippine coastal communities. Coastal communities where resources are in good

Table 3. Population changes in project and control sites.

Village	1997	2000	% change	Annual rate
Bentenan	1204	1355	12.54	4.18
Tumbak	1130	1148	1.59	0.53
Rumbia	226*	253	11.95	5.97
Minanga I	1200**	1365	13.75	4.58

*1998 population **estimated by village secretary

condition (see Pollnac *et al*., 2000), may be attracting persons away from depleted areas to regions where there are better economic opportunities to be gained from exploiting resources that are still in good condition. Since the coastal resources in the Minahasa region are still in good condition, we may be seeing a similar coastal migration pattern in Indonesia. However, the change may be the result of a faulty census. Whatever the reason, if this growth rate is real and sustained, it will put increasing pressure on local resources, increasing the need for improved management. More research is needed to better understand the factors behind these coastal demographic trends.

2.2.3 Ethnicity and Religion

Ethnic changes between 1997 and 2000 are displayed in Tables 4 through 7. Only ethnic groups comprising 10 percent or more of village population in either time period are named in the Tables. As can be seen in the Tables, there have been only minimal changes in the ethnic composition of the project and control villages. Focusing only on the largest changes in each community, the percentage of Minahasa in Bentenan increased by 16 percent ($\chi^2 = 3.69$, df = 1, $p > 0.05$), while percent of Bajo increased by about 12 percent in Tumbak ($\chi^2 = 2.12$, df = 1, $p > 0.05$). In Rumbia the largest change was found among the Sangir who increased by 17 percent ($\chi^2 = 3.66$, df = 1, $p > 0.05$). Only minimal change occurred in Minanga 1 where the percentage of Minahasans increased only 7 percent. None of the observed changes in ethnicity are statistically significant.

Table 4. Changes in ethnicity in Bentenan.

Ethnicity	1997	2000	Total	N
Bolaangmongondo	28.8	25.0	26.7	39
Gorontalo	10.6	17.5	14.4	21
Minahasa	31.8	47.5	40.4	59
Other	28.8	10.0	18.5	17
Total	100.0	100.0	100.0	
N	66	80	146	

Table 5. Changes in ethnicity in Tumbak.

Ethnicity	1997	2000	Total	N
Gorontalo	17.9	10.0	13.2	18
Minahasa	7.1	13.8	11.0	15
Bajo	41.1	53.7	48.5	66
Other	43.9	22.5	27.3	37
Total	100.0	100.0	100.0	
N	56	80	136	

Table 6. Changes in ethnicity in Rumbia.

Ethnicity	1998	2000	Total	N
Sangir	23.1	40.0	32.1	36
Minahasa	42.3	36.7	39.3	44
Other	34.6	23.3	28.6	32
Total	100.0	100.0	100.0	
N	52	60	112	

Table 7. Changes in ethnicity in Minanga 1.

Ethnicity	1998	2000	Total	N
Minahasa	76.0	83.3	80.0	88
Other	24.0	16.7	20.0	22
Total	100.0	100.0	100.0	
N	50	60	110	

There are only two religious groups found in the project and control communities—Christian and Muslim. In all villages except Minanga 1, percent Muslim increased by a only few percent—9 percent in Bentenan and about 2 percent in Tumbak and Rumbia (Table 8). In Minanga 1, percent Muslim dropped only by 5 percent. None of these changes are statistically significant.

Table 8. Changes in percent Muslim in project and control villages.

Village	1997	2000
Bentenan	72.7	82.5
Tunbak	98.2	100.0
Rumbia	30.8	33.3
Minanga I	30.0	25.0

2.3 OCCUPATIONAL STRUCTURE OF PROJECT AND CONTROL VILLAGES

2.3.1 Introduction

Occupation is one of the most important aspects of social organization related to community development and resource management. The occupations practiced by households in coastal communities are directly related to important variables such as

income, which directly impacts quality of life and development. The occupation structure is also related to coastal resource management, especially when some sources of household income involve harvesting or farming of living aquatic resources, extraction of mineral resources, and landscape alteration (e.g., construction of breakwaters, clearing for crops, pasture land, and buildings, etc.). The following information concerning occupational structure in the project and control villages was obtained by asking respondents to name all sources of household income. They were then requested to rank each source in terms of relative importance.

2.3.2 Bentenan

The occupational structures of Bentenan for 1997 and 2000 are displayed in Tables 9, 10 and 11. There are three Tables due to the fact that in 2000 only coastal sub-villages (*dusun*) were sampled and there are occupational differences between coastal and inland sub-villages. The discussion of changes will focus only on Tables 9 and 10, which include only the coastal sub-villages.

Table 9. Percent distribution of occupations in coastal *dusuns* Bentenan (2000).

OCCUPATION	1st	2nd	3rd	4th	5th	6th	7th	TOTAL
FISHING	15.0	42.5	17.5	7.5	2.5	--	2.5	87.5
MILKFISH FRY	--	7.5	25.0	25.0	7.5	2.5	--	67.5
GLEANING	--	--	--	--	--	2.5	--	2.5
ORNAMENTALS**	--	--	2.5	--	--	--	--	2.5
SEAWEED FARM	72.5	10.0	10.0	--	--	--	--	92.5
TRADE FISH	2.5	10.0	7.5	2.5	--	--	--	22.5
TRADE FRY	--	2.5	2.5	--	2.5	--	--	7.5
TRADE SEAWEED	--	10.0	--	2.5	--	--	--	12.5
TRADE OTHER	2.5	--	--	--	--	--	--	2.5
PROCESSING	--	--	10.0	5.0	7.5	--	--	22.5
FARMING	5.0	10.0	2.5	2.5	--	2.5	--	22.5
OTHER	5.0	7.5	10.0	17.5	2.5	--	--	42.5
TOTAL	102.5*	100	87.5	62.5	22.5	7.5	2.5	

N= 40 *Total >100% due to one individual ranking 2 sources 1st.
**Capture of ornamental fish.

Table 10. Percent distribution of occupations in Bentenan* (1997).

OCCUPATION	1st	2nd	3rd	4th	5th	6th	TOTAL
FISHING	71	3	3	6	--	--	83
MILKFISH FRY	10	52	13	19	--	--	94
ORNAMENTALS**	--	--	--	--	3	--	3
SEAWEED FARM	--	10	19	--	6	--	35
TRADE FISH	10	19	19	--	--	--	48
TRADE FRY	--	--	6	--	--	--	6
TRADE SEAWEED	--	--	--	--	3	--	3
TRADE OTHER	3	3	3	3	--	--	12
PROCESSING	--	--	6	16	--	--	22
FARMING	3	6	16	10	3	3	41
OTHER	3	6	--	--	3	--	12
TOTAL	100	99	85	54	15	3	

N=31 *Coastal *dusuns* **Collecting ornamental fish.

Table 11. Percent distribution of occupations in Bentenan (1997).

OCCUPATION	1st	2nd	3rd	4th	5th	6th	TOTAL
FISHING	54	5	2	5	--	--	66
MILKFISH FRY	7	41	12	15	--	--	75
ORNAMENTALS*	--	--	--	--	2	--	2
SEAWEED FARM	--	7	15	--	5	--	27
TRADE FISH	12	15	15	--	--	--	42
TRADE FRY	--	--	5	--	--	--	5
TRADE SEAWEED	--	---	--	--	2	--	2
TRADE OTHER	2	5	2	2	--	--	11
PROCESSING	--	5	10	20	--	--	35
FARMING	12	12	17	7	2	2	52
OTHER	11	10	2	5	2	--	30
TOTAL	100	100	80	54	11	2	

N=41 *Collecting ornamental fish.

The largest change involves seaweed farming. The percentage of households involved in this activity increased from 35 in 1997 to 93 in 2000. Also important, while seaweed farming was not ranked first in importance by any of the households in the sample in 1997, almost three-fourths (73 percent) did so in 2000. Other notable changes are an increase in the "other" category (12 to 45

percent) and decreases in milkfish fry collecting (94 to 68 percent), fish trading (48 to 23 percent) and farming (41 to 23 percent).

It is also important to note that while the percentage of households involved in fishing remained essentially the same (χ^2 =0.21, df = 1, p >0.05), the percentage of households ranking fishing as first in importance for household income decreased from 71 to 15 percent. Fishing thus decreased from first to second in importance. This does not mean that there has been a reduction in fishing effort—as discussed in the section on changes in occupational structure below, only three percent of fishers (including milkfish fry collectors) report that they have reduced their fishing efforts as a result of seaweed farming activity. The notable decrease in milkfish fry collecting (χ^2 = 8.11, df = 1, p <0.05) is difficult to explain since it did not occur in the other villages (see below). The decrease in fish trading might be the result of intensification and consolidation by fewer traders since it occurred in all four of the geographically contiguous villages in this report. Decrease in the relative importance of farming is probably related to the increase in the "other" category. This category includes small shop keeper (15%), carpenter (10%), water taxi and electrician (5% each), government employee, tailor and midwife (2.5 % each) for a total of 42.5 percent.

2.3.3 Tumbak

The occupational structures of Tumbak for 1997 and 2000 are displayed in Tables 12 and 13. As found for Bentenan the largest change involves seaweed farming. The percentage of households involved in this activity increased from 23 in 1997 to 93 in 2000. Also important, while seaweed farming was not ranked first in importance by any of the households in the sample in 1997, almost two-thirds (65 percent) did so in 2000. Other notable changes are an increase in the "other" category (27 to 38 percent) and decreases in gleaning (28 to 15 percent), fish trading (35 to 28 percent), processing (30 to 15 percent) and farming (38 to 25 percent).

Table 12. Percent distribution of occupations in Tumbak (2000).

OCCUPATION	1st	2nd	3rd	4th	5th	6th	TOTAL
FISHING	25.0	45.0	10.0	5.0	--	--	85.0
MILKFISH FRY	--	--	2.5	2.5	--	--	5.0
GLEANING	--	2.5	2.5	7.5	--	2.5	15.0
ORNAMENTALS**	--	2.5	7.5	--	--	--	10.0
SEAWEED FARM	65.0	22.5	2.5	2.5	--	--	92.5
TRADE FISH	2.5	10.0	12.5	2.5	--	--	27.5
TRADE SEAWEED	2.5	5.0	--	--	--	--	7.5
TRADE OTHER	--	--	2.5	--	--	--	2.5
PROCESSING	--	2.5	5.0	7.5	--	--	15.0
FARMING	--	2.5	10.0	7.5	5.0	--	25.0
OTHER	5.0	5.0	15.0	10.0	2.5	--	37.5
TOTAL	100	97.5	70.0	45.0	7.5	2.5	

N=40 **Capture of ornamental fish.

Table 13. Percent distribution of occupations in Tumbak (1997).

OCCUPATION	1st	2nd	3rd	4th	5th	6th	TOTAL*
FISHING	70	8	5	3	--	--	85
MILKFISH FRY	3	--	--	--	--	--	3
GLEANING	3	3	5	8	10	--	28
ORNAMENTALS**	3	10	3	--	--	--	15
SEAWEED FARM	--	18	5	--	--	--	23
TRADE FISH	15	8	10	--	3	--	35
TRADE SEAWEED	--	--	3	--	--	--	3
TRADE OTHER	--	3	--	--	--	--	3
PROCESSING	--	25	5	--	--	--	30
FARMING	--	10	13	10	3	3	38
OTHER	8	8	3	8	--	--	27
TOTAL*	100	90	50	28	15	3	

N=40 *Row and column totals differ from sums of Table rows and columns due to rounding. **Collecting ornamental fish.

It is also important to note that while the

percentage of households involved in fishing remained the same (85 percent), the percentage of households ranking fishing as first in importance for household income decreased from 70 to 25 percent. Fishing thus decreased from first to second in importance. This does not mean that there has been much of a reduction in fishing effort—only three percent of fishers (including milkfish fry collectors) report that they have reduced their fishing efforts as a result of seaweed farming activity. As discussed for Bentenan, the decrease in fish trading might be the result of intensification by fewer traders since it occurred in all four of the geographically contiguous villages in this report. Decreases in the relative importance of farming, gleaning and processing are probably related to the increase in seaweed farming as well as the "other" category. This category includes carpenter (10 percent), remittances and cake making (5 percent each), and 2.5 percent each for animal husbandry, cage fish culture, small shop keeper, trading, ice seller, meal vendor, and selling roofing material.

2.3.4 Rumbia

The occupational structures of Rumbia for 1998 and 2000 are displayed in Tables 14 and 15. As found for the project sites, the largest change involves seaweed farming. The percentage of households involved in this activity increased from zero in 1998 to 87 in 2000. It ranks second to farming, which is practiced by 97 percent of the population. Also important, seaweed farming is ranked first in importance by more households than any other activity, even farming. Other notable changes are decreases in gleaning (27 to zero percent), fish trading (27 to 7 percent), and processing (62 to 40 percent). The slight change in percent fishing is not statistically significant (Yates corrected χ^2 =0.06, df = 1, p >0.05). There was very little change in percent involved in the "other" category, which includes boat builder, remittances, small shop keeper, and government at 7 percent each, as well as coconut tree climber, carpenter, tailor, teacher, animal husbandry and laborer at 3 percent each.

Table 14. Percent distribution of occupations in Rumbia (2000).

OCCUPATION	1st	2nd	3rd	4th	5th	6th	7th	TOTAL**
FISHING	3	13	37	13	17	3	--	87
MILKFISH FRY	--	7	13	27	7	7	--	60
SEAWEED FARM	43	23	13	3	--	3	--	87
TRADE FISH	--	--	--	7	--	--	--	7
TRADE FRY	--	--	3	--	--	--	--	3
TRADE SEAWEED	--	--	--	3	--	--	--	3
TRADE OTHER	--	--	--	--	3	--	--	3
PROCESSING	7	10	10	3	7	3	--	40
FARMING	33	30	20	10	3	--	--	97
OTHER	17	13	--	10	3	--	3	47
TOTAL	103*	97	97	77	40	17	3	

N= 30 *Total >100% due one individual ranking 2 sources 1st.
**Row and column totals differ from sums of Table rows and columns due to rounding.

Table 15. Percent distribution of occupations in Rumbia (1998).

OCCUPATION	1st	2nd	3rd	4th	5th	6th	7th	TOTAL*
FISHING	15	27	27	8	12	--	4	92
MILKFISH FRY	8	15	27	8	4	--	--	62
GLEANING	--	--	4	15	4	4	--	27
TRADE FISH	4	4	--	12	8	--	--	27
TRADE OTHER	--	4	8	4	4	4	--	23
PROCESSING	15	4	19	12	8	4	--	62
FARMING	42	35	8	8	--	--	--	92
OTHER	15	8	--	16	4	4	4	50
TOTAL*	100	97	93	83	44	16	8	

N=26 *Row and column totals differ from sums of Table rows and columns due to rounding.

2.3.5 Minanga

The occupational structures of Minanga for 1998 and 2000 are displayed in Tables 16 and 17. As found for the project sites, the largest change involves seaweed farming. The percentage of households involved in this activity increased from zero in 1998 to 60 in 2000. It ranks second to fishing, which is practiced by 73 percent of the population. It also ranks second to fishing in terms of the percentage of households indicating it is most important for household income (23 versus 40 percent, respectively). There was essentially no change in the total percent of households involved in fishing. Other notable changes are decreases in farming (56 to 36 percent), fish trading (68 to 53 percent), and processing (72 to 53 percent). There was an increase in the percentage of households involved in the "other" category (24 to 46 percent). This category included small shop keeper (13 percent), boat builder and nipa shingle maker (10 percent each) and carpenter, tailor, remittance and resort worker (3 percent each).

Table 16. Percent distribution of occupations in coastal Minanga (2000).

OCCUPATION	1st	2nd	3rd	4th	5th	6th	7th	TOTAL*
FISHING	40	20	7	3	3	--	--	73
MILKFISH FRY	3	23	10	20	17	7	3	83
GLEANING	--	--	--	3	--	--	--	3
SEAWEED FARM	23	23	3	3	7	--	--	60
TRADE FISH	17	7	20	7	3	--	--	53
TRADE FRY	--	--	--	3	--	--	--	3
PROCESSING	--	7	20	13	10	3	--	53
FARMING	7	10	17	7	--	3	--	36
OTHER	10	7	7	3	7	7	7	46
TOTAL*	100	97	80	63	47	20	10	

N=30 *Row and column totals differ from sums of Table rows and columns due to rounding.

Table 17. Percent distribution of occupations in Minanga (1998).

OCCUPATION	1st	2nd	3rd	4th	5th	6th	7th	TOTAL*
FISHING	40	12	12	4	4	--	--	72
MILKFISH FRY	--	8	32	28	8	4	--	80
GLEANING	--	--	--	--	4	--	4	8
TRADE FISH	16	36	12	4	--	--	--	68
TRADE FRY	4	--	--	--	--	--	--	4
TRADE OTHER	12	12	--	--	--	--	--	24
PROCESSING	16	12	24	12	4	4	--	72
FARMING	12	8	8	12	16	--	--	56
OTHER	--	12	4	4	--	4	--	24
TOTAL*	100	100	92	64	36	12	4	

N=25 *Row and column totals differ from sums of Table rows and columns due to rounding.

2.3.6 Changes in Occupational Structure

Overall the greatest change in occupational structure involves the phenomenal increase in seaweed farming. In the past two years seaweed farming has increased exponentially in the Bentenan/Tumbak area. While in 1997 only about 25 percent of the sample from the two villages carried out the practice, this increased to almost 93 percent in 2000. Further, in 1997 no one ranked seaweed farming first in terms of contribution to livelihood. In 2000 fully 69 percent ranked it first. As a consequence, almost the entire surface of the sea between Bentenan village and Bentenan Island is speckled with the multicolored plastic bottles used as floats for the seaweed lines. The floats continue southward on past Sompini point, into Sompini Bay and along the coast just off the village of Tumbak. To the north they are fewer, but can be seen on the horizon towards Rumbia. Only the area between the reef and the beach, a few boat passage channels, and the mooring area for the *pajeko* boats of Bentenan remain clear.

For the most part the increase in seaweed farming is due to increases in prices paid for the product for the international market, possibly as a partial function of the decreased foreign exchange value of the Rupiah. Whatever the reason, Bentenan and Tumbak, which practiced seaweed farming in the 1980s and began again in the late 1990s (Pollnac et al. 1997a) have expanded areas devoted to the practice, from 105 Ha. in 1997 to 378 Ha. in 1999 (Dimpudus, et al. 1999). Of significance, however, neighboring villages, such as Minanga 1 to the south, where seaweed farming was never practiced, and Rumbia to the north where it was introduced and failed in 1993-1994, have begun devoting significant effort to its cultivation in the past nine and fourteen months, respectively. In Rumbia fully 87 percent of the sample report being involved in the activity with 43 percent ranking it as first in importance and 23 percent as second. Sixty percent of the Minanga sample are involved, with a total of 47 percent ranking it as first or second in importance (23.3 percent each).

Reportedly, this burgeoning of the practice has had a significant impact on incomes since many fishers who began cultivating seaweed or increased their efforts continue to fish at almost previous levels. Since seaweed cultivation activities are frequently at a different time than fishing and both males and females, as well as children, cultivate the crop (see Table 18), there are minimal impacts on fishing activity. Only three percent of fishers (including milkfish fry collectors) report that they have reduced fishing activity as a result of increased seaweed farming activity. Some fishers report that they may fish a little less, but the fish aggregating potential of the floating seaweed lines results in their harvesting as much or more fish in less time.

Table 18. Percent distribution of seaweed farm workers.

	Bentenan	Tumbak	Total	N
Male adults	8	0	4	3
Adults	57	68	62	46
Adults & children	35	32	34	25
Total	100	100	100	
N	37	37	74	

Since evaluating impacts of *Proyek Pesisir* involves examination of changes in the well being of the community, part of which is measured by material style of life (MSL), the growing importance of seaweed cultivation may confound our efforts in this important endeavor. In response to the question concerning whether they are better off, worse off, or the same as 5 years ago, 79 percent of the Bentenen/Tumbak sample and 58 percent of the Rumbia/Minanga sample report that they are better off. Seventy-three and 58 percent, respectively, say that they are better off because of seaweed farming. As one of the seaweed farmers in the control village of Minanga stated, "the income from seaweed farming has allowed us to purchase new electronics for our homes." These electronics and other household improvements purchased with the profits from seaweed farming form part of our measurement of MSL. Hence, it is important to try to estimate the significance of seaweed farming for household well being, as well as mathematically control for it in our examination of the impacts of *Proyek Pesisir*.

2.3.7 Estimates of Costs and Earnings for Seaweed Culture

The technology associated with seaweed farming in the area is quite simple. Small cuttings (propagules) of seaweed are tied to lines floating in the sea and are left to grow-out for a period of time that varies between 1 and 2.5 months, depending on water temperature and availability of nutrients. The lines are suspended near the surface of the water column by floats made for the most part of 600ml plastic water bottles. Although

clear plastic water bottles predominate, many other types and colors of plastic containers are used. Corners of the rectangle of floating lines are supported by more substantial floats. These corner buoys are often composed of 4 or more 1500ml plastic water bottles bound together with line, sometimes with a block of styrofoam sandwiched between the bottles. Net buoys or large (4 or more liter) plastic bottles may also be used for corner buoys. Seaweed plantings in the area are usually composed of fifteen to twenty 100 to 150 meter lines, resulting in an area of about 30 to by 100 to 150 meters. There are, of course, farms that are smaller or larger than this modal value. This floating structure is held in place by a system of anchors, usually composed of sand-filled feed bags, sometimes concrete anchors, which are attached to the floating lines by somewhat more substantial lines.

Reported costs are based on interviews with a small sample of seaweed farmers in the four villages. Costs are converted to cost per meter of planted line for comparative purposes. The line used for suspending the propagules reportedly costs 32,500Rp/175 M roll (185.7Rp/M). One kilogram of the "ties" used to tie the propagule to the line costs 10,000Rp and is reported to be sufficient for tying two 90 *depa* (144 M) lines (34.72Rp/M). The plastic bottles used as floats cost 200Rp each, and 40 are needed for a 150 M line (53.33Rp/M). Costing anchors was difficult because costs vary with depth and material used, which was quite variable. Anchor costs for 3 farms were determined and the modal value per meter of planted line was about 300Rp. Propagules cost 1000Rp/Kg, and 6 farmers report an average of 0.613 Kg/M; hence, average cost is 613Rp/M. Reported values range from 0.347- 2.19Kg/M. Extreme values of 1.25 and 2.19 Kg/M were reported by two seaweed farmers from Minanga who harvest after only a month. These values are not included in the average.[1]

Lines and anchors reportedly last a year or more given proper care and minimal extreme waves and currents. Ties last for 4 harvests and floats from 2 to 4 harvests. Given 6 to 7 harvests per year, we will assume that ties and floats will be replaced at least once yearly if the year begins with new equipment. Seaweed farmers reported high, average, and low harvests. Most report 6 to 7 harvests a year. Mean high harvest (dried) is .4517 Kg/M (range 0.343 – 0.6 Kg/M), mean average .3472 (range 0.156 – 0.563) and mean low 0.1755 (range 0.03 – 0.375). Converting weights to value, using an average price of 4250Rp/kg (dry), average high harvests are worth 1920Rp/M, average harvests 1476Rp/M and low 746Rp/M.

Using the above figures, yearly costs total 662Rp/M (assuming only a year for anchors and lines, although it may be more). This results in net earnings of 645Rp/M for high harvests, 201Rp/M for medium, and a loss of 529Rp/M for lowest harvests. Looking at a seaweed operation with twenty 150M lines and six average harvests (201Rp/M) a year, the operator receives 3,618,000 Rp profit per year. With thirty 150M lines, the profit jumps to 5,427,000 Rp/year.

Using as an example, a seaweed farmer from Minanga who cultivates twenty 160M lines, using an average of 175Kg propagule per line (1.094kg/M) harvests 55Kg dried seaweed per line (.3438kg/M) in 1.5 months. If the farmer receives 4250Rp/Kg., gross harvest value is 1461Rp/M. One and one-half months' costs for lines, floats, and anchors (using above calculations) would be 83Rp/M, and propagule cost is 1094Rp/M, resulting in a

[1] Seaweed farmers can cut propagules from their own harvest. Since most farmers interviewed quoted the 1000Rp/Kg price, it is used in calculating costs.

total cost of 1177Rp/M. Subtracting this from the gross value we obtain a net value of 284Rp/M. The farmer harvests twenty 160 meter lines (3200M), resulting in a profit of 908,800Rp. [2]

2.3.8 Implications of Changes in Seaweed Culture

Tables 19 and 20 provide some descriptive statistics concerning the extent of seaweed culture activities in the project and control sites. Given medium net earnings of about 200Rp/M, it is clear that seaweed farming contributes significantly to household income in both the project and the control sites. A larger percentage of households in the project sites take part in the activity, and average total line length is greater in the project sites with line length being greatest in Tumbak. This variance in the extent of seaweed farming must be controlled for in our examination of project impacts, especially with regard to impacts on income and its indicator, material style of life.

Table 19. Length of seaweed line farmed in project sites.

	PROJECT SITES	BENTENAN	TUMBAK
N of cases	74	37	37
Minimum	200.0	200.0	300.0
Maximum	52800.0	15750.0	52800.0
Median	1990.0	1800.0	2000.0
Mean	4192.4	2863.4	5521.5
Standard Dev	7470.6	3135.4	9985.4

Table 20. Length of seaweed line farmed in control sites.

	CONTROL SITES	MINANGA	RUMBIA
N of cases	43	18	25
Minimum	360.0	360.0	375.0
Maximum	16320.0	7200.0	16320.0
Median	1536.0	1710.0	1536.0
Mean	2305.8	2422.7	2221.6
Standard Dev	2730.0	1997.9	3193.4

2.4 PROJECT IMPACTS ON MATERIAL STYLE OF LIFE

2.4.1 Material Style of Life

The question for monitoring concerns whether or not project activities have improved the coastal environment (both natural and human[3]) in Bentenan and Tumbak to the extent that existing productive activities have increased their livelihood (both monetary and non-monetary income). In the absence of reliable income data, material style of life is used as an indicator of level of livelihood; thus, changes in this indicator are assumed to reflect parallel changes in livelihood. This section of the report analyses the impacts of Proyek Pesisir on material style of life.

[2] This does not take into account the value of the farmer's labor. Most seaweed farmers said that if they hired labor they would pay 10,000Rp/day. Most farmers report spending 2 to 3 days a week maintaining their farm. A six week grow-out period would thus require a maximum of about 18 days labor, which would cost 180,000Rp, leaving the farmer a profit of 728,800Rp.

[3] The natural environment includes the non-human aspects of the sea and its adjacent land-mass. The human environment includes the human populations, their multiple behaviors and the material aspects of these behaviors (e.g., their occupations, tools, housing, social behavior, etc.).

2.4.2 Material Style of Life Scale

As a means of developing a standardized material style of life scale for all project and control sites, a principal component analysis was conducted for the 28 material style of life variables[4] for all ten project and control villages across the two time periods (N = 812 households). Six of the items manifested very low component loadings in the first analysis of the data, so they were eliminated, and the analysis, using varimax rotation of components, was conducted once again. The scree test (Cattell 1966) was used to determine the number of components, resulting in 3 components which account for a total of 46 percent of the variance in the data set. The results of this analysis are found in Table 21. Items loading highest on the first component indicate a relatively well-constructed house with adequate furnishings. Items loading highest on component two reflect modern appliances, and those with high positive loadings on factor three are associated with a solid, permanent structure (e.g., cement walls and tin roof) while those loading a high negative are associated with a less permanent structure (wood walls, floor, and window).

Table 21. Principal component analysis of material style of life variables.

Variable	Modern House and Furnishings	Appliances	Modern Structure
Bamboo wall	-0.820	-0.056	-0.092
Nipa roof	-0.731	-0.095	-0.367
Concrete floor	0.704	0.054	0.334
Dirt floor	-0.684	-0.074	0.204
Open window	-0.680	-0.188	0.138
Glass window	0.667	0.214	0.333
Tin roof	0.662	0.098	0.456
Concrete wall	0.647	0.127	0.597
Electricity	0.508	0.165	-0.022
Cabinet	0.501	0.380	0.086
Livingroom set	0.478	0.306	0.063
Bench	-0.400	-0.071	0.017
Satellite dish (TV)	0.056	0.744	0.044
Television	0.261	0.637	0.106
Refrigerator	-0.010	0.592	-0.017
Fan	-0.016	0.548	0.014
Radio-cassette player	0.232	0.545	0.025
Indoor toilet	0.276	0.478	0.202
Modern cook stove	0.245	0.391	0.086
Wood wall	0.128	-0.103	-0.644
Wood floor	-0.182	-0.009	-0.643
Wooden window	-0.019	-0.060	-0.565
Percent Variance	23.376	12.276	10.055

Component scores representing the position of each household on each component were created for each household. The component scores are the sum of the component coefficients times the sample standardized variables. These coefficients are proportional to the component loadings. Hence, items with high positive loadings contribute more strongly to a positive component score than those with low or negative loadings. Nevertheless, all items contribute (or subtract) from the score; hence, items with moderately high loadings on more than one component (e.g., tin roof and concrete wall in the analysis presented here) will contribute at a moderate level, although differently, to the component scores associated with each of the components. This type of component score provides the best representation of the data. In this paper, for this data we will refer to these scores as Material Style of Life (MSL) Component Scores. They are standardized scores with a mean of zero and a standard deviation of one.

[4] See Pollnac and Crawford (2000) for a discussion of the use of principal component analysis with this type of data.

2.4.3 Project Impacts on Material Style of Life

The question for monitoring concerns whether or not project activities have impacted the natural and human environment to the extent that the changes have influenced the level of livelihood and, subsequently, the material style of life in the project communities. As a means of testing for this impact, mean component scores for each component are calculated for each time period in the project and control villages. If the project has had a positive impact we would expect that mean component scores would increase more in Bentenan and Tumbak than in the control sites. The results of this analysis are found in Table 22. The analysis indicates that the MSL values increased in the project sites while decreasing somewhat in the control sites; however, the only change that is statistically significant is the moderate increase in the score on the appliances component in Bentenan and Tumbak.

Table 22. Mean MSL component scores for Bentenan & Tumbak and control sites for 2 time periods.

	Bentenan & Tumbak			Control		
	1997/8	2000	t-test	1997/8	2000	t-test
HOUSE & FURNISHINGS	0.183	0.273	0.689	-0.123	-0.171	0.252
APPLIANCES	-0.123	0.343	2.567*	0.327	0.073	1.011
STRUCTURE	-0.466	-0.191	1.506	-0.269	-0.320	0.270
N	81	78		51	60	

* = p < 0.05

Table 23 compares MSL scores across the project and control sites during the monitoring period (2000). As can be seen in Table 23, the project sites had higher scores on all three components, but only the difference on the house and furnishings component is statistically significant ($p<0.01$). As can be seen in Table 24 there are no statistically significant differences between the two project sites.

Table 23. Mean MSL component scores for project (Bentenan & Tumbak) and control sites in 2000.

	Project	Control	t-test
HOUSE & FURNISHINGS	0.273	-0.171	2.842*
APPLIANCES	0.343	0.073	1.259
STRUCTURE	-0.191	-0.320	0.719
N	78	60	

* = p < 0.01

Table 24. Mean MSL component scores for Bentenan and Tumbak in 2000.

	Bentenan	Tumbak	t-test
HOUSE & FURNISHINGS	0.246	0.299	0.273
APPLIANCES	0.432	0.610	0.544
STRUCTURE	-0.053	-0.329	0.719
N	39	39	

Turning to the question concerning non-project factors that could have influenced changes in MSL, the most significant recent change was the increase in seaweed farming (discussed above) which increased in the project villages and was recently begun in the controls. Median line length among seaweed farmers in the control villages is only about 77 percent of that in Bentenan and Tumbak, and might account for the differences illustrated in Table 23. To determine the relationship between seaweed farming and MSL component scores, length of seaweed line cultivated was correlated with MSL. The results of this analysis are in Table 25. As can be seen in Table 25, seaweed line length is only statistically significantly correlated with the appliances MSL score. This makes sense, since the

Table 25. Correlations between MSL components and seaweed line length in total sample.

MSL COMPONENT	LINE LENGTH
HOUSE & FURNISHINGS	0.172
APPLIANCES	0.190*
STRUCTURE	-0.054

* = P<0.05

increase in seaweed farming was so recent that the amount of accumulated income would be such that small purchases rather than extensive investment in house structure would be most likely. If we examine the correlations between the MSL appliances component and seaweed line length in the individual project and control villages in 2000 (Table 26) we find that only Bentenan manifests a statistically significant correlation between the two variables. This correlation is quite strong and probably accounts for the overall correlation between these two variables in Table 25. It also probably accounts for the change observed in the project villages between the 1997/98 and 2000. Nevertheless, between 1997 and 2000, the household and furnishings component increased in the project villages while it decreased in the control villages (Table 22), resulting in a statistically significant difference between the project and controls in 2000 (Table 23). The changes themselves were slight, therefore not statistically significant, but the results are overall better scores on the household and furnishings component in the project villages.

Table 26. Correlation between seaweed line length and MSL appliances component.

VILLAGE	CORRELATION
BENTENAN	0.527*
TUMBAK	0.177
MINANGA	0.089
RUMBIA	0.059

* = p<0.005

2.5 CHANGES IN RESOURCE BELIEFS

2.5.1 Resource Beliefs Scale

As one means of obtaining information concerning community member's perceptions of the coastal resources and potential human impacts on these resources, household members from the 10 project sites and control sites were requested to provide a statement concerning the degree of their agreement or disagreement with nine statements. These questions were posed at both the baseline (1997/98) and monitoring (2000) phases of the project to determine if project activities had any influence on these perceptions. Each of the nine statements involves some aspect of relationships between coastal resources and human activities. The following are the statements used:

1. We have to take care of the land and the sea or it will not provide for us in the future.
2. Fishing would be better if we cleared the coral where the fish hide from us.
3. If our community works together we will be able to protect our resources.
4. Farming in the hills behind the village can have an effect on the fish.
5. If we throw our garbage on the beach, the ocean takes it away and it causes no harm.
6. We do not have to worry about the air and the sea, God will take care of it for us.
7. Unless mangroves are protected we will not have and small fish to catch.
8. There are so many fish in the ocean that no matter how many we catch, there will always be enough for our needs.
9. Human activities do not influence the number of fish in the ocean.

The statements were arranged in the interviews so as to limit interference between similar statements (e.g., statements number 8 and 9 were separated by 6 other statements). It will also be noticed that agreement with some would indicate an accurate belief, while agreement with others would indicate the opposite. This was done to control for responses where the respondent either agrees or disagrees with everything. Statements

were randomly arranged with respect to this type of polarity. Respondents were asked if they agree, disagree, or neither (neutral) with respect to each statement. If they indicated either agree or disagree, they were asked if they agree (disagree) strongly, agree (disagree), or just agree (disagree) a little with the statement. This resulted in a scale with a range from one to seven. Polarity of the statement is accounted for in the coding process, so as a score value changes from one to seven it indicates an increasingly stronger and accurate belief concerning the content of the statement.

The scale values associated with the nine statements involving beliefs concerning relationships between the coastal resources and human activities were factor analyzed using the principal component analysis technique and varimax rotation. One of the statements ("Farming in the hills behind the village can have an effect on the fish") manifested very low loadings on all factors, so it was eliminated from the final analysis. The scree test was used to determine optimum number of factors to be rotated (Cattell 1966). The result of this final analysis can be found in Table 27.

Table 27. Principal component analysis of conservation attitude variables.

Statement (abbreviated)	Vastness	Efficacy
God will take care of the sea for humans	0.694	0.130
Humans do not impact the number of fish	0.659	-0.086
There will always be enough fish	0.603	-0.160
The ocean can harmlessly absorb beach garbage	0.595	0.263
We have to take care of the land and sea	0.021	0.713
Working together can protect our resources	0.020	0.668
If we clear coral it will improve fishing	0.264	0.547
We must protect mangroves for small fish	-0.151	0.530
Percent of Total Variance Explained	21.583	20.660

Statements loading high positive on the first component involve perceptions of the lack of human control (God will take care of it), inexhaustibility (endless supplies of fish) and vastness (it can absorb all the rubbish) of the ocean. Statements loading highest on the second component involve the efficacy of human actions (we have to take care, protect, not clear coral, and work together) with respect to health of the resource. Thus, the first component is labeled *"Vastness"* and the second *"Efficacy*." Component scores (see above discussion) were calculated for each individual on each component.

2.5.2 Project Impacts on Resource Beliefs

In terms of resource beliefs, it is important to determine if project activities have had any impact on community members' beliefs about the coastal environment. As a means of testing for this impact, mean Resource Belief Component Scores for each component are calculated for each time period in the project and control communities (Table 28). If the project has had a positive impact we would expect that mean scores would increase more in Bentenan and Tumbak than in the control sites. The results of the analysis presented in Table 28 illustrate that this is the case. Values on both components of the resource belief measure increased significantly in Bentenan and Tumbak, while they decreased in the control sites. In fact,

Table 28. Mean resource beliefs component scores for Bentenan & Tumbak and control sites for 2 time periods.

	Bentenan & Tumbak			Controls		
	1997/98	2000	t-test	1997/8	2000	t-test
VASTNESS	-0.515	-0.139	3.152*	0.601	-0.072	5.117**
EFFICACY	-0.747	-0.045	5.330**	0.144	-0.024	1.149
N	122	160		102	120	

*p < 0.005 ** = p < 0.001

the decrease in score on the *Vastness* component is statistically significant in the control sites.

When we compare Bentenan and Tumbak with respect to changes in mean resource belief scores since project implementation (Table 29), we see that there have been statistically significant positive changes in both the vastness and efficacy scores in Bentenan. In Tumbak, only the efficacy score has manifested a statistically significant positive change.

Table 29. Changes in mean resource beliefs component scores for Bentenan and Tumbak since project implementation.

	Bentenan			Tumbak		
	1997	2000	t-test	1997	2000	t-test
VASTNESS	-0.474	0.054	3.384*	-0.562	-0.332	1.280
EFFICACY	-0.867	-0.085	3.812**	-0.606	-0.005**	3.725
N	66	80		56	80	

*p < 0.005 ** = p < 0.001

If project activities have an impact on resource beliefs component scores at the community level, we would expect that degree of involvement in project activities would impact resource beliefs at the individual level. To explore this possibility, we will examine the relationships between resource beliefs and extent of involvement and knowledge about Proyek Pesisir in Bentenan and Tumbak. Other variables potentially impacting resource beliefs such as age, education, and sex (gender) will also be examined. Both age and sex influence experience, hence knowledge concerning natural resources is expected to vary as a result of the division of labor by age and sex as well as differential length of exposure. Level of formal education is also expected to influence perceptions of natural resources, through exposure to environmental science in science courses in the schools. Age, formal education, and gender were determined by direct questions on the survey.

Degree of involvement and knowledge about Proyek Pesisir activities are measured by several questions included in the survey. First, respondents were asked what they know about Proyek Pesisir. The number of distinct, correct responses is used as a measure of project knowledge (*Project Knowledge*). Second, respondents were requested to indicate the project activities in which they participated. The total number of activities is used as a indicator of participation (*Participation*). Third, membership in project related organizations is used as another indicator of participation. Number of project organizations joined is the measure (*Organization Membership*). Fourth, knowledge about rules associated with the marine protected area is used as another measure of project knowledge. Number of MPA rules known is the indicator (*MPA Knowledge*). Finally, values for the previous four measures were summed to construct a measure of total project involvement (*Project Involvement*).

Correlations between these predictor variables and the *Vastness* and *Efficacy* component scores can be found in Table 30. With respect to both Bentenan and Tumbak, Table 30 indicates that years of formal education, age, and degree of project participation are statistically significantly correlated with both resource belief components. All are positive except for age, which is negatively correlated with the *Vastness* component. Additionally, gender of respondent (male), project related organization membership and MPA rule knowledge are positively related to the *efficacy* component score.

Most of the relationships observed in Table 30 are relatively easy to understand. For example involvement in project activities were intended to increase environmental awareness and knowledge, so we would expect that project participation would increase the accuracy of resource beliefs. Years of formal education should also have a positive impact on environmental knowledge. The negative relationship with age can probably be explained by the strong negative correlation between age and education in our sample ($r = -0.44$, $p<0.001$), which is quite common in developing economies. The positive relationship between the *Efficacy* component score and the gender of respondent being male, however, bears closer examination.

Table 30. Correlations between predictor variables and resource beliefs component scores.

	Bentenan and Tumbak		*Bentenan*		*Tumbak*	
VARIABLE	VASTNESS	EFFICACY	VASTNESS	EFFICACY	VASTNESS	EFFICACY
EDUCATION	0.380***	0.163*	0.371***	0.170	0.395***	0.160
GENDER MALE	0.096	0.198*	0.110	0.125	0.089	0.287*
AGE2	-0.235**	0.155*	-0.185	0.261*	-0.258*	0.052
PARTICIPATION	0.226**	0.212**	0.268*	0.240*	0.199	0.181
KNOWLEDGE	0.093	0.100	0.139	-0.078	-0.016	0.332**
MEMBERSHIP	0.092	0.214**	0.107	0.336**	0.010	0.032
MPA KNOWLEDGE	-0.107	0.224**	0.088	0.195	0.026	0.272*
INVOLVEMENT	0.085	0.285**	0.134	0.273*	0.095	0.296**
N	160		80		80	

**=P<0.05 **=P<0.01 ***=P<0.001*

When the data from Bentenan and Tumbak are analyzed separately we see that gender male is statistically significantly related to the *Efficacy* component only in Tumbak. An examination of the relationship between gender and involvement in project activities in Tumbak, however, provides an explanation for this finding. The relationship between male gender and the project participation score is 0.45 ($p<0.001$), indicating that females participate less than males. No females belong to project related organizations, and there is a statistically significant positive correlation between the overall project involvement score and male gender ($r=0.42$, $p<0.001$). Clearly, project involvement is an intervening variable between gender and resource beliefs.

Several reasons are suggested to account for this difference between males and females in project participation. First, the Tumbak sample is 100 percent Islamic, and the full participation of women in the type of project activities promulgated by Proyek Pesisir may be culturally inappropriate. Although the majority of the Bentenan sample is Islamic (83 percent), the sample is drawn from coastal dusuns, which abut predominantly or entirely Christian inland dusuns where other role models for female behavior exist. In contrast, Tumbak, surrounded on one side by the sea, the other by mangrove swamp, with only an isolated, unpaved road connecting it to wider Minahasan society is like an island of Islam, offering little in contrasting female role models. Further, although the field extension officer is female, she spends most of her time in Bentenan where she has frequent informal interaction with village women, providing a role model and stimulating their participation in Proyek Pesisir. These types of stimuli are absent in Tumbak where her infrequent interactions are more formal.

The next question concerns the relative importance of the predictor variables in terms of their individual and combined ability to account for variance in the resource beliefs component scores. For example, since years of formal education is statistically significantly correlated with participation ($r = 0.21$, $p < 0.01$) it is important to determine the independent contribution each of these two variables makes to the variance in the

resource beliefs component scores. It is also important to determine their combined contribution to the variance. The same concern holds for all the predictor variables. This can be accomplished with regression analyses, and most efficiently with stepwise regression analyses.

In the application used here, all independent variables (the predictor variables in Table 30) are intercorrelated with the dependent variable (the resource beliefs component scores). The one with the highest correlation (the one that explains the most variance in the resource beliefs component score) is entered first into the multiple regression equation. Then the effects of the entered variable are controlled, and the variable with the highest partial correlation with the resource beliefs component score is entered into the equation. The R^2 (squared multiple correlation coefficient, which is equal to the amount of variance explained in the resource beliefs component score) for the two independent variables and the dependent is then calculated. The next step enters the independent variable that has the highest partial correlation with the resource beliefs component score controlling for variables already entered. This stepwise procedure is continued until some pre-set criterion is reached. In this case the criterion was that the variable to be entered has a $p < 0.05$. Partial correlations were carefully examined at each step to insure that multi-collinearity did not have an effect on the analysis. The results of these analyses for both resource beliefs component scores can be found in Table 31.

Table 31. Multiple predictors of resource beliefs scores in Bentenan and Tumbak.

DEPENDENT VARIABLE: VASTNESS

INDEPENDENT VARIABLE	STANDARDIZED COEFFICIENT	t	p (2 tail)
MPA Knowledge	-0.213	2.823	0.005
Education	0.354	4.849	< 0.001
Participation	0.219	2.851	0.005

$R=0.455$ $R^2=0.207$ Adj. $R^2=0.192$ $F=13.57$ $p<0.001$

DEPENDENT VARIABLE: EFFICACY

INDEPENDENT VARIABLE	STANDARDIZED COEFFICIENT	t	p (2-tail)
Membership	0.166	2.085	0.039
MPA Knowledge	0.180	2.259	0.025

$R=0.275$ $R^2=0.076$ Adj. $R^2=0.064$ $F=6.426$ $p=0.002$

Table 31 indicates that three of the independent variables, MPA knowledge, years of formal education and participation in project activities account for 19 percent of the variance in the vastness component score. It is interesting that knowledge of MPA rules is negatively related to this score. MPA knowledge is positively correlated with participation ($r = 0.33$, $p<0.001$) and its zero-order correlation with the vastness component is negative but not statistically significant (Table 31). The partial correlation with the vastness component increases, however, when the effects of education and project participation are controlled (partial-$r = -0.168$, $p=0.005$).

These results clearly indicate that Proyek Pesisir activities have had a positive influence on resource beliefs among the residents of both Bentenan and Tumbak. The analysis also clearly indicates that degree of project participation by individuals has a positive influence on these beliefs. Gender differences seem to be related to differences in participation in Tumbak. Changes in Bentenan were greater than those in Tumbak, but both changed in a positive direction.

2.5.3 Perceptions of Bomb Fishing

Fishing with the use of explosives is perhaps the most destructive technique used in North Sulawesi. This is recognized by the local fishers, and there are no statistically significant differences between the villages or across time with respect to responses to this question. In 1997-1998 a large majority of the respondents agreed with the statement that bomb fishing hurts the resource (88 percent in Bentenan, 96 percent in Tumbak and 94 percent in each of the control villages). By the year 2000 the percent agreeing with this statement changed little, being over 90 percent in the project and control villages (96 percent in Bentenan, 93 percent in Tumbak and Minanga, and 92 percent in Rumbia).

There are, however, differences in reasons provided to explain why some fishers use explosives. Responses to the open-ended question were coded into the 12 categories seen in Tables 32 and 33. Frequency distribution of responses across the villages and at the two time periods are displayed in these Tables. Focussing only on response categories used by at least 10 percent of the total sample (total > 21 for 1997/98 and total > 27 for 2000), it is relatively obvious that the project sites differed from the controls in 1997/98. During 1997/98 almost half of the respondents from the project sites reported that they did not know why bomb fishers used explosives for fishing in contrast to only 13 percent from the control villages (χ^2=28.65, df = 1, ϕ=0.36, p<0.001). Respondents from the project villages were also more likely to respond that bomb fishing is a quick and easy way to fish (34 versus 19 percent, respectively; χ^2=7.00, df = 1, ϕ=0.18, p<0.05). However, they were less likely than those from the control villages to say that fishers bomb fished because they could catch more (7 versus 26 percent, respectively; χ^2=16.71, df = 1, ϕ=0.27, p<0.01) and profit more because it was an inexpensive way to fish (5 versus 24 percent, respectively; χ^2=16.59, df = 1, ϕ=0.27, p<0.01). There is no statistically significant difference between the project

Table 32. Frequency distribution of reasons why some people bomb fish in project and control villages 1997/98.

	Bentenan	Tumbak	Rumbia	Minanga	Total
Don't know	32	24	4	9	69
Quick/easy	23	19	14	5	61
Catch more	4	4	13	14	35
Habit	3	5	9	5	22
Fun/hobby	4	2	2	0	8
No alternative	2	11	4	3	20
Cheap/more profit	3	3	11	13	30
Not enforced	0	0	0	1	1
Unaware of law/impact	0	0	11	7	18
Bad attitude	1	0	5	5	11
Know how	0	0	5	7	12
N	66	56	52	50	

Note: Rows can sum to more than N because a respondent can provide more than one response.

Table 33. Frequency distribution of reasons why some people bomb fish in project and control villages 2000.

	Bentenan	Tumbak	Rumbia	Minanga	Total
Don't know	18	31	18	20	87
Quick/easy	34	15	9	7	65
Catch more	10	10	8	6	34
Habit	4	16	6	11	37
Fun/hobby	0	1	0	1	2
No alternative	12	4	4	5	25
Cheap/more profit	10	4	14	4	32
Not enforced	1	0	3	2	6
Unaware of law/impact	8	1	2	5	16
Other	0	0	1	0	1
Bad attitude	1	2	1	1	6
Know how	0	2	1	1	4
N	80	80	60	60	

Note: Rows can sum to more than N because a respondent can provide more than one response.

and control villages with regard to the response that bomb fishers fish that way because of habit (7 versus 14 percent respectively, χ^2=3.22, df = 1, ϕ=0.12, p>0.05). Although the response that bomb fishers are not aware of the law or potential harm to the environment was a response provided by only 8 percent of the respondents, all are from the control villages—fully 18 percent of respondents from the control villages gave this response. Likewise, only respondents from the control villages noted that bomb fishers used explosives because they know how.

2.5.4 Project Impacts on Perceptions of Bomb Fishing

Between 1997/98 and 2000, responses from the control villages became more like those from the project villages. "Don't know" responses in the project villages reduced from 46 to 31 percent (χ^2=6.91, df = 1, ϕ=0.16, p<0.05) while in the control villages they increased from 13 to 32 percent (χ^2=11.15, df = 1, ϕ=0.22, p<0.01). Hence, project village residents' knowledge about impacts increased in contrast to the control villages. The only statistically significant difference between the project and controls is that respondents from the project villages are still more likely to maintain that bomb fishers use explosives because it is a quick and easy way to fish (31 versus 13 percent, respectively; χ^2=11.50, df = 1, ϕ=0.20, p<0.01).

2.6 THE PAST, PRESENT AND FUTURE: PROBLEMS & ACCOMPLISHMENTS

2.6.1 Introduction

People behave on the basis of their beliefs. If they perceive problems, they are going to want to do something about them. If the project can solve some of these problems, they will be more likely to support project activities. Likewise, if they feel that their situation is improving, and if they have any idea that project activities may have something to do with the improvements they perceive, project activities will be more likely to be sustained. In other words, perceptions of problems, relative well being, and accomplishments can have an impact on behavior with respect to project activities; hence, tracking these perceptions can help us configure project activities to better fit the needs of the people.

2.6.2 Changes in Well Being

Perceived changes in overall well being are very important. If people feel that they are better off today than in some period in the past, it colors their entire outlook on life. In this section we examine perceived changes in well being over the past five years at two time periods in the project and control sites (Tables 34 and 35).

Table 34. Percent distribution of perceived changes in well-being in project and control sites at time-1.

WELL BEING	CONTROLS	PROJECT	Total	N
WORSE OFF	42.2	15.0	27.5	61
SAME	25.5	20.0	22.5	50
BETTER OFF	32.4	65.0	50.0	111
Total	100.0	100.0	100.0	
N	102	120	222	

χ^2 = 27.289, C = 0.33, p<0.001

Table 35. Percent distribution of perceived changes in well-being in project and control sites at time-2.

WELL-BEING	CONTROL	PROJECT	Total	N
WORSE OFF	13.6	6.9	9.7	27
SAME	28.0	13.2	19.5	54
BETTER OFF	58.5	79.9	70.8	196
Total	100.0	100.0	100.0	
N	118	159	277	

χ^2 = 15.016, C = 0.23, p = 0.001

The project sites were clearly different from the control sites in 1997-1998. More of the respondents in the project sites felt that their well being had improved over the past five years. The same appears to hold true for their responses in 2000 (Table 35). Nevertheless, it appears that the control sites have changed more in a positive direction than the project sites. If we examine the influence of time in the control sites (comparing time-1 and time-2 data for the control sites), the contingency coefficient (C) is 0.32 (χ^2 = 24.86, df = 2, $p < 0.001$) indicating a significant change. For the project sites C is only 0.17 (χ^2 = 8.31, df =- 2, $p = 0.016$), indicating only a slight, although statistically significant change. This, of course, may be due to the fact that the baseline data for the project sites were collected prior to the impacts of the El Nino event of 1997-1998 as well as prior to the Asian economic crisis of late 1997. At this time respondents were bound to feel better off than during the drought and economic crisis.

As a means of examining the impacts of these two events, we also sampled the project sites at the time we collected data in the control sites in 1998. The analysis of this data indicated no statistically significant difference in perceived changes in well being between the project and control sites in 1998 (Table 14 in Pollnac *et al*., 1998). There were, however, drastic negative changes in the project sites between 1997 and 1998 which were attributed to both the drought associated with El Nino and the economic crisis as can be seen in Table 36 (Pollnac *et al*., 1998). If we compare changes in the project and control sites between 1998 and 2000 the project sites have a greater increase in the percentage of respondents reporting that they feel better off. In the project sites the percentage increased from 22 to 80 percent while in the control sites the increase was from 32 to 69 percent—increases of 58 and 37 percent respectively. The distribution (numbers) of those who felt better off in the project and control sites during the two time periods can be found in Table 37.

Table 36. Percent distribution of perceived changes in well-being in project sites in 1997 and 1998.

WELL BEING	1997	1998	Total	N
WORSE OFF	15.0	48.9	24.2	40
SAME	20.0	28.9	22.2	37
BETTER OFF	65.0	22.2	53.3	88
Total	100.0	100.0	100.0	
N	120	45	165	

χ^2 = 27.88, C = 0.38, p<0.001

Table 37. Distribution of respondents who reported feeling better off in project and control sites.

YEAR	PROJECT	CONTROL	N
1998	10	32	42
2000	127	69	196
N	137	101	

χ^2 = 23.79, C = 0.32, p<0.001

Hence, it appears that recovery from the events of 1997-1998 was greater in the project than the control sites. Nevertheless, within the project sites in 2000 we find no difference between participants and non-participants with respect to percentage feeling that they are better off (78 versus 82 percent respectively, $\chi^2 = 0.035$, $p>0.05$). This does not necessarily mean that the project has had no impact—one could infer that project benefits are distributed equably throughout the community. It is important to note that many of the respondents reporting that they are better off today attribute it to seaweed farming, 42 percent in the control and 65 percent in the project sites.

With respect to changes in household well being today as compared to 5 years in the past, respondents were also asked why. In 1998, responses provided by over 10 percent of respondents in either group are: 1) drought, 2) increasing income, 3) inflation, 4) decreases in the number of fish caught, and 5) no change (Pollnac *et al*., 1998). Eighteen

percent of the respondents in the project villages in contrast to only 5 percent in the control villages blamed the change on the drought (Yates corrected $\chi^2 = 4.92$, $\phi = 0.21$, $p<0.03$). Residents of Bentenan and Tumbak were also more likely than those from Rumbia and Minanga to blame negative changes on inflation (62 versus 30 percent respectively; $\chi^2 = 13.17$, $\phi = 0.30$, $p<0.001$) and a decrease in the volume of fish captured (18 versus 3 percent respectively; $\chi^2 = 7.90$, $\phi = 0.26$, $p<0.01$). Twenty percent and 15 percent of the respondents from the project and control villages, respectively, attributed a positive change to increased income ($\chi^2 = 0.64$, $\phi = 0.07$, $p>0.05$) and 4 and 15 percent, respectively, reported no change ($\chi^2 = 3.22$, $\phi = 0.15$, $p>0.05$).

2.6.3 Project Impacts on Perceptions of Well Being

The responses to this question in 2000 were categorized into the 14 categories found in Table 38 along with their frequency distribution across the project and control sites. Focusing only on response categories provided by at least 10 percent of the sample, we find that 40 percent of the respondents in the control sites mention economic reasons for the changes in contrast to only 14 percent in the project sites ($\chi^2 = 23.79$, $\phi = 0.29$, $p<0.001$). Further, residents of the project sites are more likely than those from the control sites to attribute the reported changes to a change in occupation (58 versus 43 percent respectively; $\chi^2 = 6.70$, $\phi = 0.15$, $p<0.01$). Over three-fourths (78%) of those who attribute positive changes to a change in occupation refer to seaweed farming as the occupation. Residents of the project sites are more likely than those from the control sites to attribute the change to seaweed culture (51 versus 26 % respectively, $\chi^2 = 18.40$, $\phi = 0.26$, $p<0.01$). Finally, 15 percent of those from the project sites and 9 percent from the control sites attribute the changes to inflation. This difference is not statistically significant ($\chi^2 = 2.55$, $p> 0.05$).

Table 38. Time-2 (2000) frequency distribution of reasons why for changes in well being over the past five years.

VARIABLE	BENTENAN	TUMBAK	RUMBIA	MINANGA	Total
DON'T KNOW	2	1	2	1	6
INFRASTRUCTURE	5	0	0	0	5
MARKETING	1	0	0	3	4
MATERIAL STYLE OF LIFE	0	0	2	0	2
EQUIPMENT	0	1	1	1	3
INFLATION	10	15	8	3	36
LESS EXPENDITURES	0	0	0	1	1
ECONOMIC	16	7	26	22	71
OCCUPATION	48	45	30	21	144
RESOURCES/ENVIRONMENT	2	6	1	4	13
LAND OWNERSHIP	0	0	2	0	2
OTHER	5	6	4	8	23
HEALTH	0	0	2	3	5
SOCIAL	2	4	1	3	10
TOTAL*	91	85	79	70	325
N	80	80	60	60	280

*Column frequencies total to more than N due to the fact that a respondent can provide more than one response.

Turning to changes in perceptions of future status, respondents were asked if they felt they would be worse off the same or better off five years in the future. Results of the analyses of these data are in Tables 39 and 40. Table 40 indicates that 84 percent of the respondents in the project sites in 2000 felt they would be better off in 5 years in contrast to 73 percent in the control sites. This difference, although small, is statistically

significant ($\chi^2 = 4.53$, $\phi = 0.13$, $p<0.05$).[5] In the project sites 88 percent of those who participated in project activities felt they would be better off five years in the future in contrast to 79 percent of non-participants during the monitoring period in 2000. This difference is not statistically significant ($\chi^2 = 2.23$, $\phi = 0.12$, $p>0.05$).

Table 39. Percent distribution of perceptions of well-being 5 years in the future in project and control sites at time-1.

	CONTROLS	PROJECT	Total	N
WORSE	0.980	0.000	0.446	1
SAME	6.863	1.639	4.018	9
BETTER	17.647	69.672	45.982	103
DON'T KNOW	74.510	28.689	49.554	111
Total	100.000	100.000	100.000	
N	102	122	224	

Table 40. Percent distribution of perceptions of well-being 5 years in the future in project and control sites at time-2.

	CONTROLS	PROJECT	Total	N
Same	1.7	0.0	0.7	2
Better	73.3	83.8	79.3	222
Don't know	25.0	16.3	20.0	56
Total	100.0	100.0	100.0	
N	120	160	280	

The difference between the project and control sites is even greater during the baseline period (Table 39). At that time 69 percent of the project site respondents reported that they would be better off five years in the future in contrast to only 18 percent of those from the control sites. Three quarters of the respondents from the control sites would not even hazard a guess as to their future status. These differences are also statistically significant ($\chi^2 = 60.54$, $\phi = 0.52$, $p<0.001$).[6]

Another technique used to evaluate perceived changes in family well being, as well as community control of resource, influence on community affairs, and amount of resource harvested is a visual, self-anchoring, ladder like scale. This scale allows for making fine ordinal judgements, places less demands on respondent memory, and can be administered rapidly. Using this technique, the respondent is shown a ladder-like diagram with 15 steps. The respondent is told that the first step represents the worst possible situation. For example, with respect to coastal resources, the respondent is informed that the first step indicates an area with no fish or other resources, that the water is so foul nothing could live in it. The highest step is described as rich, clean water, filled with fish and other wildlife. The respondent is asked where on this the local area is today (the self-anchoring aspect of the scale). The respondent is also asked to indicate where it was pre-project (3 years ago) and where he/she believes it will be 3 years in the future. Such scales can be treated as "quasi-metric" permitting the use of parametric statistics with fewer reservations than with Likert scales administered only verbally. This data is analyzed 1) by subtracting the value for 3 years ago from the value for today, and 2) subtracting the value for today from the value for 3 years in the future. This results in figures indicating the degree of change between the time periods (e.g., 3 years ago to today and today to 3 years in the future. Difference in means between the project and control sites are calculated and presented in Table 41.

Table 41 indicates that respondents from the project sites perceived larger positive changes in all four variables over the past three years. In terms of the project sites' projecting changes into the future, the only change that is significantly larger than those projected by the control sites concerns the status of the resource. Perceptions of positive

[5] The Chi-square was calculated for a Table wherein the "same" and "don't know" rows were collapsed into a single row. This was done due to the fact that the cell values in the "same" row were too small to calculate reliable statistics.

[6] Chi Square was calculated based on the sum of the "don't know', "worse" and "same" rows versus the "better" row due to the extremely low frequencies in the former three rows.

changes over the past 3 years in Bentenan and Tumbak are held by project participants as well as non-participants. Project participation, as measured by number of project activities is not statistically correlated with degree of perceived change over the past 3 years. It is, however, statistically significantly correlated with degree of perceived positive future changes in well being of the family ($r = 0.20$, $p = 0.01$), future control over the resource ($r = 0.23$, $p = 0.005$) and future status of the resource ($r = 0.19$, $p = 0.02$). This suggests that while benefits of the project are spread equally throughout the community, it is the degree of participation that influences perceptions of positive changes in the future.

Table 41. Perceived changes in selected variables over time in project and control sites.

	3 YEARS AGO TO TODAY				TODAY TO 3 YEARS IN THE FUTURE			
	PROJECT	CONTROL	T-VALUE	PROB.	PROJECT	CONTROL	T-VALUE	PROB.
FAMILY	1.72	0.86	3.78	<0.001	2.47	1.99	1.86	>0.05
CONTROL	2.83	1.28	4.99	<0.001	2.49	2.18	1.11	>0.05
INFLUENCE	2.80	1.89	2.46	<0.05	2.06	1.99	0.27	>0.05
RESOURCE	0.37	-1.20	4.35	<0.001	2.09	0.69	4.79	<0.001
N*	156-160	116-118			155-160	109-114		

*N varies due to missing data on some variables.

2.6.4 Perceived Problems

Respondents were asked to tell us what they thought were the major problems facing them in both 1997-98 and 2000. During the baseline conducted in Bentenan and Tumbak in 1997 (Pollnac *et al*., 1997a) almost 60 distinct problems were mentioned by the respondents. In the 1997 report the responses were categorized into 21 response categories (see Pollnac *et al*., 1997a) and the first, hence most salient, responses provided by more than 5 percent of the total sample were statistically analyzed. According to the distributions of these responses, Bentenan residents were more likely to mention money (56 versus 21 percent respectively; $\chi^2 = 15.1$, $\phi = 0.35$, $p < 0.005$) and financing dependents (12 versus 4 percent respectively; $\chi^2 = 2.94$, $p > 0.05$) than Tumbak residents. Tumbak residents were more likely to mention lack of or deficient gear (11 versus 5 percent respectively; $\chi^2 = 1.68$, $p > 0.05$), lack of drinking water (32 versus 2 percent respectively; $\chi^2 = 21.6$, $\phi = 0.42$, $p < 0.005$), and low or variable harvest of fish (11 versus 3 percent respectively; $\chi^2 = 1.79$, $p > 0.05$). As can be seen by the Chi-square analyses, only two of these differences are statistically significant: citing of money as a problem by residents of Bentenan and the lack of water for Tumbak residents.

The same question was posed to both project and control village residents in 1998 following the el Nino induced drought of 1997-98 and during the Asian financial crisis of that same period. Responses provided by over 10 percent in either group are: 1) no problems, 2) decreasing catch, 3) providing for child's education, 4) amount of income, 5) inflation, 6) obtaining basic household needs, and 7) obtaining water. Analyses of these data indicated that the residents in the project sites were more likely than those in the control sites to mention decreasing catch as a problem (18 versus 3 percent respectively; Yates corrected $\chi^2 = 7.90$, $\phi = 0.26$, $p < 0.01$), as well as child's education (31 versus 8 percent respectively; $\chi^2 = 13.28$, $\phi = 0.30$, $p < 0.001$), obtaining basic needs (47 versus 25 percent respectively; $\chi^2 = 6.44$, $\phi = 0.21$, $p < 0.02$), and obtaining water (33 versus 1 percent respectively; Yates corrected $\chi^2 = 30.44$, $\phi = 0.48$, $p < 0.001$).

Within project group analysis of this data indicated that problems with obtaining water and decreasing catch were more likely to be mentioned by residents of Tumbak than

Bentenan (χ^2 -Yates corrected and χ^2 = 7.90 and 13.28, df = 1, ϕ = 0.26 and 0.30, p < 0.010 and 0.001 respectively). Additionally, residents of Bentenan were more likely than those of Tumbak to mention problems associated with providing for their children's education (χ^2 -Yates corrected = 6.76, df = 1, ϕ= 0.44, p < 0.01).

2.6.5 Project Impacts on Perceptions of Problems

The same question was once again posed to the project and control village residents in 2000. The frequency distribution of the responses can be found in Table 42. An analysis of response categories, which were mentioned by more than 10 percent of the respondents in any of the four villages indicates that the residents of control sites are no more likely to respond that they have no problems than those in the project sites (51 versus 46 percent respectively; χ^2 = 0.81, p > 0.05). An equal percentage in both the problem and control sites complained about their income (17 percent). Residents of Tumbak, however, are more likely to complain about infrastructural problems than those from the other villages (30 versus 2 percent respectively; χ^2 = 49.78, ϕ = 0.42, p < 0.001) and more likely to mention the resource or the environment as a problem (13 versus 3 percent respectively; χ^2 = 11.27, ϕ = 0.20, p < 0.01). Ninety-six percent of the infrastructure problems mentioned by Tumbak residents were related to the water supply and health care, and 90 percent of the environment issues involved a seaweed disease.

Table 42. Frequency distribution of "problems" mentioned in project and control sites in 2000.

PROBLEM MENTIONED	BENTENAN	TUMBAK	RUMBIA	MINANGA	Total
NONE	42	32	28	34	136
EQUIPMENT	0	2	0	2	4
EMPLOYMENT	0	0	0	1	1
SOCIAL	8	1	5	3	17
INFRASTRUCTURE	2	24	2	0	28
MATERIAL STYLE OF LIFE	0	0	1	0	1
EDUCATION & EDUC.FEES	4	4	2	3	13
INCOME	19	8	12	8	47
HEALTH/HEALTH CARE	1	1	2	2	6
ENVIRONMENT	2	10	1	2	15
WEATHER/CROP DISEASE	0	0	2	0	2
ECONOMIC	1	3	7	0	11
LACK OF NECESSITIES	2	1	3	5	11
MARKETING	0	1	0	0	1
OTHER	1	0	0	1	2
N*	80	80	60	60	

*Rows may sum to more than N due to the fact that a respondent can provide more than one response.

2.7 PARTICIPATION: WHO AND HOW?

2.7.1 Who Participates?

Not everyone in a community participates in project activities. In this section of the report we look at characteristics of participants. There are several aspects of participation that are important. The first is what we will term "active participation", and the second we identify as "involvement," which includes both active participation (if any) and knowledge about the project. Active participation is rather straightforward in its definition. It refers to participation in actual project activities, such as group membership, carrying out project related tasks, such as participating in a beach cleanup, etc. Involvement includes knowledge about the project, knowledge being an indicator of interest, hence a passive type of participation. Of course, involvement also includes active participation, if present; hence, a person could have a degree of involvement with little or no active participation in the project.

2.7.2 Measuring Participation and Involvement

Degree of participation and involvement in Proyek Pesisir activities are measured by several questions included in the survey. We have two measures of participation. First, respondents were requested to indicate project activities in which they participated. The total number of activities is used as an indicator of participation (*Participation*). This is the basic measure of participation. Second, membership in project related organizations is used as another indicator of participation. Number of project organizations joined is the measure (*Membership*). This will form part of the overall measure of involvement. We also have two measures of knowledge, which are used for constructing the measure of involvement. First, respondents were asked what they know about Proyek Pesisir. The number of distinct, correct responses is used as a measure of project knowledge (*Knowledge*). Second, knowledge about rules associated with the marine protected area is used as another measure of project knowledge. Number of MPA rules known is the indicator (*MPA Knowledge*). Both of these knowledge measures will form part of the overall involvement measure. Finally, values for the previous four measures were summed to construct a measure of total project involvement (*Involvement*).

2.7.3 Determining Characteristics of Participants

There is a long history of research that makes it clear that certain socioeconomic characteristics might be related to project participation (see Rogers, 1995). Formal education has long been noted as a variable variously influencing behavior, with the more highly educated more likely to participate in new activities and acquiring new information. It has long been noted that younger people are more likely to become involved in new activities; hence, we would expect that project participation would be negatively correlated with age. The division of labor by gender in many societies impacts participation as well. For example, in societies where women's work is strictly defined and limited, if the project activities fall outside these limits, female participation may be minimal or absent. Finally, differential levels of wealth may influence participation. The very poor might not have the time or energy to devote to project activities. The risk involved with change may also seem too great for those at the margins of existence. Conversely, the more wealthy may have more free time to devote to project activities and their relative wealth may provide them with more latitude for risking some of their income if project activities have a somewhat negative, rather than positive impact. Formal education, age and gender are measured by direct questions in the interview form. Relative wealth is measured with the material style of life scales (MSL scales) which are discussed above.

As a means of determining characteristics of participants, years of formal education, age, gender, and material style of life are intercorrelated with the participation and involvement measures. Village is also included to determine if there are differences between villages. Village is a dummy variable with Tumbak as the village either present or absent. The results of this analysis can be found in Table 43. Table 43 indicates that education, male gender, and the house and furnishings component of the MSL measures are statistically significantly related to participation in project activities. More variables are statistically significantly related to the total involvement measure: education, male gender, age, the house and furnishings component of MSL, and the total MSL measure.

The next question concerns the relative importance of the predictor variables in terms of their individual and combined ability to account for variance in the project participation measures. For example, since years of formal education is statistically significantly correlated with age ($r = -0.435$, $p < 0.001$) it is important to determine the independent contribution each of these two variables makes to the variance in the project participation measures. It is also important to determine their combined contribution to the variance. The same concern holds for all the predictor variables. This can be accomplished with regression analyses, and most efficiently with stepwise regression analyses. Stepwise regression is applied using the technique described with regard to Table 31 above. The results of these analyses for both project participation measures can be found in Table 44.

Table 43. Correlations between socioeconomic variables and participation in project activities.

	PARTICIPATION	INVOLVEMENT
VILLAGE	0.000	0.129
EDUCATION	0.214**	0.225**
GENDER MALE	0.335***	0.327***
AGE	0.120	0.168*
RELIGION	0.090	-0.063
HOUSE & FURNISHINGS	0.182*	0.250**
APPLIANCES	0.002	-0.020
STRUCTURE	0.133	0.133
TOTAL MSL	0.153	0.168*

***=p<0.001 **=p<0.01 *=p<0.05
N=160 (N=156 for all MSL scales)

Table 44 indicates that the four independent variables (years of formal education, gender male, age and the house & furnishings MSL component) account for over one-fifth of the variance in project involvement. Likewise, years of formal education, education and the house & furnishings MSL component account for a little over one-sixth the variance in the participation measure. Both of these multiple correlations, as well as the beta coefficients associated with each of the independent variables, are statistically significant. This means that the variables independently contribute significantly to the variance in project participation as measured here. All the relationships are positive (e.g., as the value on the independent variable increases, or is present as in the case of a dummy variable like male gender, the degree of participation or involvement increases). The direction of the correlations is as predicted in the introduction to this analysis except for age. We expected that age would be negatively correlated with participation. This assumption is based on long established behavioral science theory which has found that younger people are more likely to be innovative than older (cf. Rogers and Shoemaker, 1971). There is no statistically significant relationship between age and the participation measure (*Participation*); thus the significant positive correlation must be the result of the correlation between age and one of the constituents of the total involvement measure. The correlations between age and the two Proyek Pesisir knowledge variables *Knowledge* (r=0.041, p>0.05) and *MPA Knowledge* (r=0.121, p>0.05) are not statistically significant. Age's correlation with membership in project related organizations (*Membership*), however, is statistically significant (r=0.171,

Table 44. Multiple predictors of project participation measures in Bentenan and Tumbak.

DEPENDENT VARIABLE: INVOLVEMENT

INDEPENDENT VARIABLE	STANDARDIZED COEFFICIENT	t	p (2-tail)
Education	0.310	3.771	<0.001
Gender male	0.260	3.534	0.001
age	0.204	2.440	0.016
House & furnishings	0.183	2.485	0.014

R=0.492 R^2=0.242 Adj. R^2=0.222 F=12.078 p<0.001 N=156

DEPENDENT VARIABLE: PARTICPATION

INDEPENDENT VARIABLE	STANDARDIZED COEFFICIENT	t	p (2-tail)
Education	0.179	2.418	0.017
Gender male	0.330	4.482	<0.001
House & furnishings	0.163	2.210	0.029

R=0.430 R^2=0.185 Adj. R^2=0.169 F=11.512 p<0.001 N=156

p=0.03). Further, it is interesting that when we examine the relationship between age and the various project participation and knowledge variables in the two project communities separately, we find statistically significant correlations only in Bentenan. In Bentenan, age is positively correlated with *Participation* ($r=0.304$, $p<0.01$), *Membership* ($r=0.286$, $p=0.01$), and *Involvement* ($r=0.252$, $p<0.05$). We have no explanations for these relationships between age and project participation at this time.

The only relationship for which no direction was predicted is gender, which contributes most to the variance in both measures of participation. We thought, perhaps, that the prevalence of Islam in the coastal areas of Bentenan and Tumbak would have some influence on participation of women in the project. In Bentenan 82.5 percent of the sample and in Tumbak fully 100 percent of the sample are Islamic. In most Islamic societies adult females tend to avoid interaction with males outside their family and tend to have strictly defined roles, including allowable activities. Most of these rules are somewhat relaxed in Indonesia, but this can vary considerably from community to community. In Bentenan and Tumbak the rules are less strictly observed, and some Islamic women's clothing and styles of public interaction differ little from the local Christians. For example, although their participation is minimal, some females fish (with kinsmen) from boats in both Bentenan and Tumbak.

Tumbak, however, is more strictly Islamic than Bentenan. Although the majority of the Bentenan sample is Islamic (82.5 percent), the sample is drawn from coastal sub-villages, which abut predominantly or entirely Christian inland sub-villages where other role models for female behavior exist. In contrast, Tumbak, surrounded on one side by the sea, the other by mangrove swamp, with only an isolated, unpaved road connecting it to wider Minahasan society is like an island of Islam, offering little in contrasting female role models. Further, although the field extension officer for Bentenan and Tumbak is female, she spends most of her time in Bentenan where she has frequent informal interaction with village women, providing a role model and stimulating their participation in Proyek Pesisir. These types of stimuli are absent in Tumbak where her infrequent interactions are more formal. Additionally, the village assistant in Bentenan is female in contrast to the male assistant in Tumbak adding to the female role models in the former village. Hence, if Islamic practices influence behaviors impacting on project participation, we would predict stronger positive relationships between male gender and the project participation variables in Tumbak.

These assumptions are supported by the data. In Tumbak the correlations between male gender and the project participation and involvement measures are 0.449 and 0.419 respectively ($p<0.001$), while in Bentenan they are 0.222 and 0.245 ($p<0.05$). Hence, Islam, gender of village assistants and the extension officer, and/or some other unexplored cultural variables, appear to have influenced the participation of females in project activities.

2.7.4 How do They Participate?

Above we examined who participates in the Proyek Pesisir activities. In this subsection we look at how they participate—what activities community members know about and/or participate in. Here we will also examine the relationship between individual socio-economic and cultural characteristics and specific aspects of project participation and knowledge.

The analysis above indicates that gender is one of the primary predictors of project participation. Table 45 cross-tabulates gender with participation in specific project activities. The Table can also be used as an indicator of the extent of participation in the various activities. For example, a larger proportion of the sample (23 percent) participated in mangrove planting and training than any other activity. In practically all activities with a total frequency greater than one or two, males outnumber females in terms of participation. The only exceptions are beach cleanup and cooking for project activities. In the three cases where the percentage of participation is great enough to not stretch the credibility of a statistical test (more than five percent participation), the differences between male and female participation are statistically significant. For example, 25 percent of the males in the sample report participating in the crown of thorns starfish (COT) cleanup in contrast to only 8 percent of the females ($\chi^2 = 9.00$, $\phi = 0.32$, $p < 0.05$). With regard to mangrove replanting and training, 31 percent of the males and only 14 percent of the females report participation ($\chi^2 = 7.03$, $\phi = 0.21$, $p < 0.05$). Finally, 11 percent of the males in contrast to only one percent of the females report participating in marine protected area (MPA) activities (Yates corrected $\chi^2 = 5.23$, $\phi = 0.21$, $p < 0.05$).

Table 45. Gender cross-tabulated with participation in project activities.

ACTIVITY	FEMALES	MALES	Total
COOKING	5	0	5
COT CLEAN-UP	6	20	26
WATER SUPPLY	1	3	4
MCK	0	2	2
FORGOT	1	0	1
FIELD SURVEY	0	1	1
MEETING	2	6	8
ICM TRAINING	0	5	5
MANGROVE	11	25	36
FLOOD CONTROL	1	4	5
SEAWEED	1	1	2
BEACH PROFILE	2	4	6
INFORMATION CENTER	2	3	5
EXTENSION	0	2	2
BEACH CLEANUP	3	1	4
EROSION MEETING	1	0	1
WELCOME GUESTS	1	0	1
CROSS-VISIT	1	2	3
FISHERIES TRAINING	0	1	1
CRAB FATTENING	0	2	2
BOAT ENGINE	0	2	2
MPA	1	9	10
REEF MONITORING	0	1	1
MANAGEMENT PLAN	0	1	1
N	80	80	160

Note: Column sums may be greater than "N" since an individual may participate in more than one activity.

According to the analysis presented above, education is another variable related to participation in project activities. Education, dichotomized at the sample mean (mean = 6.6 years, median = 6.0 years; more than 6 equals "high", and 6 or less equals "low") is cross-tabulated with participation in specific project activities in Table 46. Although there are statistically significant relationships between education as a continuous variable and number of project activities participated in, the two levels analyzed in Table 46 show little difference with respect to participation in specific activities.[7] The chi-squares calculated for COT cleanup, mangrove planting and training, and involvement in MPA activities are all statistically non-significant ($\chi^2 = 0.001$, 0.062, and 0.002 respectively, all $p>0.05$).

Age is another variable statistically significantly related to involvement in project activities (Tables 43 and 44 above). Age is dichotomized at the sample mean (mean = 38.4, those 38 and less are classified as young, and those 39 and above, as old) and cross-tabulated with participation in specific project activities in Table 47. There are some

[7] Note that there are 105 individuals with 6 or fewer years of education and 55 with more than 6. Hence, examination of frequencies can be misleading. For example, 16 percent (17 out of 105) of those with six or less years of education participated in the COT cleanup, and an equal percentage (9 out of 55 or 16%) of those with more than 6 years participated.

clear differences in terms of participation in specific activities in Table 47. As would be expected, older individuals are less likely to participate in the COT cleanup, which involved underwater activity, including some diving (1 versus 18 percent respectively; $\chi^2 = 11.33$, $\phi = 0.27$, p=0.05). Likewise, attendance at meetings, which requires little of the physical activity enjoyed by younger individuals is more likely to involve the older portion of the population (1 versus 10 percent respectively, Yates corrected $\chi^2 = 5.17$, $\phi = 0.18$, $p < 0.05$).

Table 46. Frequency distribution of education cross-tabulated with participation in project activities.

ACTIVITY	LOW EDUC	HI EDUC	Total
COOKING	4	1	5
COT CLEAN-UP	17	9	26
WATER SUPPLY	1	3	4
MCK	0	2	2
FORGOT	1	0	1
FIELD SURVEY	0	1	1
MEETING	7	1	8
ICM TRAINING	1	4	5
MANGROVE	23	13	36
FLOOD CONTROL	1	4	5
SEAWEED	1	1	2
BEACH PROFILE	2	4	6
INFORMATION CENTER	3	2	5
EXTENSION	1	1	2
BEACH CLEANUP	1	3	4
EROSION MEETING	1	0	1
WELCOME GUESTS	1	0	1
CROSS-VISIT	0	3	3
FISHERIES TRAINING	0	1	1
CRAB FATTENING	2	0	2
BOAT ENGINE	2	0	2
MPA	6	4	10
REEF MONITORING	0	1	1
MANAGEMENT PLAN	0	1	1
N	105	55	160

Note: Column sums may be greater than "N" since an individual may participate in more than one activity.

Finally we look at the relationship between material style of life and participation in specific project activities. The house and furnishings component is indicated as being significantly related to degree of participation and involvement in project activities in Tables 43 and 44 above. The component scores for this component are dichotomized at the sample mean (mean = 0.273, those above the mean are classified as high MSL and those at or below, as low MSL) and cross-tabulated with participation in specific project activities in Table 48.

Table 47. Frequency distribution of age cross-tabulated with participation in project activities.

ACTIVITY	YOUNG	OLD	Total
COOKING	2	3	5
COT CLEAN-UP	17	1	26
WATER SUPPLY	1	3	4
MCK	1	1	2
FORGOT	0	1	1
FIELD SURVEY	1	0	1
MEETING	1	7	8
ICM TRAINING	2	3	5
MANGROVE	17	19	36
FLOOD CONTROL	1	4	5
SEAWEED	1	1	2
BEACH PROFILE	4	2	6
INFORMATION CENTER	0	5	5
EXTENSION	0	2	2
BEACH CLEANUP	4	0	4
EROSION MEETING	0	1	1
WELCOME GUESTS	1	0	1
CROSS-VISIT	2	1	3
FISHERIES TRAINING	1	0	1
CRAB FATTENING	0	2	2
BOAT ENGINE	1	1	2
MPA	5	5	10
REEF MONITORING	1	0	1
MANAGEMENT PLAN	0	1	1
N	92	68	160

Note: Column sums may be greater than "N" since an individual may participate in more than one activity.

The sample size is smaller in Table 48 due to the fact that material style of life information was missing for 4 individuals. Additionally, the dichotomy at the sample mean for the house and furnishings component of MSL resulted in more than twice the number of individuals at the high end; hence, care must be taken when examining the tabular entries, which are frequencies, not percent. As we found for education, there appears to be little relationship between the house and furnishings component of MSL and project participation in specific activities. None of the observed

differences in participation in COT cleanup, mangrove planting and training, or MPA activities are statistically significant (χ^2 = 0.28, 1.07 and 0.89 respectively, p > 0.05).

Membership in project related organizations is one of the components of the project involvement scale analyzed above (Tables 43 and 44). Here we analyze this variable as a specific aspect of project participation. We examine membership in terms of both number of organizations and as a dichotomy. We also look at the specific types of organizations joined. Overall, 19 percent of the sample reported membership in a project related organization. Table 49 examines correlations between organization membership and other socioeconomic variables. There are two types of organization membership variables. We refer to these as "membership" and "member". Membership is a continuous variable, the total number of organizations one belongs to, and member is a simple dichotomy—one is either a member or not, with no reference to total number. This was done because only 19 percent of the sample are members of project related organizations, resulting in a highly skewed distribution, which makes the Pearson's correlation coefficient and associated probabilities suspect when using the continuously distributed variables. Hence the variables were dichotomized, and Phi-correlation coefficients calculated. The Chi-square distribution is used as the test of significance for the Phi coefficient. The Phi-correlations between project organization membership and all 5 socioeconomic variables are statistically significant. Education is the only Pearson's r not statistically significant. Basically, these results indicate that being older, being male, having a high total MSL score, having a higher level of education, and living in Bentenan (village is a dummy variable with Tumbak as the indicator) are all factors influencing membership in project related organizations.

Table 48. Frequency distribution of house and appliances MSL component cross-tabulated with participation in project activities.

ACTIVITY	LOW MSL	HIGH MSL	Total
COOKING	2	2	4
COT CLEAN-UP	6	17	23
WATER SUPPLY	0	4	4
MCK	0	2	2
FORGOT	0	1	1
FIELD SURVEY	0	1	1
MEETING	2	6	8
ICM TRAINING	2	3	5
MANGROVE	8	26	34
FLOOD CONTROL	0	5	5
SEAWEED	0	2	2
BEACH PROFILE	2	4	6
INFORMATION CENTER	0	5	5
EXTENSION	1	1	2
BEACH CLEANUP	1	3	4
EROSION MEETING	0	1	1
CROSS-VISIT	1	2	3
FISHERIES TRAINING	0	1	1
CRAB FATTENING	0	2	2
BOAT ENGINE	0	2	2
MPA	1	8	9
REEF MONITORING	0	1	1
MANAGEMENT PLAN	0	1	1
N	48	108	156

Note: Column sums may be greater than "N" since an individual may participate in more than one activity.

Table 49. Correlations between project organization membership and independent variables.

	Pearson r	Phi
VARIABLE	MEMBERSHIP	MEMBER
VILLAGE	-0.166*	-0.19*
EDUCATION	0.144	0.16*
GENDER MALE	0.294**	0.32***
AGE	0.171*	0.20*
TOTAL MSL	0.185*	0.21**

***=p<0.001 **=p<0.01 *=p<0.05

Note: Variables not natural dichotomies are dichotomized at sample means for calculating Phi coefficient.

Once again, gender is the strongest predictor of an aspect of project participation. Only 6 percent of females, in contrast to 31 percent of males belong to project related organizations. And once again differences are greatest in Tumbak where 23 percent of the males and no females belong to project related organizations (χ^2 = 10.14, ϕ = 0.36, p

= 0.001). In Bentenan, 13 percent of the females and 40 percent of the males belong to project related organizations. The difference between male and female participation in Bentenan is also statistically significant ($\chi^2 = 7.81$, $\phi = 0.31$, $p = 0.005$), but it is not as great as in Tumbak.

The next question involves degree of involvement in different types of organizations. Organization type is cross-tabulated with village in Table 50. This Table indicates that in the sample, the greatest degree of participation is in the core group, environmental management, mangrove replanting, and boat engine groups.

Table 50. Type of organization cross-tabulated with village.

Group Type	Bentenan	Tumbak	Total
None	59	71	130
Core group	9	1	10
Management committee	2	0	2
MPA management	3	1	4
Env Management	7	1	8
Mangrove replanting	3	5	8
Crab raising	0	2	2
Boat engine	3	3	6
Information Center	2	0	2
Dike construction	1	0	1
Beach profiling	1	0	1
N	80	80	160

Note: Column sums may be greater than "N" since an individual may participate in more than one activity.

2.7.5 What do They Know about the Project?

The first question we can pose is "how much do they know"? To answer this question we constructed several measures of knowledge. We have two questions asked as part of the survey, which are applicable. First, respondents were asked what they know about Proyek Pesisir. The number of distinct, correct responses is used as a measure of project knowledge (*Knowledge*). Second, respondents were queried about rules associated with the marine protected area. Number of MPA rules known is the indicator (*MPA Knowledge*). Both of these knowledge measures were summed to develop a composite measure (*Total Knowledge*). Finally respondents were asked if they participated in and/or knew about meetings concerning the Bentenan/Tumbak coastal management plan. They were also asked if they were aware that the plan had been approved. Responses to these two questions were summed to form a indicator of *Plan Knowledge*.

It is hypothesized that the knowledge indicators will be correlated with the same socioeconomic indicators we examined in terms of their relationships to project participation and involvement (village, gender, age, education, and the MSL measures). We further hypothesize that the project knowledge indicators are related to participation. This seems to be obvious, but there have been paper projects wherein the measure of participation was the number of people who "signed-up" but were never really involved. Participation measures are the same as those discussed above. First, respondents were requested to indicate project activities in which they participated. The total number of activities is used as an indicator of participation (*Participation*). This is the basic measure of participation. Second, membership in project related organizations is used as another indicator of participation. Number of project organizations joined is the measure (*Membership*). Correlations between these variables and project knowledge are in Table 51.

Table 51 indicates that many of the same variables we find related to project participation are related to project knowledge (cf. Table 43). There are some differences in magnitude, however. For example, while gender is one of the strongest predictors of participation, it is only statistically significantly correlated with two of the knowledge measures, and the correlations are rather weak. Gender has no impact on either MPA or Plan Knowledge.

Correlations with education are also somewhat weaker, and the correlation with village has increased a great deal, except for Plan Knowledge.

Table 51. Correlations between socioeconomic variables and project knowledge.

	KNOWLEDGE	MPA KNOWLEDGE	PLAN KNOWLEDGE	TOTAL KNOWLEDGE
VILLAGE	-0.211**	0.438***	0.003	0.298***
EDUCATION	0.198*	0.097	0.130	0.166*
GENDER MALE	0.042	0.192*	0.123	0.185*
AGE	0.041	0.121	0.095	0.123
HOUSE & FURN.	0.203*	0.159*	0.054	0.226**
APPLIANCES	0.009	-0.093	-0.041	-0.077
STRUCTURE	0.116	0.029	0.038	0.075
TOTAL MSL	0.158*	0.024	0.018	0.088
PARTICIPATION	0.248**	0.326***	0.365***	0.387***
MEMBERSHIP	0.170*	0.265**	0.270**	0.302***

***=p<0.001 **=p<0.01 *=p<0.05
N=160 (N=156 for all MSL scales)

The correlation with gender probably decreased as a consequence of the differences between active and passive participation. Active participation, actually becoming involved in activities and joining groups, is probably culturally discouraged for females as discussed above. These cultural factors, however, do not inhibit passive participation—learning about Proyek Pesisir, its activities and purposes. The positive correlation between village and MPA knowledge is clearly related to the fact that Tumbak, in contrast to Bentenan, has established an MPA. Bentenan has not yet made this important step. Other statistically significant relationships support hypotheses discussed above (e.g., socioeconomic predictors of participation as well as the relationship proposed between participation and knowledge).

The next question concerns the relative importance of the predictor variables in terms of their individual and combined ability to account for variance in the project knowledge measures. For example, since gender is statistically significantly correlated with participation ($r = -0.335$, $p < 0.001$) it is important to determine the independent contribution each of these two variables makes to the variance in the project knowledge measures. It is also important to determine their combined contribution to the variance. The same concern holds for all the predictor variables. This can be accomplished with regression analyses, and most efficiently with stepwise regression analyses as discussed above. The result of the stepwise regression analyses, using only variables statistically significantly correlated with the knowledge measures, can be found in Table 52.

Table 52. Multiple predictors of project knowledge measures in Bentenan and Tumbak.

DEPENDENT VARIABLE: PROJECT KNOWLEDGE

INDEPENDENT VARIABLE	STANDARDIZED COEFFICIENT	t	p (2-tail)
Village	-0.208	2.749	0.007
House & furnishings	0.169	2.200	0.029
Project participation	0.222	2.886	0.004

R=0.365 R^2=0.133 Adj. R^2=0.116 F=7.802 p<0.001 N=156

DEPENDENT VARIABLE: MPA KNOWLEDGE

INDEPENDENT VARIABLE	STANDARDIZED COEFFICIENT	t	p (2-tail)
Village	0.477	7.148	<0.001
Project participation	0.194	2.436	0.016
membership	0.235	2.915	0.004

R=0.578 R^2=0.334 Adj. R^2=0.321 F=26.089 p<0.001 N=160

DEPENDENT VARIABLE: TOTAL KNOWLEDGE

INDEPENDENT VARIABLE	STANDARDIZED COEFFICIENT	t	p (2-tail)
Village	0.324	4.666	<0.001
House & furnishings	0.152	2.159	0.032
Project participation	0.347	4.922	<0.001

R=0.518 R^2=0.268 Adj. R^2=0.254 F=18.582 p<0.001 N=156

The results of the regression analyses in Table 52 clearly indicate the primacy of village, project participation, and MSL as determinants of project knowledge. Only one variable (project participation) was entered into the equation for Plan Knowledge (R=0.365, R^2=0.133, Adj. R^2=0.127, F=24.078, p<0.001, N=159); hence, the results were not formed into a separate sub-Table for Table 52. The existence of the MPA in Tumbak clearly influences knowledge about MPA rules, which also influences the total knowledge score. The negative relationship between residing in Tumbak and general knowledge about Proyek Pesisir, however, is difficult to understand. It might be due to the fact that the extension officer is a Christian female who spent less time in Tumbak than in Bentenan. The relatively large contribution project participation makes to project knowledge is expected in a real project like *Proyek Pesisir*, as opposed to a "paper project"; hence, underscoring the reality of the project. Finally, the positive relationship between MSL and knowledge is probably related to the proposition that the poor have less time and/or energy to devote to participating in and learning about project activities.

What, specifically, do community members know about the project? Responses to this open-ended question were coded into the 7 categories listed in Table 53 and cross-tabulated with village (see Table 53). Only 9 percent of the Bentenan sample reported they knew nothing about Proyek Pesisir in contrast to 21 percent from Tumbak ($\chi^2 = 4.90$, $\phi = 0.18$, $p < 0.05$).

Table 53. Frequency distribution of knowledge about aspects of Proyek Pesisir cross-tabulated with village.

KNOW ABOUT PROYEK PESISIR	BENTENAN	TUMBAK	Total
DON'T KNOW	7	17	24
COMMUNITY DEVELOPMENT	14	6	20
MARINE/ENVIRONMENTAL PROTECTION	33	36	69
PHYSICAL WORKS/PROJECTS	11	1	12
ENVIRONMENTAL SURVEYS/MONITORING	12	13	25
RESOURCE/LIVELIHOOD DEVELOPMENT	3	4	7
COASTAL RESOURCES MANAGEMENT	19	8	27
MARINE PROTECTED AREA	0	4	4
N	80	80	160

Note: Column sums may be greater than "N" since an individual may know about more than one activity.

Most (43 percent) respond that the project is involved with environmental activities, especially marine environmental protection. There is little difference between the two communities with regard to this response. Seventeen percent of the respondents say that Proyek Pesisir is a coastal resource management project. Twenty-four percent of Bentenan respondents provide this reply in contrast to 10 percent of those from Tumbak ($\chi^2 = 5.39$, $\phi = 0.18$, $p < 0.05$). Thirteen percent feel that the project helps with community development or strengthening (18 percent in Bentenan and 8 percent in Tumbak, $\chi^2 = 3.66$, $\phi = 0.15$, $p < 0.10$). Finally, more Bentenan residents than those from Tumbak reply that the project involves physical works or projects such as dike building and water systems (14 versus 1 percent respectively; Yates corrected $\chi^2 = 7.29$, $\phi = 0.21$, $p < 0.05$).

Finally, respondents from both communities were requested to report what they know about the rules associated with the marine protected area in Tumbak. As noted above (Table 53) residents of Tumbak know more rules than those from Bentenan since the MPA is situated in the sea adjacent to Tumbak. MPA rule types known are cross-tabulated with village in Table 54. Sixty-four percent of the respondents from Bentenan were unable to identify any MPA rules in contrast to only 14 percent from Tumbak ($\chi^2 = 42.13$, $\phi = 0.21$, $p < 0.001$). The only rule known by approximately equal percentages of both Tumbak and Bentenan residents is that no extractive activities are allowed in the

MPA (31 and 29 percent respectively; $\chi^2 = 0.12$, $p > 0.05$). Overall, the high level of knowledge regarding MPA rules in Tumbak indicates that any non-compliance will probably not be due to a lack of understanding of the rules; hence, the socialization process within the community has been adequately carried-out.

Table 54. Frequency distribution of knowledge of MPA rules cross-tabulated with village

	BENTENAN	TUMBAK	Total
DON'T KNOW	51	11	62
NO FISHING	4	43	47
NO EXTRACTIVE ACTIVITIES	23	25	48
NO DESTRUCTIVE ACTIVITIES	28	61	89
NO SEAWEED FARMING	1	2	3
NO PASSING THROUGH	1	16	17
NO THROWING GARBAGE	1	0	1
N	80	80	160

Note: Column sums may be greater than "N" since an individual may know more than one rule.

3.0 SUMMARY AND CONCLUSIONS

3.1 INVOLVEMENT IN AND KNOWLEDGE ABOUT PROJECT ACTIVITIES

The analysis clearly indicates differential involvement in and knowledge about project activities. This is to be expected. There is a long history of research that makes it clear that certain socioeconomic characteristics might be related to innovative behavior such as project participation (e.g., Rogers 1995). Formal education has long been noted as a variable variously influencing such behavior, with the more highly educated more likely to participate in new activities and acquiring new information. Although research results have been inconclusive, it has been suggested that younger people are more likely to become involved in new activities; hence, we would expect that project participation would be negatively correlated with age. The division of labor by gender in many societies impacts participation as well. For example, in societies where women's work is strictly defined and limited, if the project activities fall outside these limits, female participation may be minimal or absent. Finally, differential levels of wealth may influence participation. The very poor might not have the time or energy to devote to project activities. The risk involved with change may also seem too great for those at the margins of existence. Conversely, the more wealthy may have more free time to devote to project activities and their relative wealth may provide them with more latitude for risking some of their income if project activities have a somewhat negative, rather than positive impact. Hence, differential perception in the early stages of project implementation is to be expected and should not be viewed negatively. As participants demonstrate the benefits of participation, and as the resources improve, others will learn from their example, see less risk and join in the activities. Almost a century of innovation research indicates that participation is usually low in the beginning. If the activities have demonstrable impacts and are appropriate for the levels of education and incomes of the people, participation will then increase exponentially, manifesting the famous "S" curve of the diffusion of innovations (Rogers 1995; Hamblin *et al*., 1973; Tarde, 1903).

3.2 PARTICIPATION AND INVOLVEMENT

The analyses presented indicate that years of formal education, male gender, age and the house & furnishings MSL component account for a significant proportion of the variance in project involvement. Likewise, years of formal education, education and the house & furnishings MSL component are related to variance in the participation measure. Further, the statistical analyses clearly demonstrate that these variables independently contribute significantly to the variance in project involvement and participation as measured here. Additionally, an examination of factors related to project organization membership, an important aspect of project involvement, indicates that being older, being male, having a high total MSL score, having a higher level of education, and living in Bentenan are all factors influencing membership. Gender is the strongest predictor of membership. Only 6 percent of females, in contrast to 31 percent of males belong to project related organizations. Differences are greatest in Tumbak where 23 percent of the males and no females belong to project related organizations. In Bentenan, 13 percent of the females and 40 percent of the males belong to project related organizations.

All the relationships, except for age are in accordance with our expectations concerning factors related to project participation. We expected that age would be negatively correlated with project involvement. This was based on the assumption that younger people are more likely to be innovative than older, an assumption that has not always been supported in the innovation literature (Rogers, 1995). Our findings contribute to these mixed findings in the literature. In the overall analysis, there is no statistically significant relationship between age and the general participation measure; thus, the significant positive correlation with involvement might be the result of the significant correlation between age and membership in project related organizations. Further, it is interesting that when we examine the relationship between age and the various project participation and knowledge variables in the two project communities separately, we find statistically significant correlations only in Bentenan. We have no explanations for these relationships between age and project participation at this time.

The only relationship for which no direction was predicted is gender, which contributes most to the variance in both measures of participation. We thought, perhaps, that the prevalence of Islam in the coastal areas of Bentenan and Tumbak would have some influence on participation of women in the project. In Bentenan 82.5 percent of the sample and in Tumbak fully 100 percent of the sample are Islamic. In most Islamic societies adult females tend to avoid interaction with males outside their family and tend to have strictly defined roles, including allowable activities. These assumptions are supported by the data. In Tumbak the correlations between male gender and the project participation and involvement measures are 0.449 and 0.419 respectively ($p<0.001$), while in Bentenan they are 0.222 and 0.245 ($p<0.05$). The fact that the correlations are weaker in Bentenan might be related to the smaller percentage of Islamic households, or it might be related to the fact that the female extension officer, who is a Christian, spent little time in Tumbak, reducing her potential influence as a positive role model. Also, the village assistant in Tumbak is a male in contrast to Bentenan where there is a female assistant, providing an additional role model for the women in Bentenan. Exchange of information occurs most frequently and effectively between individuals who are similar (Rogers,1995), suggesting that characteristics of the extension officer may have impeded the frequency and effectiveness of her interactions in Tumbak. Hence, Islam, location of the female extension officer, the gender of the village assistants, and/or some other unexplored cultural variables, appear to have influenced the participation of females in project activities.

One means of addressing the low level of female participation in Tumbak could involve assigning a Islamic female extension officer and field assistant to the village. Nevertheless, while this may increase female participation, it may have a negative impact on participation by males in this Islamic community. Perhaps a mixture of both genders, but with an extension officer who spends more time in the community would be appropriate. Remember, however, that while female participation was less in Tumbak than Bentenan, it was significantly lower than male participation in both villages. This may be a consequence of the fact that females in rural areas in developing economies have very little free time. In both villages women spend considerable time obtaining water. This is especially true in Tumbak where they must travel by boat to the river to obtain fresh water. Washing clothes by hand, food preparation, and child care also take considerable time and effort without modern conveniences such as water piped to the home, washing machines and modern electric or gas ranges. The relative absence of men

in fishing communities, while they are at sea, adds to this already significant workload of the woman (Pollnac 1988, 1984). Pollnac (1984) conducted a cross-cultural comparative analysis of the division of labor by gender in 186 societies. This study reports that a number of activities which are classified as mixed male and female activities for the sample as a whole are more likely to be performed predominantly or exclusively by females in societies with a moderate or high emphasis on fishing. Hence, the workload of women in rural, fishing communities in developing economies may be another factor that inhibits their participation in project activities.

3.3 KNOWLEDGE ABOUT PROJECT ACTIVITIES

Turning to knowledge about project activities, level of participation, membership in project organizations, and village of residence are the strongest predictors. Education, male gender, and the house & furnishings MSL score are statistically significantly, but only weakly correlated with knowledge about project activities. This contrasts with participation and involvement, where male gender is among the strongest predictors. The correlation with gender probably decreased as a consequence of the differences between active and passive participation. Active participation, actually becoming involved in activities and joining groups, is probably culturally discouraged as well as temporally more difficult for females as discussed above. These cultural and workload factors, however, do not inhibit passive participation—learning about Proyek Pesisir, its activities and purposes. The results of the regression analyses clearly indicate the primacy of village, project participation, and MSL as determinants of project knowledge. The existence of the MPA in Tumbak clearly influences knowledge about MPA rules, which also influences the total knowledge score. The negative relationship between residing in Tumbak and general knowledge about Proyek Pesisir, however, is difficult to understand. The relatively large contribution project participation makes to project knowledge is expected in a real, as opposed to a "paper project". Finally, the positive relationship between MSL and knowledge is probably related to the proposition that the poor have less time and/or energy to devote to participating in and learning about project activities.

3.4 MACRO-EVENT INDUCED CHANGES

Changes occurred in the villages of Bentenan and Tumbak since implementation of Projek Pesisir. Some were due to macro climatic (el Nino) and macro economic (the Asian economic crisis) events. Some can be attributed to Proyek Pesisir. Fortunately, baseline and monitoring data were collected at nearby villages, which can serve as controls to separate out the effects of these macro events. A change in occupational structure, which is probably related to the el Nino induced drought, is a decrease in households involved in farming and an increase in those involved in a diverse group of "other" occupations in the coastal sub-villages of the project sites and Minanga. Only Rumbia manifested little change in households involved in farming.

Overall the greatest change in occupational structure, however, is probably related to the Asian economic crisis which makes seaweed from Indonesia extremely competitive in the international market. In the past several years seaweed farming has increased exponentially in the Bentenan/Tumbak area. While in 1997 only about 25 percent of the sample from the two villages carried out the practice, this increased to almost 93 percent in 2000. Further, in 1997 no one ranked seaweed farming first in terms of contribution to livelihood. In 2000 fully 69 percent ranked it first. In Rumbia and Minanga 1,

households involved in seaweed production increased from none in 1998 to 87 and 60 percent respectively. Only three percent of fishers (including milkfish fry collectors) report that they have reduced fishing activity as a result of increased seaweed farming activity, and the percentage of households involved in fishing in both the project and control villages has remained essentially the same. Some fishers report that they may fish a little less, but the fish aggregating potential of the floating seaweed lines results in their harvesting as much or more fish in less time.

Nevertheless, due to the extremely lucrative nature of seaweed farming at the present time, the percentage of households ranking fishing as first in importance for household income decreased from 71 to 15 percent. Information discussed above makes it clear that seaweed farming contributes significantly to household income in both the project and the control sites. A larger percentage of households in the project sites take part in the activity, and average total line length is greater in the project sites with line length being greatest in Tumbak. This variance in the extent of seaweed farming must be controlled for in our examination of project impacts, especially with regard to impacts on income and its indicator, material style of life.

3.5 PROJECT INDUCED CHANGES-MATERIAL STYLE OF LIFE

The analysis indicates that the material style of life (MSL) values increased in the project sites while decreasing somewhat in the control sites; however, the only change that is statistically significant is the moderate increase in the score on the appliances component in Bentenan and Tumbak. A comparison of MSL scores across the project and control sites during the monitoring period (2000) indicates that the project sites had higher scores on all three components, but only the difference on the house and furnishings component is statistically significant. Since seaweed line length is statistically significantly correlated with the appliances MSL score, it is difficult to attribute this change to project activities. The recent increase in seaweed farming probably contributed to the small purchases that would increase the appliances MSL score. Nevertheless, between 1997 and 2000, the household and furnishings MSL score increased in the project villages while it decreased in the control villages, resulting in a statistically significant difference between the project and controls in 2000. This change, which involves substantially more investment than changes in the appliances MSL score, might be attributable to outcomes associated with project activities.

3.6 RESOURCE BELIEFS

If project activities have increased knowledge concerning coastal resources, we would expect that mean scores on resource beliefs associated with conservation would increase more in the project sites than in the control. The results of the analysis clearly indicate that this is the case. Values on both components of the resource belief measure increased significantly in the project sites, while they decreased in the controls. Comparing the two project sites with respect to changes in mean resource belief scores since project implementation indicates that while there have been statistically significant positive changes in both the vastness and efficacy scores in Bentenan, in Tumbak, only the efficacy score has manifested a statistically significant positive change.

Ideally, these positive resource beliefs would be equally well communicated to all members of the community. Years of social science research concerning the

communication of innovations and new ideas, however, clearly indicates that this is rarely, if ever achieved (see Rogers, 1995). Our findings are in line with this earlier research. In both the project communities combined, years of formal education, age, and degree of project participation are statistically significantly correlated with both resource belief components. All are positive except for age, which is negatively correlated with the *Vastness* component. Additionally, gender of respondent (male), project related organization membership and MPA rule knowledge are positively related to the *efficacy* component score.

This all makes sense. Involvement in project activities was directed at increasing environmental awareness and knowledge, so we would expect that project participation would increase the accuracy of resource beliefs. Years of formal education should also have a positive impact on environmental knowledge. The negative relationship with age can probably be explained by the strong negative correlation between age and education in our sample, which is quite common in developing economies. The positive relationship between the *Efficacy* component score and the gender of respondent being male, however, bears closer examination.

When the data from Bentenan and Tumbak are analyzed separately we see that male gender is statistically significantly related to the *Efficacy* component only in Tumbak. The examination of the relationship between gender and involvement in project activities in Tumbak indicates that females participate less than males. No females belong to project related organizations, and there is a negative correlation between the overall project involvement score and female gender. As discussed above, these differences in participation are clearly related to the more pervasive influence of Islam on female behavior in Tumbak, as well as the fact that the female extension officer spent little time in Tumbak, reducing her potential influence as a positive role model.

The results clearly indicate that Proyek Pesisir activities have had a positive influence on resource beliefs among the residents of both Bentenan and Tumbak. The analysis also clearly indicates that degree of project participation by individuals has a positive influence on these beliefs. Gender differences seem to be related to differences in participation in Tumbak. Changes in Bentenan were greater than those in Tumbak, but both changed in a positive direction.

3.7 PERCEPTIONS OF CHANGE

If we compare perceptions of changes in the project and control sites between 1998 and 2000 the project sites have a greater increase in the percentage of respondents reporting that they feel better off. In the project sites the percentage increased from 22 to 80 percent while in the control sites the increase was from 32 to 69 percent—increases of 58 and 37 percent respectively. The distribution (numbers) of those who felt better off in the project and control sites during the two time periods can be found in Table 37. Hence, it appears that recovery from the events of 1997-1998 was greater in the project than the control sites. Nevertheless, within the project sites in 2000 we find no significant difference between participants and non-participants with respect to percentage feeling that they are better off. This does not mean that the project has had no impact—one could infer that project benefits are distributed equably throughout the community. It is important to note that many of the respondents reporting that they are better off today attribute it to seaweed farming, 42 percent in the control and 65 percent in the project

sites. Hence, perceptions of changes are probably influenced both by project activities and the macro-events which influenced the increase in seaweed farming. It is significant to note, however, that a larger percentage of respondents in the project sites in 2000 felt they would be better off in 5 years than in the control sites.

Respondents from the project sites perceived larger positive changes in family well being, community control of resource, influence on community affairs, and amount of resource harvested over the past three years. Respondents from project sites also projected greater positive changes in the status of the resource 3 years in the future. Perceptions of positive changes over the past 3 years in Bentenan and Tumbak are held by project participants as well as non-participants. Project participation, as measured by number of project activities is not statistically correlated with degree of perceived change over the past 3 years. It is, however, statistically significantly correlated with degree of perceived positive future changes in well being of the family, future control over the resource and future status of the resource. This suggests that while benefits of the project are spread equally throughout the community, it is the degree of participation that influences perceptions of positive changes in the future. Let us hope that Proyek Pesisir helps realize these expectations.

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Appendix A

Project activities in Bentenan – Tumbak

Appendix A

Table AI: Project activities in Bentenan – Tumbak

BENTENAN

Category	Date	Activity	Participants		
			F	M	Total
Meeting	21 Oct 98	Studi Lapangan peserta ICM	8	29	37
	25 Nov 97	Sharing pengalaman peranan masyarakat dalam pengelolaan sumberdaya pesisir di Pulau Apo Philippina	8	18	26
	19 Jan 98	Focus Group gender	10	4	14
	4 Apr 98	Pertemuan Kelompok Nelayan: Perkenalan dan penyampaian harapan bersama	5	22	27
	24 Apr 98	Pertemuan Kelompok Nelayan: Pembahasan Rencana Program	4	10	14
	6 Jun 98	Pelaksanaan Awal: Pusat Informasi dan Pembentukan Panitia Pengelola	11	13	24
	12 Jun 98	Pertemuan awal untuk paket PLH	0	2	2
	23 Jul 98	Pertemuan dengan rombongan Dirjen Bangda	8	21	29
	21 Agust 98	Pertemuan pelaksanaan awal Pusat Informasi dan rencana rehabilitasi daerah rawa	2	5	7
	21 Oct 98	Pertemuan masyarakat dengan peserta training ICM Outreach	8	28	36
	24 Oct 98	Pembersihan pantai	12	18	30
	26 Nov 98	Kegiatan pelaksanaan awal	4	7	11
	6 Dec 98	Kegiatan pelaksanaan awal	6	9	15
	14 Jan 99	Pembentukan Tim Pengelola Pelaksanaan Awal	1	8	9
	24 May 99	COREMAP Visit	12	32	44
	4 Jul 99	Sosialisasi Draft I Rencana Pengelolaan Bentenan-Tumbak	2	8	10
	10 Jul 99	Sosialisasi Draft I Rencana Pengelolaan Bentenan-Tumbak	5	15	20
	18 Jul 99	Sosialisasi Draft I Rencana Pengelolaan Bentenan-Tumbak	23	30	53
	22 Jul 99	Sosialisasi Draft I Rencana Pengelolaan Bentenan-Tumbak	18	25	43
	25-26 Jul 99	Sosialisasi Draft I Rencana Pengelolaan Bentenan-Tumbak	30	30	60
	29 Jul 99	Sosialisasi Draft I Rencana Pengelolaan Bentenan-Tumbak	42	43	85
	7 Nov 99	Persetujuan Rencana Pengelolaan Desa Bentenan	4	26	30
	16 Des 99	Pertemuan masyarakat Dusun III untuk pembangunan talud sungai	1	9	10
	14 Feb 00	Pertemuan tentang rehabilitasi rawa dan sungai	6	25	31
	18 March 00	Pertemuan Kelompok Pengelola Lingkungan Hidup	4	27	31
		TOTAL	**234**	**464**	**698**

Table AI: Project activities in Bentenan - Tumbak (continued)

Category	Date	Activity	Participants		
			F	M	Total
Presentation	11 April 98	Penjelasan Tentang Proyek Pesisir	7	32	39
	14 April 98	Penjelasan Tentang Proyek Pesisir	8	6	14
	6 June 98	Penjelasan Tentang Proyek Pesisir	11	13	24
	1 July 98	Hasil Survey Rawa dan Profil Pantai	5	18	23
	7 Agust 98	Penjelasan Tentang Proyek Pesisir	35	5	40
	23 Sept 98	Materi Hasil Pelatihan ICM dan Pelaksanaan Awal	11	2	13
	25 Sept 98	Materi Hasil Pelatihan ICM dan Pelaksanaan Awal	32	1	33
	15 Oct 98	Sosialisasi ICM Training	5	7	12
	17 Oct 98	Sosialisasi ICM Training	18	17	35
	18 Oct 98	Sosialisasi ICM Training	14	23	37
	24 August 99	Analisa Data Profil dan Survey	6	6	12
		TOTAL	**152**	**130**	**282**
Training	25-26 Mar 98	Pengukuran Profil Pantai dan Tinggi Muka Air Rawa Pasang Surut	5	5	10
	25-27 Apr 98	Pengukuran Profil Pantai dan Tinggi Muka Air Rawa Pasang Surut	7	4	11
	23-25 May 98	Pengukuran Profil Pantai dan Tinggi Muka Air Rawa Pasang Surut	7	4	11
	23-24 June 98	Pengorganisasian Kelompok	8	8	16
	22 Agust 98	Pengukuran Profil Pantai dan Tinggi Muka Air Rawa Pasang Surut	5	3	8
	15-16 Feb 00	Pelatihan Kelompok Lingkungan Hidup	9	29	38
	15-17 Feb 00	Coral Reef Monitoring Participatory	6	14	20
		TOTAL	**47**	**67**	**114**
Env. Ed.	12 Feb 98	Coastal Processes and Erosion	7	37	44
	15-16 Feb 00	Pemutaran Film Ekosistem Terumbu Karang	20	30	50
		TOTAL	**27**	**67**	**94**
		GRAND TOTAL (BENTENAN)	**460**	**728**	**1188**

Table AI: Project activities in Bentenan - Tumbak (continued)

TUMBAK

Category	Date	Activity	Participants		
			F	M	Total
Meeting	14-16 July 97	The CRMP and Field Activities, CRM Issues of concern by villagers	179	273	452
	25 Nov 97	Sharing pengalaman peranan masyarakat dalam pengelolaan sumberdaya pesisir di Pulau Apo Philippina	12	72	84
	20 Jan 98	Focus Group Gender	7	5	12
	26 Feb 98	COTs Clean Up in Bentenan-Tumbak	17	145	162
	1 Mar 98	Pelaksanaan awal penanaman bakau	0	9	9
	3 Apr 98	Persamaan persepsi masyarakat, kepala desa, dan Proyek Pesisir	152	243	395
	4 April	Pertemuan lanjutan Penaman Bakau	0	17	17
	13 Apr 98	Pertemuan monitoring penanaman bakau dan permohonan bantuan material untuk sarana air minum	1	16	17
	22 Apr 98	Persiapan Post COT clean up	11	18	29
	23 May 98	Pertemuan Kegiatan Penanaman Bakau	33	15	48
	28 May 98	Penanaman Bakau	92	83	175
	18 Jun 98	Pertemuan formal penjajakan kelompok binaan	10	11	21
	23 Jun 98	Pertemuan dengan rombongan Dirjen Bangda dan penyerahan dana pelaksanaan awal	5	22	27
	24 Jun 98	Persiapan Daerah Perlindungan Laut	17	23	40
	13 Agust 98	Pertemuan aspek lingkungan hidup dan persiapan DPL	7	71	78
	21 Sept 98	Musyawarah Umum : Daerah Perlindungan	113	116	229
	13 Oct 98	Koordinasi kegiatan pelaksanaan awal, daerah perlindungan dan pembersihan COT	5	13	18
	21 Oct 98	Pertemuan masyarakat dengan peserta training ICM Outreach	14	47	61
	11 Nov 98	Pertemuan masyarakat dengan Bappeda	6	39	45
	17 Nov 98	Pertemuan masyarakat dengan Bappeda	6	29	35
	24 Nov 98	Rapat koordinasi pembersihan COT	3	6	9
	28 Nov 98	Rapat koordinasi pembersihan COT untuk persiapan terakhir	3	9	12
	29 Nov 98	Pembersihan COT	57	99	156
	7 Apr 99	Penyerahan bantuan pembangunan dari Bappeda	1	36	37
	25 May 99	COREMAP Visit	9	28	37
	30 Jul 99	Rapat perangkat desa dengan Kelompok Inti	1	11	12
	6 Agust 99	Pertemuan tokoh masyarakat	0	12	12
	22 Sept 99	Sosialisasi DPL dan Rencana Pengelolaan	0	9	9
	1 Nov 99	Penjelasan Rencana Pengelolaan	6	16	22
	1 Nov 99	Pembentukan kelompok DPL	7	16	23

Table AI: Project activities in Bentenan - Tumbak (continued)

Category	Date	Activity	Participants		
			F	M	Total
Meeting cont.	25 Jan 00	Pertemuan Kelompok Pengelola DPL	1	19	20
	7 March 00	Pertemuan masyarakat untuk aturan DPL	8	72	80
	17 March 00	Pertemuan Kelompok Katinting	1	16	17
	21 March 00	Pertemuan kelompok katinting untuk penentuan penerima katinting tahap pertama	4	13	17
	24 March 00	Penyerahan bantuan katinting kepada kelompok nelayan Tumbak	2	9	11
		TOTAL	**790**	**1638**	**2428**
Presentation	27-29 August 98	Sharing Pengalaman Proses Pembentukan DPL dan Pelatihan Manta Tow di Desa Blongko	5	7	12
		TOTAL	**5**	**7**	**12**
Training	25-26 Mar 98	Administarsi dan Keuangan	3	9	12
	1-6 June 98	Coral Reef Monitoring Participatory I	5	7	12
	22 July 98	Administrasi dan Keuangan	3	10	13
	24-29 Agust 98	Coral Reef Monitoring Participatory II	5	7	12
	10-15 Nov 98	Coral Reef Monitoring Participatory III	3	5	8
	13 March 00	Pengelolaan Kepiting Bakau	0	4	4
		TOTAL	**19**	**42**	**61**
Env. Ed.	28 April 98	Terumbu Karang	37	17	54
	7 March 00	Pemutaran Film tentang Ekosistem Terumbu Karang	54	88	142
	27 Apr 98	Pertemuan PLH	16	21	37
		TOTAL	**107**	**126**	**233**
		GRAND TOTAL (TUMBAK)	**921**	**1813**	**2734**
		GRAND TOTAL - BENTENAN AND TUMBAK	**1381**	**2541**	**2734**

Source : Workplan Implementation Reports. Proyek Pesisir. Jakarta.