ISSN 1410 - 7821

Jurnal PESISIR & LAUTAN

Indonesian Journal of Coastal and Marine Resources

Volume2, No. 1, 1999

INSTITUT PERTANIAN BOGOR

PKSPL-IPB

ISSN 1410-7821, Volume 2, No. 1, 1999

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Halaman muka: Teluk Manado (foto: Bengen, D.G., 1998)

KATA PENGANTAR
FOREWORD

Pada edisi ketiga jurnal "Pesisir & Lautan" ini, kami hadir dengan format dan tampilan yang lebih komunikatif dan menarik.

Mengingat bahwa kebutuhan untuk berbagi pengalaman dan pengetahuan terus meningkat, maka berdasarkan saran-saran dan masukan-masukan yang kami peroleh dari para penelaah dan pembaca, jurnal "Pesisir & Lautan" akan hadir ke hadapan Anda tiga kali dalam setahun dimulai sejak penerbitan edisi ketiga ini.

Semoga jurnal ini dapat menjadi suatu media informasi bagi para pemerhati maupun praktisi pengelolaan sumberdaya pesisir dan lautan.

Selamat membaca dan kontribusi Anda kami nantikan.

For the third edition of "Pesisir & Lautan" journal, we have redesigned the format and appearance, in order to make it more attractive and communicative.

The need for sharing experience and knowledge is increasing from day to day; hence, in response to many suggestion and inputs from reviewers, readers and subscribers (both domestic and abroad), we have decided that the journal will be published three times a year commencing this edition.

We hope that this journal will be more attractive as information exchange platform to all people concerned with coastal and marine resources and their management.

Enjoy your reading and we are waiting for your contribution as well !

Pemimpin Redaksi
Editor-in-Chief

Dr. Ir. Dietriech G. Bengen

A COMPARISON OF LEVEL OF DEVELOPMENT AMONG COASTAL AND NON-COASTAL COMMUNITIES IN NORTH SULAWESI AND SOUTH SUMATRA

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ABSTRACT

This paper examines the question as to whether coastal communities and fishers in Indonesia are the poorest of the poor. It reviews recent socio-economic studies on coastal communities in Indonesia, and provides a quantitative analysis of secondary data on coastal and non-coastal communities in North Sulawesi in relation to IDT and Swa development classifications, as well as percent and density of fishers and farmers for coastal villages in Minahasa. It also provides an analysis of secondary data on income levels of farming and fishing communities in South Sumatra. It concludes that coastal communities in Minahasa, North Sulawesi tend to be less developed than non-coastal communities. The less developed status of coastal communities is not related to fisher density, fisher percent, or farmer density and has only a weak relationship to percent farmers. Isolation appears to be an important factor. In South Sumatra, percent fishers in a community was positively correlated with higher average household income while percent farmers was negatively correlated with higher income. The paper concludes that the generalized statement that coastal communities are less developed and fishers are the poorest of the poor in Indonesia cannot be supported due to the significant diversity among the level of development of coastal communities and income levels of fishers in various localities. Coastal development and resource management planning programs need to take such diversity into account, which suggests a need for more decentralized approaches to governance.
Keywords: income, poverty, fishers, coastal villages, level of development, decentralization

Abstrak

Tulisan ini menganalisa mengenai pernyataan bahwa masyarakat nelayan pesisir merupakan kelompok termiskin dan mencoba mengkaji ulang studi sosial ekonomi yang sudah dilakukan sebelumnya tentang masyarakat pesisir di Indonesia. Studi-studi ini didukung pula analisis kuantitatif data skunder kelompok masyarakat pesisir dan non pesisir di daerah IDT dengan daerah-daerah yang lebih makmur, juga presentase dan kelimpahan nelayan dan petani di desa-desa pesisir di Minahasa. Data skunder tingkat pendapatan petani dan nelayan di Sumatera Selatan dijadikan perbandingan dasar analisis pula. Hasilnya menunjukan bahwa masyarakat pesisir Minahasa, Sulawesi Utara cenderung lebih miskin dibandingkan masyarakat non pesisir di daerah itu. Akan tetapi pernyataan tersebut tidak ada kaitannya dengan kepadatan dan persentase nelayan, atau kelimpahan petani dan persentase petanipun sangat kecil sekali. Anggapan ini muncul sebagai faktor penting. Dari hasil laporan di Sumatra Selatan, faktor persentase nelayan dalam suatu kelompok berkorelasi positif dengan tingkat pendapatan rata-rata rumah tangga yang lebih tinggi, sementara tingkat pendapatan petani yang lebih tinggi berkorelasi negatif terhadap persentase petani di daerah tersebut. Dari analisis ini disimpulkan bahwa pernyataan umum mengenai masyarakat pesisir merupakan kelompok termiskin tidak dapat didukung karena keberagaman diantara tingkat kemajuan dan pendapatan nelayan di daerah-daerah yang berbeda. Program -program Perencanaan dalam pengelolaan pengembangan wilayah pesisir dan sumberdayanya hendaknya memasukan keanekaragaman masalah kedalamnya, dimana membayangkan suatu keperluan yang lebih pada pendekatan desentralisasi pemerintahan.
Keywords: pendapatan, kemiskinan, nelayan, desa-desa pesisir, tingkat perkembangan, desentralisasi

INTRODUCTION

A number of recent reports and socio-economic studies in Indonesia have made statements concerning poverty and income levels of coastal communities and fishers. A Ministry of Environment report stated that fishers with small boats generally live below the poverty level and that coastal villages generally have a poor quality of life (MSE, 1996). A North Sulawesi (MREP, 1996a) study reports that fishing in the region is carried out by poor fishers and that most of the residents in the coastal area studied have low incomes. The report also states that many of the poor villages which receive IDT funds (a government program for poor villages) have residents which are fishers. In addition, they conclude that the coastal villages surveyed are poor due to the fact that they rely on fishing, have poor marketing systems, an absence of cold storage facilities and because they are isolated. The report however, contains no quantitative data backing these conclusions. In another study of 132 households surveyed in four coastal communities on the east coast of Minahasa (Pollnac, et al., 1998), fisher households manifest a lower level of material style of life as indicated by items such as household structural features, furnishings, and appliances. This suggests that fisher households in these communities tend to be poorer than households where fishing is not one of the top three ranked productive activities.

A study from Irian Jaya reports that fisher incomes are low to medium (MREP, 1996b). No reference is made to actual average fisher incomes or what they are compared to for concluding their incomes are low to medium. A South Sulawesi study finds that fishers in the communities surveyed have no income from sources other than fishing (MREP, 1996c). Ranges of income for respondents in the coastal communities surveyed is reported, but no conclusions on the poverty level of fishers or the coastal communities surveyed are made. A review of data in their report however, indicates that coastal fishers have incomes lower than brackishwater farmers. Brackishwater farmers are the highest income group in all the coastal villages sampled. However, in comparing incomes with rice farmers, some villages show higher income from fishing whereas others show higher income from rice farming.

In contrast to the above mentioned studies which tend to highlight the poverty of coastal communities and fishers, a study from South Sumatra (MREP, 1995) concludes that in all of the coastal communities studied, household income levels are above the poverty level. They also report that coastal communities have a high level of occupational multiplicity dominated by farming and fishing, which may be one of the factors accounting for the high income levels. In addition, they conclude that household income levels for fisher crews are the lowest while levels for fishers who own good gear is the highest. A study of the economic value of fisheries in Bunaken National Marine Park, North Sulawesi (NRMP, 1996) concludes that fishers in the park are not poor and income levels are not low. Income levels for fishing (artisanal and commercial) and seaweed farming households are reported to be two to three times higher than income levels of unskilled labor single income households in Manado, the major urban center of North Sulawesi. An earlier study of fishing communities in Bunaken Park (Pontoh, 1991) concludes that fishing incomes are from 62 to 75 percent lower than the national per capita income. However, no information is provided on how non-coastal communities or non-fisher households in North Sulawesi compare to this level.

None of the studies described above have made detailed comparisons between coastal and non-coastal communities, and only a few have attempted to compare fishers to other occupational groups. However, many of the reports make statements about the poverty of coastal communities and fishers with little or no supporting evidence. The literature review indicates that such statements may be true for one region or village but not for another. Hence, this previous research does not support a generalized conclusion for Indonesia that coastal villages are less developed and fishers are the poorest of the poor. This can have important implications for coastal resources

management, development, planning, and policy programs. If based on inaccurate assumptions or conclusions, these programs may not achieve the expected results.

Testing assumptions concerning income levels of individuals in fishing as well as other occupational categories can be problematic. It is often difficult to obtain information on income levels or the standard of living of fishers as well as individuals in other rural occupations. In addition, there is often no clear cut distinction among occupations of individuals as being a full-time fisher or farmer. Often, individuals and households in rural communities obtain income from several occupational sources and engage in a multitude of productive activities. This is particularly evident in coastal communities of Minahasa where households can engage in four or more productive activities, which may or may not be a combination of land and sea-based activities (Pollnac et al., 1997). It is also important to note that not all productive activities result in income, and it is typical for rural coastal households to engage in both income generating and subsistence activities. By concentrating only on income, we may exclude many important productive activities which contribute to the quality of life of coastal household members, but which can be difficult to place a monetary value on. Additionally, many fishers are also part-time farmers and visa versa, so clear cut distinctions between fishers and farmers as occupational categories can be meaningless. It can be argued that exploitation of multiple land and sea-based coastal resources for income generating and subsistence activities is an optimal adaptation for coastal communities. However, it also makes the job of social science research in these communities more challenging.

Rather than attempting to look at differences in the income levels of different occupational groups, another strategy is to examine differences in the level of development or well being of various types of communities. Community-based coastal resources management programs typically target the community as a whole rather than any one occupational group. From a coastal resources management and development planning policy perspective, understanding how coastal communities fare relative to other non-coastal communities can be an important consideration and justification for targeting specific programs towards coastal communities.

METHODOLOGY

Minahasa and North Sulawesi: Information on the development status of villages (as defined by government agencies and available from existing secondary data sources) within North Sulawesi and the Minahasa Regency are analyzed to determine whether coastal communities are in general, less developed or poorer than their non-coastal counterparts. Two types of Government of Indonesia (GOI) classifications for level of village development are used. One is based on a system of classification of villages as IDT (Inpres Desa Tertinggal) or non-IDT (poor or non-poor villages, respectively) devised by BAPPENAS (National Development Planning Board), BPS (Central Statistics Bureau) and Departemen Dalam Negeri (Department of Home Affairs) to provide special development funds to "poor" villages (BPS, 1995). Criteria for classifying villages as IDT or non-IDT includes opinions of local government officials as well as summary scores on approximately 18 variables such as health, education, communications and transportation facilities, drinking water supply, electrification, occupation of residents, among others. The other system of classification devised by the Dirjen BANGDA (Directorate General for Regional Development) and Kantor Pembangunan Masyarakat Desa (Village Community Development Office) divides villages into three "Swa" (self-effort) categories: Swadaya, Swakarya and Swasembada (PMD, 1998). These three categories grade villages as less-developed, middle-developed or more-developed respectively. This classification is based on six criteria including public education and health; safety, law and order; level of village economy, community participation, understanding of the basic principals of the state ideology of Pancasila, and the awareness of Indonesia as a nation-state.

A review of statistics (BPS, 1996) for the development classifications are made for North Sulawesi Province to determine whether there are relationships between percent of coastal villages within kabupatens with the percent of villages in the various development classifications. A more

detailed analysis of village level information for the Minahasa regency is then conducted to further examine the relationships. Information on IDT (BPS, 1995), and Swa (BPS, 1993) classifications obtained for all coastal and non-coastal villages in Minahasa is compared using statistical analyses.

Several hypotheses are tested which might explain the low level of development of coastal communities in Minahasa. Village level data obtained (BPS, 1993) from various Bureau of Statistics documents are analyzed to see if there is a relationship between the various development categories and percent of fishers or farmers, or fisher and farmer density in the coastal villages. Percent fishers and percent farmers (the largest occupational subcategories in rural Minahasan coastal villages) are calculated by dividing the number of individuals identified as employed in each category by the total village population. Fisher density and farmer density are determined for each coastal village by dividing the number of individuals identified as employed in this category by the total land area of the village. A t-test is used to examine differences of the means of these variables with the IDT and Swa classifications. Due to the low frequency of villages classified as Swadaya, the three-level Swa classification is collapsed into a low-swa (swadaya and swakarya) and high-swa (swasembada) classification for this analysis. Another possible explanation for the low level of development of coastal communities is that geographic isolation may be a contributing factor. This hypothesis is tested by scoring all coastal villages as either isolated or non-isolated and comparing this with the village development categories. Isolated communities are defined as those on offshore islands, or with poor road infrastructure to and from the village.

South Sumatra: An analysis of summary data reported on 19 villages from South Sumatra (MREP, 1995) is conducted to test differences between percent fishers and farmers with respect to average household income levels. A Pearson correlation is ran on these data. Two of the villages in this group are non-coastal (do not border on the coast) but have marine fishers as an occupational group within the community. A scatter plot of percent fishers versus percent farmers for the 19 villages in the study is made to determine potential clustered relationships among the villages. The raw data on individual household income is unavailable for analysis. Therefore, average annual household incomes for each cluster reported in the results are the averages of the village averages, not average household income of all respondents surveyed in the villages which are contained within the cluster. Since an average of averages can be grossly misleading where sample sizes in each subgroup (village) are different or unknown, the raw data for average household income of each village can be found in Table 6.

RESULTS

North Sulawesi: The number and percent of coastal villages in North Sulawesi for Regencies (Kabupaten) which are predominantly rural administrative units, versus urban (Kotamadya) administrative units are provided in Table 1. The overall percentage of coastal versus non-coastal villages for urban and rural administrations are the same. However, they exhibit a wide range of variation from one administration to the other. Slightly more than one third of all villages in North Sulawesi are coastal. The percentage of coastal and IDT villages in the various administrations is compared in Table 2. The rural administrations have a higher percentage of IDT villages than urban administrations. Within rural administrations, those with a higher percentage of coastal communities also have a higher percentage of IDT villages. The urban administrations show no such distinction.

A comparison of percent coastal and percent of categories of "Swa" villages in North Sulawesi is presented in Table 3. Urban administrations tend to have a higher percentage of more-developed (Swasembada) villages than rural administrations. The majority of urban administration villages also fall into the more-developed category. The rural administrations tend to have slightly more less-developed (Swadaya) villages than urban administrations. The rural administrations have substantially more middle-developed (Swakarya) and substantially less more-developed (Swasembada) villages. The relationship between percent coastal and percent "Swa" categories is

less distinct for rural administrations and no relationship is evident for urban administrations. All urban administrations have a higher percentage of Swasembada villages than the rural administrations.

Minahasa has the lowest percentage of coastal and IDT villages among the Kabupaten (rural) administrations. In addition, Minahasa has the highest percentage of Swasembada and lowest percentage of Swadaya villages for Kabupaten administrations. The IDT and "Swa" classifications suggest that Minahasa is one of the more developed Kabupatens within the Province of North Sulawesi. Minahasa has a similar percentage of IDT villages (21.9 percent) as the average for Kotamadya (urban) administrations (20.4 percent). However, the "Swa" classifications rank it lower than the urban administrations, but the highest among the rural Kabupatens.

The relationship between percentage of coastal villages with IDT and Swa classifications aggregated at the Kabupaten level suggests that there may be a relationship between coastal villages and the Swa and IDT classifications. Caution is needed in attempting to draw parallels to urban (Kotamadya) administrations where this relationship does not appear to hold.

A more detailed analysis of village level data in the Minahasa Regency may provide additional information concerning the relationship between coastal residence and level of development. Out of a total of 495 villages in Minahasa, 111 are classified as coastal. (BPS, 1993). Comparing coastal and inland villages in Minahasa on the basis of IDT classification indicates that 47 percent of the coastal villages are classified as IDT in contrast to only 15 percent of the inland villages. This difference is statistically significant (($2 = 51.36$, $df = 2$, $phi = 0.32$, $p < 0.001$). Similarly, when comparing coastal and inland villages on the basis of the "swa" categories, 75 percent of the inland are classified as swasembada (the highest level) in contrast to only 45 percent of the coastal (($2 = 35.68$, $df = 2$, $phi = 0.27$, $p < 0.001$). These results indicate that coastal villages tend to have more IDT classified villages and more villages classified into lower "Swa" categories. Therefore, coastal communities in Minahasa are more likely to be poorer or less developed than their non-coastal counterparts. These findings suggest that some characteristic of the coastal villages has impeded their development.

Results of the analysis testing the hypotheses that percent fisher and farmer, and fisher and farmer density may be related to level of development are presented in Tables 4 and 5. Tables 4 & 5 indicate that there is no difference in fisher density or percent fishermen in the different development classifications of coastal villages. The means in the tables are not to be considered as representing overall mean fisher density or mean percent fisher since the population of the included villages varies. There is no significant difference in percent farmers in IDT and non-IDT coastal villages. However, there is a difference in percent farmer in low-swa (swadaya and swakarya) and high-swa (swasembada) coastal villages. Coastal villages with a higher percent of farmers tend to be classified as low-swa. While this is statistically significant, the actual difference is quite small (.296 versus .234) suggesting it may not be a useful factor in explaining differences in level of village development, particularly considering there was no significant difference for this variable in the IDT classifications.

One potential explanation for this difference may be that arable land in coastal communities is less available or less fertile, or irrigation and water resources are not as well developed, resulting in lower productivity and potential income. Therefore, coastal communities with more farmers may tend to be poorer for this reason. Nevertheless, farmer density is not significantly different in the different development classifications of coastal villages. Since not all land within a community is arable, farmer density (number of farmers per unit of total village land area) may not be a good factor for explaining the level of development or poverty status of coastal communities. Calculating farmer density using total arable land rather than total land may be a better variable to use in future analyses of this nature.

Since fisher percent and fisher density does not seem to be a significant factor, other factors may be more important in explaining the difference in the level of development of coastal

communities. When comparing isolation with IDT classifications, only 42 percent of non-IDT coastal villages are isolated whereas 80 percent of IDT coastal villages are isolated (($2 = 16.475$, $df = 1$, $phi = 0.387$, $p < 0.001$). This relationship is similar for Swa classifications where only 34 percent of Swasembada (high-swa) coastal villages are isolated while 82 percent of Swadaya and Swakarya (low-swa) coastal villages are isolated (($2 = 25.819$, $df = 1$, $phi = 0.484$, $p < 0.001$). Hence, geographic isolation appears to play a role in the development of coastal villages.

South Sumatra: Percent fishers in the South Sumatra communities is positively correlated ($r = 0.568$, $p < .02$) with average household income, and percent farmers in the community is negatively correlated ($r = -0.543$, $p < .02$) with average household income. Hence, coastal communities with higher percentages of fishers tend to have higher average household incomes, and coastal communities with higher percentages of farmers tend to have lower average household incomes. In this case, communities with a high percentage of fishers on average are not the poorest of the poor, and the presence of large numbers of fishers tends to increase average household incomes in those villages.

A scatter plot of percent fishers versus percent farmers for the 19 villages in the study is presented in Figure 1. The villages are clustered into four categories representing different occupational groups. The A cluster can be characterized as business and service dominated villages with next to the highest average annual household incomes (see Table 6). The B cluster are farmer dominated villages with next to the lowest average annual household incomes. In two-thirds of the cluster C villages, fishers outnumber farmers, but in one-third of the villages, fishers equals farmers. These villages have the lowest average annual household incomes. The cluster D villages are fisher dominated non-farming villages with the highest average household incomes. Average household incomes of fisher dominated villages is equal to or greater than farmer dominated villages and more on par with the business and service dominated villages. In these South Sumatra villages, the presence of fishers tends to increase average household incomes in the community and places them as some of the better off communities. This is contrast to the results of the village analysis in Minahasa where percent fishers is not related to the level of village development, and the four east coast villages analyzed (Pollnac et al., 1998), where fisher households tend to have lower levels of material style of life items than farming households. The Bunaken Marine Park study (NRMP, 1996), however, produced similar results to the South Sumatra analysis, concluding that fishers are not poor.

DISCUSSION

North Sulawesi, and Minahasa: In the Minahasa Regency of North Sulawesi, coastal communities tend to be less developed or poorer than non-coastal villages. This relationship is based on the definition and criteria of the Government of Indonesia IDT and "Swa" development classifications. While coastal villages in Minahasa tend to be poorer than non-coastal villages, not all coastal villages are poorer than their non-coastal neighbors. This is a statistical relationship, and one must remember that more than one-half the coastal villages in Minahasa are non-IDT. Furthermore, this information does not provide us with any direct indication of whether fishers as an occupational group are poorer than other occupational categories.

The reasons why coastal communities in Minahasa tend to be less developed are not fully understood. It may be due to ecological differences of coastal communities (agricultural soils may be poorer, freshwater supply less available), or that infrastructure (for marketing marine or agricultural produce) is less developed in comparison with their non-coastal neighbors. There is no indication that percent fishers in a community or the number of fishers per unit area of village land is related to level of development. The percentage of farmers in the community may have some influence, but this relationship is weak and needs further investigation. Geographic isolation, however, is a relatively strong predictor of coastal community development as defined here. This

suggests that improvements in transportation infrastructure can be an important strategy to foster the development of coastal communities.

While we have no data to support this assertion, another potential reason why coastal communities tend to be less developed in Minahasa may be that government development programs have not targeted coastal communities as much as perhaps they should. This suggests that further research is necessary. In addition, government programs designed for all communities regardless of geographic location may not be appropriate for coastal communities and therefore may have less of an impact. Another explanation may be that the Swa and IDT classifications tend to overemphasize factors such as physical facilities (schools, health centers, etc.). This might tend to magnify infrastructure differences between communities rather than accurately reflect other measures of quality of life (infant mortality or income) which are not used in the IDT and Swa classifications. More research is needed to better understand the tendency of coastal communities in Minahasa to be lesser developed. Regardless of the reasons, the fact that coastal communities tend to be poorer in Minahasa provides justification for designing development programs specifically for coastal villages.

Since rural coastal communities are heavily dependent on the coastal resource base for their livelihood, community-based coastal resources management initiatives can be an appropriate response to address the lesser developed state of coastal villages in Minahasa. Such programs however need to view coastal communities as unique geographic areas where the productive activities of many coastal residents are dependent on both land and sea-based resources. Hence an integrated approach to their development is needed which considers issues concerning the development and management of coastal agriculture, fisheries, freshwater resources and transportation infrastructure, among other factors.

There is no clear indication that fishers are the poorest of the poor in Minahasa. There are examples in North Sulawesi where fishers are better off than other occupational groups, whereas in other cases they tend to be poorer. Such variation is also seen among other provinces in Indonesia including South Sulawesi and South Sumatra.

South Sumatra: In the case of South Sumatra, fisher dominated communities tend to be better off or equal to farmer dominated communities. Using income as the criteria for level of development indicates that fisher dominated communities in the South Sumatra are not the poorest of the poor. Some fishers (crew) are among the poorest of the poor, but others (gear owners) clearly can be considered as among the better off. It is possible however, that the income of other occupational groups in the communities studied is so high that it is their income, not the fishers, that influence the high average household income. The IDT and Swa village development classifications rely on factors other than income and it is not known how the South Sumatra communities fare with respect to these classifications, or whether income is correlated to them. Further research in this area would be useful.

General Conclusions: Caution must be used in making generalized statements about fishers being poor without supporting empirical evidence for the locality concerned. The tendency of coastal communities to be poorer in some localities is not necessarily related to the presence of fishers within the coastal communities. This may be surprising to some policy makers who often view the most obvious difference between coastal and non-coastal communities as the presence of a fisheries sector. This may lead to the mistaken judgement that the poor condition of the community is related to underdevelopment of the fisheries sector or that all fishing communities must be poor.

The diversity of the level of development between coastal and non-coastal communities, as well as within coastal communities is great. Such diversity is also evident in the level of well being between and within occupational groups. Development policies and management programs which are applied across communities and occupational groups without accounting for such differences are thus unlikely to succeed. Greater consideration therefore should be given to decentralized and flexible coastal management policies and programs for Indonesia which take into account the

diversity of village development levels and the diversity in the well being of various coastal occupational groups.

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Table 1: Number and percent of coastal and non-coastal villages in North Sulawesi

Kabupaten/ Kotamadya	Coastal Villages	Non-Coastal Villages			Total Non-Coastal Villages	Total Villages	Percent Coastal Villages
		Valley	Mt. Slope	Inland			
Kab. Minahasa	97	36	137	227	400	497	19.52
Kab. Gorontalo	91	13	62	155	230	321	28.35
Kab. Bolaang Mong.	75	24	34	129	187	262	28.63
Kab. Sangihe Talaud	198	8	26	11	45	243	81.48
Subtotal	461	81	259	522	862	1323	34.84
Kodya Gorontalo	5	0	7	33	40	45	11.11
Kodya Manado	22	3	8	35	46	68	32.35
Kodya Bitung	29	0	9	6	15	44	65.91
Subtotal	53	3	24	74	101	154	34.42
TOTAL	517	84	283	596	963	1480	34.93

Source: Statistik Potensi Desa Se-Sulawesi Utara, 1996

Table 2: A comparison of percent IDT and percent coastal villages in North Sulawesi

Kabupaten/Kotamadya	Total Villages	No. IDT	% IDT Villages	% Coastal Villages
Kab. Minahasa	497	109	21.93	19.52
Kab. Gorontalo	321	121	37.69	28.35
Kab. Bolaang Mong.	262	92	35.11	28.63
Kab. Sangihe Talaud	243	155	63.79	81.48
Subtotal	1323	477	36.05	34.84
Kodya Gorontalo	45	13	28.89	11.11
Kodya Manado	68	7	10.29	32.35
Kodya Bitung	44	12	27.27	65.91
Subtotal	157	32	20.38	35.67
TOTAL	1480	509	34.39	34.93

Source: Statistik Potensi Desa Se-Sulawesi Utara, 1996

Table 3: A comparison of percent "Swa" category villages and percent coastal villages in North Sulawesi

Kabupaten/ Kotamadya	Total Villages	No. Swa Daya	No. Swa Karya	No. Swa Sembada	% Swa Daya	% Swa Karya	% Swa Sembada	% Coastal Villages
Kab. Minahasa	497	28	76	292	5.5	35.4	58.8	19.52
Kab. Gorontalo	321	51	162	101	15.9	50.5	31.5	28.35
Kab. Bolaang Mong.	262	19	112	115	7.3	42.7	43.9	28.63
Kab. Sangihe Talaud	243	25	137	70	10.3	56.4	28.8	81.48
Subtotal	1323	123	587	578	9.3	44.4	43.7	34.84
Kodya Gorontalo	45	0	0	45	0	0	100	11.11
Kodya Manado	68	5	8	55	7.4	11.8	80.9	32.35
Kodya Bitung	44	0	3	41	0	6.8	93.2	65.91
Subtotal	157	5	11	141	3.2	7.0	89.8	35.67
TOTAL	1480	128	598	719	8.6	40.4	48.6	34.93

Source: Statistik Potensi Desa Se-Sulawesi Utara, 1996
Note: Not all villages are classified as one of the three "swa" categories, so percents do not always sum to 100%.

Table 4: Comparison of fisher and farmer population density and percent of total population across IDT and non-IDT coastal villages in North Sulawesi

VARIABLE	NON-IDT	SD	IDT	SD	T-TEST	DF	PROB.
Farmer Density	0.691	1.190	1.302	3.257	1.294	99	>0.05
Farmer Percent	0.255	0.126	0.282	0.145	1.029	99	>0.05
Fisher Density	0.738	4.634	1.341	6.204	0.558	99	>0.05
Fisher Percent	0.045	0.053	0.064	0.078	1.441	99	>0.05
N	55		46				

Source: Analysis Statistik P. Besi Desa se-Sulawesi Utara 1996

Table 5: Comparison of fisher and farmer population density and percent of total population across low-swa and high-swa coastal villages in North Sulawesi

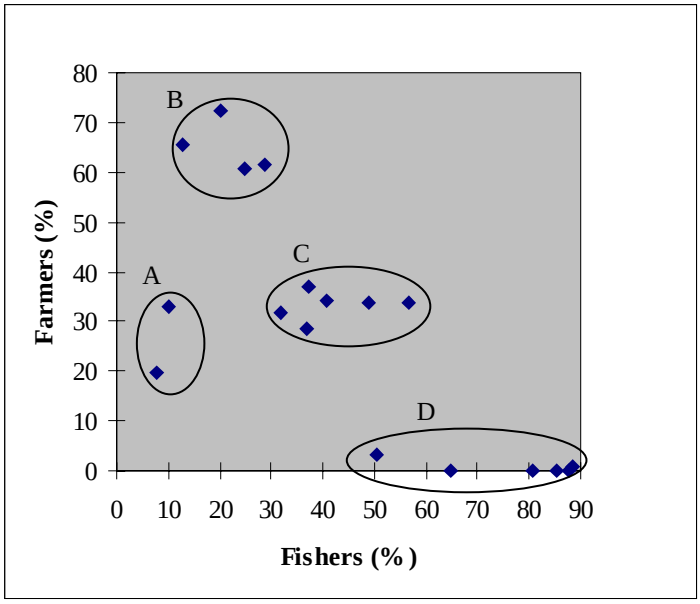
VARIABLE	LOW SWA	SD	HI SWA	SD	T-TEST	DF	PROB.
Farmer Density	1.034	2.853	0.895	1.689	0.294	99	>0.05
Farmer Percent	0.296	0.143	0.234	0.119	2.378	99	<0.02
Fisher Density	0.335	1.587	1.791	7.681	1.361	99	>0.05
Fisher Percent	0.063	0.066	0.042	0.065	1.545	99	>0.05
N	47		54				

Source: Analysis Statistik P. Besi Desa se-Sulawesi Utara 1996

Table 6: Average annual household income in 19 villages in South Sumatra in 1994 - 1995.

Village	Occupational Groups (Percent)			Income
	Fisher	Farmer	Other	(Rupiah)
Cluster A				
Permis	08	20	73	5,760,263
Bangka Kota	10	33	57	4,321,324
Cluster B				
Batu Batumpang	13	66	21	3,252,169
Templang	20	72	07	2,860,799
Tanjung Niur	25	61	15	2,860,856
Sebagin	29	61	10	5,981,924
Cluster C				
Toboal Kota	32	32	36	1,538,179
Air Nyatoh	37	28	35	3,018,018
Tanjung Ketapang	37	37	26	2,125,163
Belo Laut	41	34	25	3,016,986
Sungai Selam	49	34	17	2,314,911
Bawah				
Kundi	57	34	09	4,475,580
Cluster D				
Tanjung	51	03	46	2,514,678
Sungsan 4	65	00	35	9,081,625
Sungai Jurija	81	00	19	3,876,563
Kuala Sugihan	85	00	15	6,403,941
Sungai Lumpur	88	00	12	5,947,714
Sungsan 3	89	01	10	8,419,021
Sungsan 2	91	01	09	8,956,566

Source: MREP, 1995.



Data Source: MREP, 1995.

Figure 1: Scatter plot of percent fishers and farmers for 19 Villages in South Sumatra 1994 - 1995

A NEW DISCOVERED HOME FOR "OLD FOURLEGS": THE DISCOVERY OF AN INDONESIAN POPULATION OF LIVING COELACANTHS

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ABSTRACT

During the period of September 1997 through July 1998, two living coelacanth fishes were captured off the island of Manado Tua, North Sulawesi, almost 10,000 km from their only previously known home in the western Indian Ocean. A description of the events surrounding this discovery is presented along with a brief review of the known biology of the living coelacanth *Latimeria chalumnae*, in order to provide background for Indonesian scientists interested in pursuing research on the Indonesian coelacanth. Recent analysis of mitochondrial DNA sequences from the preserved Indonesian specimen suggest that the Sulawesi population has been genetically isolated from the western Indian Ocean population(s) for millions of years and may actually represent an undescribed species of Latimeria. Future research priorities are outlined, and a review of the important measures taken to date to provide for the immediate conservation of this unique addition to Indonesia's natural heritage is given.
Keywords: coelacanth, discovery, isolated, heritage

ABSTRAK

Selama kurun waktu September 1997 sampai dengan Juli 1998, dua ikan coelacanth hidup tertangkap di lepas perairan lepas pantai Pulau Manado Tua, Sulawesi Utara, kira-kira 10.000 km dari tempat asalnya di perairan Barat Samudera India. Sebuah gambaran dari kejadian-kejadian sekitar penemuan ini telah disajikan berupa uraian singkat mengenai biologi dari coelacanth hidup *Latimeria chalumnae*, dalam rangka memberikan latar belakang bagi peneliti-peneliti Indonesia yang tertarik untuk meneliti lebih lanjut mengenai spesies ini. Analisis baru-baru ini terhadap rangkaian DNA mitokondrial dari spesimen Indonesia awetan ini diperlihatkan bahwa populasi dari spesies yang berada di Sulawesi secara genetik diisolasi dari populasi induknya yang ada di perairan Barat Samudera India yang berumur jutaan tahun dan boleh jadi benar-benar perwakilan dari spesies Latimeria yang tak terdeskripsikan. Prioritas penelitian kemuka telah digariskan, dan sebuah telaahan terhadap pengukuran-pengukuran penting yang perlu dilakukan saat ini untuk menyediakan pelestarian secepatnya bagi warisan alam yang unik Indonesia.
Kata-kata kunci: coelacanth, discovery, isolated, heritage

INTRODUCTION

Until 1938, coelacanths were only known to a select few paleontologists as a strange order of lobe-finned fishes (Order Actinistia, Sub-class Sarcopterygii) which had appeared in the Devonian fossil record almost 370 million years ago and then seemed to go extinct about 80 million years ago near the end of the Cretaceous (Forey, 1990). This changed dramatically in early 1939 when newspapers around the world heralded the spectacular discovery of a "living fossil" coelacanth, trawled off the coast of South Africa (Smith, 1939). The large blue fish, christened *Latimeria chalumnae* in honor of the type locality and the young curator who preserved it, was proclaimed by many the "zoological find of the century" (Thomson, 1991). The subsequent 14 year search for a second specimen of this peculiar fish, narrated in the classic book "Old Fourlegs" (Smith, 1956), resulted in the discovery of the "true" home of the living coelacanth in the Comoran archipelago in the western Indian Ocean.

Since that time, almost 200 specimens have been captured from the Comoros, and many have been preserved in museums around the world (Bruton and Coutouvidis, 1991). Study of these preserved specimens has provided a number of insights on the anatomy and physiology of L. chalumnae. The coelacanth, named from the Greek words meaning "hollow spine" (in reference to its hollow fin rays), has a number of unique morphological characteristics. Chief among these are its seven lobed fins, including the paired pelvic and pectoral fins, which bear superficial resemblance to walking appendages - hence its common nickname of "Old Fourlegs" (Smith, 1956). The fish is also unique in having a hollow, oil-filled notochord instead of a true backbone, a small secondary lobe on its tail (the epicaudal lobe), and an intracranial joint, which has been postulated to allow it a bigger gape for prey capture (Balon et al., 1988).

The coelacanth is a large fish, reaching almost 2 m in maximum length and weighing up to 100 kg (Bruton and Armstrong, 1991). Estimates of its maximum lifespan vary from 11 to at least 22 years (Balon et al., 1988). Like some sharks, L. chalumnae is ovoviviparous, with the female producing large (9 cm diameter) eggs which hatch in the uterus before she gives birth to up to 26 live young, which themselves may be up to 36 cm TL at birth (Heemstra and Greenwood, 1992).

The interesting mix of morphological characteristics displayed by the coelacanth has intrigued evolutionary scientists examining the relationship of this prehistoric fish to land animals. Based upon various lines of evidence, ranging from skeletal to genetic studies, the coelacanth is believed to be derived close to the base of tetrapod (four-legged land animals) evolution, along with the living lungfishes and the fossil rhipidistian fishes (Forey, 1998).

In 1987, a new era in coelacanth research began when Hans Fricke and colleagues began pioneering submersible studies of L. chalumnae in its native habitat in the Comoros (Fricke and Plante, 1988; Fricke et al., 1987). In situ studies on the coelacanth allowed unprecedented new observations on the ecology, behavior and locomotion of these mysterious animals. These researchers quickly verified that the coelacanth is a slow-moving, nocturnal drift hunter which inhabits steep young volcanic slopes at typical depths of 150-300 m (Fricke et al., 1991). During the day, the fish shelter in lava caves in groups of up to fourteen animals, emerging at night to hunt small to medium-sized demersal fishes and cephalopods (Fricke et al., 1991; Uyeno and Tsutsumi, 1991). While they do not use their paired fins for support or locomotion upon the substrate, they do move these fins in an alternating manner which resembles a horse at a slow trot (Fricke et al., 1987). The observation that the fish are normally found below 150 m depth is apparently related to temperature requirements for optimal respiration; oxygen saturation of coelacanth blood is highest between 15-20(C (Hughes and Itazawa, 1972).

Fricke and colleagues also found that each individual coelacanth has a unique pattern of white flecks on its scales, making it possible to recognize individuals and therefore to reliably make population estimates (Fricke et al., 1991). Unfortunately, the most recent work on coelacanth population size suggests that L. chalumnae may now be in danger of extinction, only 60 years after its initial discovery. Population monitoring of L. chalumnae on Grande Comore island has revealed an apparent population decrease of 32% from 1991 to 1994 alone (Hissmann et al., 1998). This decline has been attributed primarily to overfishing by native artisanal fishermen, who occasionally catch the coelacanth as an incidental bycatch of their oilfish (Ruvettus pretiosus) fishery (Stobbs and Bruton, 1991; Fricke et al., 1995).

However, the underlying conservation problem is the (presumed) extremely limited distribution of the living coelacanth; until this year, established populations of L. chalumnae were only known from two islands in the Comoros (Hissman et al., 1998). The four known specimens caught from other localities (South Africa, Mozambique, and Madagascar) are all considered Astrays from the main Comoran populations, based upon mitochondrial DNA sequencing comparisons and the apparent unsuitability of the habitat at

these other locations (Schliewen et al., 1993; Bruton et al., 1992; Heemstra et al., 1996). The combination of extremely limited range and declining population size has qualified L. chalumnae for listing as both CITES Appendix 1 status and endangered status on the IUCN Red List of Threatened Animals, actions rarely taken for marine fishes (Vincent and Hall, 1996).

SULAWESI SURPRISE

Against this backdrop of dire conservation status for L. chalumnae, the announcement in September 1998 of a previously unknown population of coelacanths living off the northern coast of Sulawesi caused considerable scientific (and public) excitement, and provides hope that coelacanths are potentially much more widespread than originally thought (Erdmann et al., 1998). At sunrise on 30 July 1998, Bapak Lameh Sonatham and his crew retrieved a living coelacanth from their deep-set (100-150 m depth) shark gill net off the young volcanic island of Manado Tua, nearly 10,000 km from the Comoros. The specimen was 124 cm in total length and weighed 29.2 kg, and the author was able to observe it underwater for almost three hours before the carcass was deep frozen and tissue samples taken for molecular analysis (Figs. 1a-d).

In late September 1998, the fish was transported frozen to Jakarta for the purpose of preservation in formalin. Before immersing in 10% formalin, the specimen was injected with full-strength formalin in all fins, organs and throughout the body using a large-bore hypodermic needle fitted to a pressure sprayer. After 7 weeks of immersion in formalin, the specimen was rinsed and transferred into successively stronger concentrations of ethanol. It is now stored permanently in 70% ethanol in an airtight display case.

Just prior to formalin fixation, a preliminary morphological examination of the specimen was conducted. This revealed that the specimen was a female with three maturing eggs (approximately 3 cm diameter) in the ovary (Erdmann et al., in press). A review of the literature suggests that this is the second smallest-sized female coelacanth known with eggs; the only smaller specimen was a female of 109 cm TL reported with a number of immature eggs in the ovary (Millot et al., 1978). The specimen was officially donated by the author to the Indonesian Institute of Sciences' Research and Development Center for Biology (PPPB-LIPI) in Cibinong, Java, and it was accessioned as specimen # MZB10003 (Erdmann et al., in press).

The preserved specimen was actually the second coelacanth to be reported from North Sulawesi. On 18 September 1997, the author's wife saw a strange-looking fish being wheeled across the parking lot at Pasar Bersehati market in Manado (Erdmann, in press). Although the fish was immediately recognized by the author as a coelacanth, we were only able to take some photographs of the fish and briefly interview the fisherman before it was sold. After later determining that this was an exceptional find, a directed search was initiated to find another specimen.

Interviews were conducted in fishing villages throughout North Sulawesi, with over 200 fishermen interviewed and shown pictures of the coelacanth during the period from November 1997-April 1998. Although the majority of the fishermen interviewed had not seen the coelacanth previously, by late March 1998 we had identified several fishermen who seemed to recognize the fish in the pictures. These fishermen fell into two groups. Several hand-lining fishermen claimed that the fish in our pictures was "ikan sede", caught at night in a manner most similar to that reported for Comoran fishermen who occasionally catch coelacanths (Stobbs and Bruton, 1991). On the other hand, two fishermen from Manado Tua island informed us that this fish was actually "raja laut" ("king of the sea"), also caught at night, but in only in deep shark nets. The dilemma was soon solved when the ikan sede fishermen delivered to us a specimen, which turned out to be the oilfish Ruvettus pretiosus. Four months later, Lameh Sonatham delivered to us the still-living coelacanth that is now preserved in Cibinong.

Since that time, we have identified at least four fishermen in North Sulawesi who convincingly claim to have previously captured

coelacanths. Reports of varying reliability have also been received from people claiming to have witnessed coelacanths captured from other areas of Indonesia, including South Java and the Sangihe-Talaud islands above North Sulawesi. There appears to be strong evidence that at least one viable population of coelacanths exists in Indonesia, and possibly several. This immediately raises further questions: how large is the Indonesian population(s), and how closely related is it to the Comoran ones? Do further coelacanth populations exist in the vast area of ocean between Sulawesi and the Comoros?

A NEW SPECIES?

One method of examining these questions is to determine the depth of divergence between the Sulawesi and Comoran populations using mitochondrial DNA sequence comparisons; evidence of recent gene flow between these two widely separated populations would be highly suggestive of intervening populations. Recently completed molecular analyses have revealed that a 3,221 base sequence obtained from the mitochondrial genome of the Sulawesi specimen is 3.4% divergent from the published sequence of an animal captured from the Comoros, indicating a likely depth of divergence of 5.5-7.5 million years (Holder et al., submitted).

In view of the substantial sequence divergence between the populations of coelacanths, it seems likely that the Indonesian population may represent a new and undescribed species of Latimeria. However, despite this substantial molecular sequence divergence, the preliminary morphological examination conducted at Cibinong and a limited morphometric comparison has shown that the Sulawesi specimen has a very similar allometry and overall external morphology to L. chalumnae (Erdmann et al., in press). This apparent contradiction is perhaps to be expected; the coelacanth lineage has shown surprisingly few morphological changes throughout its 360-million-year history, and Latimeria is remarkably similar to its nearest fossil relative Macropoma (Forey, 1990). A detailed morphological investigation of the Sulawesi specimen is planned by PPPB-LIPI, Cibinong, in order to further explore the extent of morphological differences with Comoran specimens and the question of specific status for the Indonesian coelacanth.

With no fossil record of the age or original geographic range of Latimeria, it is difficult to postulate historical biogeographic explanations of the molecular divergence of these populations. It is possible that the massive tectonic changes which led to the formation of the Indo-Australian Arc and resultant separation of the Indian and Pacific Oceans caused a barrier to gene flow between these populations during the Miocene (Audley-Charles, 1991). The proposed Mindanao-Sulawesi land bridge, in conjunction with various proposed closures/constrictions of the Makassar Strait between Borneo and Sulawesi, may have resulted in isolation of a north Sulawesi coelacanth population in a Sulawesi/Sulu Sea basin during the Miocene and Pliocene (Hamilton, 1979; McManus, 1985). More recently, a combination of eustatic changes and possible tectonic movements may have resulted in constriction of the Makassar Strait during the late Pliocene and continuing through the Pleistocene (Audley-Charles, 1991).

FUTURE RESEARCH PRIORITIES

Research on the Indonesian coelacanths has only just begun, and there are many exciting avenues to be explored in this regard. Some will undoubtedly require collaboration with foreign scientists with previous expertise in coelacanth research, but there is considerable scope for individual research by interested Indonesian scientists. Research priorities at this time include detailed morphological and anatomical studies of the single preserved specimen, further characterization of habitat preferences and population size of the Manado Tua population, and exploration of promising additional sites within the archipelago which may be home to further coelacanth populations.

As mentioned previously, a very important priority at this time is detailed anatomical study of the preserved specimen in order to determine if it indeed represents a new species

of Latimeria. This research is already planned by the staff of PPPB-LIPI in Cibinong, and may include the collaboration of a foreign specialist in coelacanth taxonomy. However, there are many additional studies which should be undertaken with the preserved specimen, including stomach contents analysis, description of the immature eggs contained within the ovary, biochemical and genetic characterization of the specimen, and other possibilities. Numerous foreign scientists have already expressed interest in collaborating on such studies. While such collaboration is one alternative, this author strongly urges LIPI and associated scientific institutions in Indonesia to take full advantage of the opportunities presented by this specimen and encourage young Indonesian scientists to become involved in coelacanth study. Foreign collaborations can be beneficial in this regard, but only if there are Indonesian scientists who fully participate in the research and learn from the experience.

Further characterization of habitat preferences and population size of the Manado Tua coelacanth population is currently underway. Depth and temperature profiling are being conducted around Manado Tua using a transom-mounted sonar unit and continuous recording, substrate-attached Onset TidBit(temperature recorders. Preliminary results suggest that the slope angle at Manado Tua is similar to that reported for Grande Comore island (approximately 45(), while the thermocline at Manado Tua may be much less stable than that in the Comoros (Fricke et al., 1991; Erdmann, unpub.). Frequent cold-water upwelling in the area results in large temperature fluctuations of up to 7(C within a 30 minute period, and temperatures as low as 18.5(C have been recorded at only 40 m depth. This may allow coelacanths to penetrate relatively shallow waters of Manado Tua.

Unfortunately, more detailed habitat characterization and estimation of the size of the coelacanth population at Manado Tua is hampered by the typical depths at which coelacanths reside. Further work in this vein will require the use of either manned submersibles or remote-operated vehicles (ROV's) outfitted with video cameras and capable of reaching 200-300 m depth. This will require foreign collaboration, as there are currently no such instruments available for use within Indonesia. Several foreign expeditions are currently planned, including one expedition involving LIPI scientists and Hans Fricke and his team using the submersible JAGO. The Fricke team is currently the only research group in the world with experience observing and filming coelacanths in situ, and it is hoped that this expedition will be successful in locating and documenting the Manado Tua population.

The possibility of additional coelacanth populations within Indonesia seems very likely; with over 17,000 islands and 81,000 km of coastline, the Indonesian archipelago is the worlds largest. More importantly, many of these islands appear to provide optimal coelacanth habitat - steep, young volcanic slopes which plunge into deep (1000 m+) water (Monk et al., 1997). Regions of Indonesia which seem particularly promising as candidates for further coelacanth populations include the southern coasts of Java and Sumatra, the Sangihe-Talaud islands to the north of Sulawesi, and the Inner Banda Arc in Maluku, stretching southwest from Banda to Wetar. A number of reports of previous coelacanth sightings in these areas have been received from interested anglers, divers, citizens and expatriates, and plans are being made to investigate these areas more thoroughly.

Exploration of these additional candidate areas will include at least two methodologies. One possibility is the use of fishing village surveys using photographs of the previously-captured specimens as well as educational posters and brochures that are planned for publication by LIPI. While such research is "low-tech" and relatively inexpensive, it suffers from the vagaries which plague interviews of fellow human beings. Furthermore, even in areas where coelacanths may exist, if the fishing communities do not use gears which sample the appropriate habitat (e.g., deep handlines or deep gill nets), negative results will invariably be obtained. Nonetheless, fisher surveys are a worthwhile means of preliminary

investigation of further candidate coelacanth sites.

The most direct means of exploring for further coelacanth populations is again the use of either manned submersibles or ROV's. Depending upon the results of the proposed JAGO mission to Manado Tua and further fisher surveys around Indonesia, it may be a worthwhile investment for the Indonesian scientific community to consider purchase or loan of either a submersible or an ROV in order to initiate an active phase of in situ coelacanth research in Indonesia.

CONSERVATION EFFORTS

In the meantime, it is extremely important for the Indonesian government, scientific community and environmental NGO network to continue and build upon early coelacanth conservation efforts. From the outset of coelacanth research in Indonesia, conservation of this unique aspect of Indonesia's natural heritage has been the foremost priority. The announcement of the discovery of the Sulawesi population was postponed until the finding was privately presented to LIPI and PHPA and the conservation implications thoroughly discussed within the Indonesian government. Only after the pertinent conservation and scientific authorities were aware of the importance of the find and of preventing exploitation of the coelacanth population was the announcement released to the journal Nature for publication. The date of publication was timed to coincide with President Habibie's visit to Manado to preside over the "International Year of the Oceans" activities. Within days, the discovery was covered in newspapers and magazines around the world and even on television on CNN and Reuters. Within Indonesia, media coverage in national and local newspapers, magazines and television has stressed the need for conservation of this new national treasure.

This engagement with local and national scientists, policy-makers and media representatives has been highly successful. At the national level, several meetings organized by LIPI have been held to discuss the finding amongst concerned agencies and plan a national agenda for coelacanth research and conservation. Additionally, a ministerial decree declaring the coelacanth a national heritage which must be protected is now being considered by the Minister of Forestry and Agriculture. Also, the Convention on International Trade in Endangered Species (CITES) authority in Germany has contacted LIPI to discuss the possibility of extending Appendix 1 status of the living coelacanth from *Latimeria chalumnae* to the broader category of Latimeria spp., in order to extend protection to the potentially undescribed Indonesian species.

At the local level, the Bunaken National Park Authority (Balai Taman Nasional Bunaken) is well-informed on coelacanth conservation issues, as are dive operators and village policemen within the park. It is hoped that the Manado Tua coelacanth can act as a "keystone species" for the Bunaken National Park and provide a focus for improved coral reef management within the park. At least one local environmental NGO, Kelola, has begun a coelacanth education and conservation program for the villages within the park. This publicity and awareness has paid off; at least three attempts by foreign tourists/unofficial visitors to offer large rewards for further specimens have been reported by the local community and rejected by fishermen.

The likelihood of such incidents increasing in the future was a major reason for a recent meeting held in Manado in early February 1999. Sponsored by the Japanese development aid agency JICA, this meeting brought together representatives from LIPI, Universitas Sam Ratulangi, Dinas Perikanan (both national and provincial level), Balai Taman Nasional Bunaken, BAPPEDA and local and national environmental NGO's to discuss coelacanth conservation priorities. Results from that meeting include an acknowledgement that the greatest threat to coelacanth survival in North Sulawesi is not from artisanal fishermen who occasionally catch coelacanths as bycatch, but rather from potential directed efforts to capture coelacanths for either exotic animal collectors or scientific institutions, or for attempted display in

aquariums. It was strongly agreed upon that such efforts, especially to capture coelacanths for live display, must not be allowed unless substantial evidence can be compiled to show that such capture would not endanger the potentially small population here. While live display of captive coelacanths in the future may be potentially rewarding for both research and conservation purposes, all previous attempts at live capture of coelacanths have failed miserably, and such attempts should be forbidden until it is shown conclusively that living coelacanths are not in imminent danger of extinction.

Other results of the February meeting include plans for more detailed socioeconomic surveys of fishing villages within the Bunaken National Park. These surveys will further ascertain the incidence of coelacanth bycatch within the Park, the number and percentage of fishermen using gears likely to produce coelacanth bycatch, and the necessity and feasibility of banning gears which are likely to catch coelacanths and instead promoting alternative livelihood programs for displaced fishers. Additionally, representatives present at the meeting agreed on the need for a national poster campaign to both increase awareness of the Indonesian coelacanth and provide detailed instructions to fishermen on the importance of preserving bycatch specimens and contacting relevant authorities such as LIPI, Dinas Perikanan, or nearby PHPA offices such as Balai Taman Nasional Bunaken. Poster design is currently being considered, and funding from JICA will be sought to cover production costs.

The discovery of an Indonesian population of living coelacanths provides hope that conservation prospects for this magnificent fish are now considerably brighter. At the same time, it brings with it an important responsibility for the Indonesian people to act as wardens of this unique aspect of both Indonesia's and the world's natural heritage. The eyes of the international conservation community are now focused on Indonesia, and we must accept full responsibility for careful stewardship of the Indonesian coelacanth.

ACKNOWLEDGEMENTS

We would like to gratefully acknowledge the sponsorship and support of the Indonesian Institute of Sciences and the financial support of the U.S. National Science Foundation (International Programs Grant #INT-9704616) and the National Geographic Society (Grant #6349-98). The staff of PPPB LIPI have been most accommodating and enthusiastic, especially A. Tjakrawidjaja, Y. Suhardjono, I. Rachmatika, S. Wirjoatmodjo, R. Hadiaty, Pak Koestoto, and Ibu Siti Prijono. S. Jewett and the Smithsonian Institution provided financial and logistical help in preserving the specimen and arranging CITES export permits for tissue export. Additionally, Pak Subiyanto from PHPA was invaluable in arranging the CITES permit. A. Mehta-Erdmann provided valuable comments on the manuscript. I would also like to express gratitude to the Onset Computer Corporation for donation of TidBit(temperature recorders for use in this research. Finally, thanks very much to Om Lameh Sonatham and his crew for delivering to the world the first preserved Indonesian coelacanth.

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Combatting Destructive Fishing Practices in Komodo National Park: Ban the Hookah Compressor!

ABSTRACT

In efforts to quantify and combat destructive fishing practices in Komodo National Park, The Nature Conservancy has learned that patterns of marine resource use are complex. While patrols have successfully decreased the incidence of large-scale dynamite and cyanide fishing, considerable further protection is needed before the Park is truly a Marine Reserve. Currently, live reef fish have priority for places on the airplane out of Labuan Bajo, while visitors who come to see the Komodo dragon and the world's richest coral and fish life must take a 12-hour ferry! The demersal fish stocks and coral reefs, which have suffered considerable damage already, continue to be threatened by a variety of destructive methods, including the use of hookah compressors, reef gleaning, fish traps, gillnets, and bottom lines. In particular, banning the use of hookah compressors, which are used in both dynamite and cyanide fishing, is recommended. On paper, legislation protects all animals, plants, and habitats within the National Park, yet Park Authorities and Police Officers are not aware of the destructive impact of commonly practised fishing methods like compressor fishing, reef gleaning and 'bubu' trap fishing.

ABSTRAK

Dalam rangka mengukur besarnya akibat dan memberantas praktek-praktek penangkapan ikan yang bersifat merusak lingkungan di kawasan Taman Nasional Komodo, The Nature Conservancy menemukan/mendapatkan bahwa pola pemanfaatan sumberdaya alam ternyata kompleks sekali. Walaupun patroli laut telah sangat berhasil dalam menurunkan jumlah kegiatan penangkapan ikan skala besar dengan bahan peledak dan racun sianida, namun perlindungan lebih lanjut sangat dibutuhkan sebelum taman nasional ini dapat sungguh-sungguh menjadi Taman Suaka Kelautan. Pada saat sekarang pengiriman ikan karang dalam keadaan hidup memperoleh prioritas dalam pemakaian ruangan di pesawat terbang yang keluar dari Labuan Bajo, sedangkan pengunjung dan wisatawan yang berdatangan untuk melihat Komodo dan kehidupan ikan dan terumbu karang yang paling kaya di dunia haruslah menggunakan perahu penyebrangan (*ferry*) yang memakan waktu 12 jam. Sementara itu, stok ikan demersal dan terumbu karang yang telah cukup banyak mengalami kerusakan, tetap terus terancam kelestariannya oleh aneka ragam cara penangkapan yang tidak akrab lingkungan, termasuk penggunaan kompresor "hookah", pencukilan karang, bubu dan jaring insang serta pancing dasar secara khusus, pelarangan penggunaan kompresor "hookah", yang digunakan baik penangkapan dengan bahan peledak dan racun sianida (potas), sungguh direkomendasikan. Di atas kertas, hukum (undang-undang dan peraturan telah melindungi segala jenis satwa, tanaman dan habitat yang berada dalam taman nasional. Namun, otoritas taman dan petugas kepolisian tidaklah selalu waspada akan akibat buruk dari cara-cara penangkapan yang sekarang ini lazim dikerjakan disana, seperti halnya dengan kompresor, pencukilan karang dan pemakaian jerat atau bubu.

1. Komodo National Park

Komodo National Park (KNP, Figure 1) is located between the islands of Sumbawa and Flores in Indonesia. The Park was established in 1980, and has a management unit with 88 staff. The Park was declared a Man and Biosphere Reserve and a World Heritage Site in 1986. KNP includes three major islands, Komodo, Rinca and Padar, and numerous smaller islands together totalling 41.000 ha of land. KNP is famous as the habitat of the Komodo dragon, Varanus komodoensis, but it is also one of the richest areas for coral biodiversity in Indonesia, and has one of the richest fish faunas in the world with an estimated 1.000 species. The Park contains 132.000 ha of marine waters, with a high diversity of habitats including coral reefs, rocky shores, sea grass beds, sandy bays and mangroves.

There are presently some 2.300 inhabitants living within the Park, spread out over 3 settlements (Komodo, Rinca and Kerora). An estimated 15.000 people live in fishing villages directly surrounding the Park. Park inhabitants mainly derive their income from a pelagic lift net ('bagan') fishery (95% of their yield comes from this geartype) which is targeting squid and small schooling pelagic fish. Additional income and food is derived from reef gleaning ('meting'), a method whereby corals are destroyed in search of marine invertebrates. Non-inhabitant fishermen use pelagic lift nets and a variety of other geartypes in KNP waters. Although the pelagic lift net forms the most important geartype in KNP in terms of yield, other fishing methods form a major threat to the Park's marine resources. Destructive fishing practices such as dynamite and cyanide fishing (with the use of hookah compressors), reef gleaning and local overfishing destroy both the habitat and the targeted resource itself (fish and invertebrate stocks).

2. A Management Plan for the marine component of Komodo National Park

Upon request from the Ministry of Forestry, The Nature Conservancy (TNC) is assisting the National Park's authority with the management of the marine component of the Park. In October 1996, a draft management plan was completed for the marine component of KNP. The objective of the Park management is "To protect the demersal and sedentary marine life forms of Komodo National Park, their ecosystems and their habitats, and to maintain the natural population and community structures of these life forms". Key modules in the management plan are:

I. Design of a marine park zonation plan and specification of regulations.
II. Implementation of a cross-sectoral enforcement program with Park Authorities, Police, Army, Fisheries Service, Local Government and Communities.
III. Involvement of local communities through: 1) community awareness programs, 2) participatory planning, and 3) establishment of a local NGO.
IV. Building of partnerships with private enterprise to develop alternative livelihoods in a variety of compatible enterprises such as: eco-tourism, mariculture and fisheries for large coastal pelagic species.
V. Implementation of an environmental mooring buoy program to prevent anchor damage from boats bringing tourist to popular snorkelling and diving sites.
VI. Implementation of a comprehensive monitoring and research program to evaluate management measures and suggest the most desirable and effective interventions. The monitoring and research program includes the following sub-modules:
    a. monitoring of the status of the coral reefs,
    b. monitoring of the status of commercially targeted fish populations and their spawning aggregation sites,
    c. monitoring of fisheries resource utilization patterns,
    d. applied research and monitoring of the sustainability of proposed compatible enterprises (alternative livelihoods), and
    e. applied research and monitoring of the effectiveness of different methods to enhance coral reef rehabilitation.

The present paper focuses on the results from monitoring programs and on the need for effective law enforcement. This focus does not imply that other program modules are less important, on the contrary, it is our strong belief that the Park management will only achieve their goals by implementing a comprehensive program in which community involvement and alternative

livelihood strategies are very important modules. These other two modules will therefore be discussed in separate papers.

3. Present status of the resource and patterns in resource utilization

3.1. The Coral Reefs

The coral reef monitoring program covers 185 sites which are all surveyed every two years and at 3 different depths. Averages over 25 square mile areas of the Park are used to estimate the overall status of the coral reefs (Figure 2). Results of the 1996 monitoring round show that serious damage has occurred in most areas inside and outside the Park. The most heavily affected areas inside the Park are found in areas bordering the bufferzone in the northeastern region of the Park, namely the reefs off northeast Komodo, north Padar and north and east Rinca. In all these areas 65% or more of the hard coral was dead in 1996. The least damage (less than 45% mortality) occurs in the southwestern and southern areas of the Park, with some healthy (hard coral) reefs found especially in the south Komodo and south Padar regions. A few locations in the far northeast of Komodo also remain in good condition. The amount of damage generally increases from south to north and from west to east. Most fishing communities have their settlements on the northeastern side of the Park, except for Sape which is on the west side of the Park.

3.2 Fish Spawning Aggregation Sites

By monitoring the size frequencies of a number of commercially targeted fish species on a number of known aggregation sites, it will be possible to evaluate developments in the fish populations in a cost-effective manner. By identifying mass spawning sites for important fish species it will be possible to select areas which need special protection. Preliminary results show that a number of aggregation and spawning sites have been positively identified in the northeastern and southeastern areas of Komodo. Spawning aggregations of four species of grouper and of napoleon wrasse were observed to occur in these areas around the month of October. The spawning aggregation sites contain concentrations of these species during all months of the year. Many more fish spawning aggregation sites are thought to exist within the borders of Komodo National Park and additional site surveys will be conducted in October 1998.

3.3 Patterns in Marine Resource Utilization

A routine patrolling and enforcement program started on 28 May 1996, with the intention to have 2-day patrols covering the entire park area on a weekly basis, and to investigate all capture fisheries activities encountered. The number of incidents of dynamite and cyanide fishing dropped significantly during the first period of intensive patrolling in 1996. A reduction of more than 75% was recorded for dynamite incidents, and several arrests were made of fishermen using destructive fishing methods in and around the Park.

Members of the enforcement team have been trained to record data on resource utilization patterns during routine patrols in the KNP area. This data includes number, type and origin of fishing crafts, their catches and their distribution in space and time. Each non-bagan (non lift net) fishing vessel or fishing group encountered during the routine patrols is investigated. Bagan are excluded since they form a separate type of pelagic fishery which is not considered threatening to the demersal and sedentary marine resources of Komodo National Park. Bagan boats are

investigated when they engage in non-bagan activities. The objective of this monitoring program is to determine who is doing what, where and when in the Park. The data base on resource utilization patterns shows Park Managers which community groups are involved in which fishing activities, where they fish, and when they fish. Over time this data will also show any changes in the behaviour of fishermen due to management measures and it will indicate which groups of fishermen or areas in the Park may need extra attention.

Non-bagan fishing effort in the park ranges from less than 300 boats per 25 square miles per year in the south to more than 1000 boats per 25 square miles per year off the coast of northeast Komodo (Figure 3). The area with the highest fishing effort is also the area with the highest coral mortality. Areas with low coral mortality are typically those areas where fishing effort is low, (Figure 4) although high coral mortality is also found in a few areas where fishing effort is relatively low. There are no areas where fishing effort is high and coral mortality low. It is also clear that fishing effort is relatively high in areas where fish spawning aggregation sites are located and fishing therefore forms a direct threat to the fish species aggregating at these sites.

Communities in the Park, the villages of Komodo, Rinca and Kerora, represent only 21% of the non-bagan fishing effort in the Park. Communities directly surrounding the Park (Mesa, Papagarang, Labuan Bajo and Warloka) represent 36%, communities from Sape (east Sumbawa) represent 29% and outsiders from further away represent 14% of the effort. Fishermen from Komodo and Rinca are involved in reef gleaning (Figure 5), those from outside the Park mainly in bottom hook and line fishing, gillnetting, compressor and 'bubu' trap fishing.

Most geartypes are specifically yielding single yield categories except for 'compressor' and 'reef gleaning' (Figure 6). The latter two geartypes typically yield a widely varied catch, ranging from live fish and lobster (often caught with cyanide) to sea cucumber, shellfish (mostly abalone and pearl oyster), coral and seaweed. These two geartypes or methods form major threats to the marine ecosystem of Komodo National Park. It should be noted here that dynamite and cyanide fishermen (at least the larger operations) always use compressors to bring divers down and to collect their catch.

Non-destructive and low-impact methods such as pelagic hook and line together account for only 18%, whereas the highly destructive methods of reef gleaning, compressor fishing, trap fishing and 'other methods' (including bomb and cyanide fishing) together account for 34% of the total non-bagan effort. The most common geartypes used in the park, are bottom hook and line and gillnets. These geartypes together account for 48% of total effort in the Park. These geartypes are forming direct threats for the sedentary fish stocks in the Park, especially when they are used in areas where fish are aggregating to spawn. Large amounts of spilled nylon fishing line were encountered at fish spawning aggregation sites and certain species like square tail coral trout (Plectropomus aerolatus), which aggregate on shallow coral reefs, are decimated on these sites.

It is estimated that around 1.000 tons of fish, lobster, shrimp, pearl oyster and abalone were harvested from Komodo National Park in 1997. In comparison, this is about the same amount in weight as the bagan (lift net) yield from Park inhabitants (Komodo and Rinca) alone. It is important to realize that non-bagan yields represent only 5% in terms of weight of the total yield (bagan + non-bagan) landed by Park inhabitants. Fishermen from Komodo comment that non-bagan activities are still important to them since the bagan fishery is exploited by middlemen which leave very little of the profits for local fishermen. Freeing the fishermen from the claws of these middlemen, and helping them to gain higher profits from their bagan activities may be an important strategy to keep them from destroying the reefs.

4. Destructive Fishing Methods and Law Enforcement

Although the frequency of dynamite fishing in the Park has been low during recent years, destructive fishing practices and local overfishing remain a constant threat to the Park's sedentary marine ecosystems. We can really not speak of a 'Marine Reserve' when harvesting and destruction of marine life is taking place at a rate as presently is the case in Komodo National Park. We have a long way to go before the KNP waters will be a marine reserve where all living creatures and their habitats are fully protected. The local Fisheries Service, for example, feels that the KNP waters are fishing grounds where yields have to be maximized. Park Managers, however, comment that legislation is already in place to protect all animals, plants and their habitats within National Parks in Indonesia. Enforcement of this legislation, however, has not been implemented. Supporting materials from outside sources would help to convince the Park authorities of the need of a ban on hookah compressors. The protection of the marine environment in KNP has to be taken seriously and the following phases of increasingly strict law enforcement need to be implemented.

I. Remove of all large-scale dynamite and cyanide fisheries from within the Park's borders. Large-scale dynamite operations work with big boats and dive crews in canoes with hookah compressors. Large-scale cyanide operations consist of motherships with several work-boats with hookah compressors.
II. Combat large-scale dynamite and cyanide fishing in the bufferzone (northeast of KNP) and further outside the park.
III. Remove of small-scale dynamite and cyanide fisheries (with compressors in small boats) from within the Park's borders.
IV. Combat small-scale dynamite and cyanide fishing in the bufferzone and other areas directly adjacent to the Park.
V. Prohibit of key destructive geartypes from within the Park's borders. The most urgent need here is to ban the hookah compressor.
VI. Close the Park for demersal geartypes like gillnets and bottom hook and line. Only by banning the widespread use of gillnets and bottom hook and line from the Park, starting with a closure of fish spawning aggregation sites, can sedentary fish stocks truly be protected. Exceptions will have to made for Park inhabitants.
VII. Establish of multiple-use zones near settlements in the Park, where inhabitant fishermen have exclusive fishing rights to use demersal geartypes. The Park waters should remain open for pelagic fisheries, preferably with exclusive fishing rights for Park inhabitants and neighbouring communities.

In the section below, the different phases are discussed and examples are given to highlight the specific problems which are encountered while trying to achieve the goals.

I. Remove large-scale dynamite and cyanide fisheries from KNP waters

The first objective is the most easy to achieve once a routine patrolling program has been installed. Large-scale operations, run by outside fishermen, are simple to identify and have in fact been reduced by more than 80% from Komodo National Park. Serious confrontations took place especially in 1996 after which the message was clear and this type of operations became rare inside the Park. Live-aboard dive vessels still occasionally report bombing in remote corners of the Park and these are sometimes larger operations. If reports come in time, a patrol can be sent out and the bombers can usually be arrested. Large-scale cyanide fishing for aquarium fish is still occasionally

encountered and is difficult to prosecute. Boats from east Java have been chased out of the Park on various occasions but Police and Park wardens seemed unwilling to make arrests, supposedly since ex-military personnel are present on these boats.

Example. On one recent occasion our monitoring crew reports 2 large boats (15 and 20 GT) inside the Park, off northeast Komodo. Judging from their model these boats are from Banyuwangi or Madura (east Java), and they are using hookah compressors, probably fishing for aquarium fish with cyanide. We receive the report at 15.00 pm, immediately inform the Park authorities and the Police and are told to keep one speedboat standing by. We suggest sending 2 speedboats immediately. The next morning the KNP authorities and the Police send some people to go out after the cyanide boat, using one of our speedboats. The enforcement team reports later that they found the cyanide boats that morning. They were from Banyuwangi and they were fishing with cyanide for aquarium fish. One man is arrested and our speedboat driver finds some 8 to 10 litres of cyanide solution which is taken in as evidence. One person is arrested and placed in the speedboat. According to our boat driver the Police officers wanted to let the boats go right away, but the KNP staff did not agree. After that, the enforcement team orders the cyanide boats to go to Labuan Bajo immediately. They do not put any guards on the boats and they do not follow them either. Instead they go in to a Park ranger station on Komodo Island to have their lunch. When they finally go to Labuan Bajo, the cyanide boats are obviously not there. The arrested person, who is still on the speedboat, is ex-Navy and he would later be released because of "lack of evidence". This is an example where competence and bonafide leadership were clearly lacking in the enforcement team. Since late 1997 TNC has hired a pensioned Chief of Police from the region, who has an excellent patrolling record and who is joining on all patrols since early 1988. A successful arrest of a large-scale cyanide operation was made outside the Park under the leadership of this ex-policeman.

II. Combat the large-scale dynamite and cyanide fisheries in the bufferzone and other areas outside the Park.

Our present strategy is to combat the large-scale destructive fisheries as soon as they enter the Park bufferzone or other waters in the immediate Park surroundings. The minimum objective of this strategy is to make these operations leave the area before they enter the National Park, the maximum objective is to have these operations prosecuted as an example and warning to other operations. Unfortunately National Park staff are not allowed to patrol outside the Park under their present leadership but fortunately the local Police has recently obtained "Water Police" status, which means they can and should react immediately to any report of illegal activity in the waters of Komodo District. In practice this means that any suspected activity outside the Park can now be checked by calling the Police who will normally send two constables with us in our speedboat to investigate the activity. In 1997 this strategy led to violent clashes with outside large-scale dynamite fishermen who tried to throw bombs in the speedboats but who were answered with gun fire. Although actual arrests are difficult and dangerous, usually these boats do not return after this type of engagement. In case of one serious clash, the crew of a dynamite boat was arrested in Maumere Hospital, on the north coast of Flores Island, where they reported in with several shot wounds. Fortunately nobody was killed.

Fish bombing at a larger-scale still takes place at Gili Banta, north west of Komodo, by boats from Sape (east Sumbawa). This island is too far for intervention from Labuan Bajo and belongs to the Nusa Tenggara Barat (NTB) Province, where Police from Labuan Bajo have no jurisdiction. Nothing can be done here from our side. In February 1996, Banta Island was recommended for

addition to KNP and NTB provincial authorities pledged commitment to protect the Island. Nothing happened after that.

No fewer than 7 large cyanide boats (fishing for aquarium fish) from Banyuwangi have been spotted working in and just outside the bufferzone, north of KNP, in December 1997. Most of them were checked by the police and cyanide was found on all occasions. Still, these boats were only chased away and not a single person was apprehended. The district Chief of Police was present when one of these boats was investigated. Most of these boats seemed to have ex-Army or ex-Navy personnel on board. We have to have our own strong leadership on the patrol boats to make sure that arrests are made.

Late December 1997, four "*Hong-Kong-type*" metal dinghies (blue and red) with modern outboard engines, compressors and well-equipped dive crews were working around the north western tip of Flores Island. Most likely a cyanide operation which was based on a mothership, although we couldn't locate that vessel. This case was reported to the Fisheries Service who did not react. We decided to see if we could locate the mothership, and found it a few days later (the operation had moved east), with the same dinghies working nearby. Again they were diving and we suspected cyanide fishing for live reef food fish. In Labuan Bajo we reported to Police and Fisheries and we went out with two speedboats.

We apprehended the mothership and five speedboats equipped with professional gear. The divers were surprised and asked us what was going on since their boss had already "talked to the authorities". Four of the dinghies were equipped for diving and working when we arrested them. One dinghy seemed to be on stand by. The divers were using Technisub dive suits, modern regulators and well maintained hookah compressors. All dinghies had brand new Yamaha outboard engines. Each dinghy had two divers and two helpers in the boat. We came in at very high speed to minimize their time for reaction. When we approached the speedboats, the divers were just surfacing and they threw several plastic squirt bottles in the water which we were able to recover. On all speedboats and on the mothership we found many squirt bottles with unknown content.

The divers had caught groupers (flowery cod, E. fuscoguttatus), barramundi cod, coral trout (P. leopardus), lobsters and napoleon wrasse. One napoleon wrasse must have weighed more than 25 kg. One dinghy had caught 13 large flowery cod in a few hours and from the look of this catch we suspected they were in the process of cleaning out a spawning aggregation. Each dinghy had a small reservoir build next to the live fish well, where they were mixing a solution of sea water with Sunlight soap bars and possibly other substances (cyanide). We do not know what the soap is for but we have thought of a few options:

1. The soap actually increases the effectiveness of the cyanide solution
2. The soap keeps the cyanide in solution
3. The soap forms a white cloud underwater, showing where the solution is and facilitating manipulation
4. Decoy

We do not know which, if any of these, is the answer. If this practice has been observed earlier and/or if it is known why the soap is used, we would very much hope to hear the answer to this question.

On the mothership we found several bottles with a solution showing white powder (but no soap). We suspect this to be cyanide. The concentration in these bottles seemed to be high since the powder was not dissolving. On the mothership there was a large box with sunlight soap bars. In total there were 8 hookah compressors (4 on the mothership and one in each dinghy). The mothership had a large well-maintained inboard engine and two auxiliary Yamaha outboard

engines. The mothership could work with 8 divers in the water and each dinghy with 2 divers. It is about 25 meters long and has several large live fish wells. There were 23 crew in total and all were brought to Labuan Bajo where they are being processed by the police.

The captain showed some letters, with signatures from the local Fisheries Service and other local government officials which would allow this boat to fish with "hook and line" and "traps". No gear of this kind was found on any of the boats and the letters were not official licences but "locally arranged papers". The crew told us that their boss was called Arifin, from Kendari, Sulawesi, and this person would be staying at the house of Pak Haji Idris (a local live fish trader) in Labuan Bajo. Rumours are, that the whole operation is actually financed by a Korean person who is using Arifin as a straw man. We have agreed with the local head of police that we will supply travel money for one policeman to bring the evidence to the Criminal Laboratory in Jakarta.

We have also obtained several bottles (which were not recorded as evidence) which we had analysed separately to enable cross-checking of results. One set of five bottles was send to Vaughn Pratt at the International Marinelife Alliance (IMA) and these samples tested positive for cyanide. A second set was send to PT Sucofindo in Jakarta and these also tested positive with reported results for cyanide concentration:

"Sample 1" : 762.50 mg/l
"Sample 2" : 1251.00 mg/l (with soap)
"Sample 3" : 2017.50 mg/l
"Sample 4" : 2.30 mg/l (with soap)
"Sample 5" : 1401.00 mg/l

"Sample 4" was filled out of the reservoir in the dinghy, into a used squirt bottle. This result suggest that the cyanide was not yet mixed in that reservoir. The low concentration was probably left over cyanide from the used bottle.

In the meantime the local Fisheries Service has reported to its upper echelons that the arrested fishermen were using just soap to catch fish and that there was no cyanide. The boat is still being held because it didn't have all the right papers but the rumours are that this will be "fixed" before the trial starts. The police sent one constable to the criminal laboratory only after 3 weeks and when we checked the evidence they were bringing, it was clear that "unsoaped" cyanide solution had disappeared. Some of the "soaped" solution was still there and we still have hope that the manipulation of evidence has been insufficient. There is a good chance though, that the criminal laboratory will not find any cyanide.

We are confident though that our 'minimum objective' will be achieved, and that this operation will leave the area before ever having entered the waters of Komodo National Park. The fishermen on this operation will hopefully also bring the message back home in the case they do not end up in jail.

III. Remove the small-scale dynamite and cyanide fisheries from the Park

Although the small-scale dynamite fishery is no longer a very large threat inside the Park, small-scale cyanide fishing by surrounding communities remains a major problem. Many boats from the Pulau Mesa and Sape communities are fishing with compressors inside the Park and patrol data show that they normally catch lobster and live reef fish (mostly barramundi cod). Many of the compressor fishermen are using cyanide but this is difficult to prove. They keep their cyanide containers connected to large stones which are dropped overboard as soon as they see the patrol boat. No cyanide is found when these boats are searched and it is picked up by the divers after the

patrol has left. These type of small-scale cyanide operations can only be stopped by banning the use of hookah compressors.

Inspection of holding cages outside the Park (where these boats are landing their catch) showed large numbers of napoleon wrasse, barramundi cod, groupers and coral trout. Fishermen who were interviewed upon landing admitted the use of cyanide in front of Police, Fisheries, Park authorities and the press, but nothing was done. Although the trade in napoleon wrasse is prohibited without a special licence, this means nothing in practice since local traders, who do not have any licence, can apparently continue even after serious complaints in the press. Local government officials do not seem to have any incentives to make problems for the live reef fish trade (on the contrary, we would have to conclude). Live fish fly out of Labuan Bajo to Bali every day and in the small plane take priority over tourists, who are refused and have to take an old ferry to Sumbawa. The supply of oxygen for these live fish transports is larger then the one available for recreational SCUBA-diving emergencies.

IV. Combat the small-scale dynamite and cyanide fisheries in the Park's bufferzone and in other areas surrounding the Park.

Small-scale bombing and cyanide fishing is still a problem in areas just outside the park and is very difficult to combat. Our strategy is to invest in intensive interaction with communities. Arrests will be engineered when certain groups are becoming a clear problem, but rather than pushing criminal charges, communication is the key after arrests. We try to involve small-scale fish bombers in our community work or in alternative livelihood projects after they have been arrested. Their communities will also receive extra attention in terms of awareness programs and surveillance. An example of combatting small-scale fish bombing is described below.

October 1997. Suspected fish bombing on reefs north of the Park's bufferzone, by boats with models as from Palue Island (north Flores). The boats seemed to be based in the area around Labuan Bajo since this is where they were sailing to and from. Many fishermen with boats of the "Palue model" are camping at a beach on Bajo Island, near Labuan Bajo. Fishermen from Labuan Bajo complain that these people are bombing the reefs where they normally fish with hand lines. They report that the Palue people are selling fish from fish bombing every day at Pulau Mesa. In November fish bombing is observed on a reef not far from Labuan Bajo. We observe a small green boat of the Palue model. Many dead fish are floating around while that boat returns in direction of Bajo Island near Labuan Bajo.

We find out that there is a settlement of Palue origin near Labuan Bajo in an area called "Nangenae". These people keep strong connections with their "home island", work together with fish bombers from that island and are notorious dynamite fishermen themselves. This community has now become the focus of our attention and the Police are also starting to collect information in their village.

In December our fish monitoring team reports a dynamite fishing operation at work at Kanawa Island, north of the Park's bufferzone. A small boat of the Palue type is at work and this boat is probably from the Nangenae settlement. We decide to organize an arrest and go out in the company of two policemen. A successful arrest is made of a 'Palue' fisherman from Nangenae. The fisherman confesses quickly and we confiscate around 200 kg of dynamited fish. This fishermen is roughed up a bit by the police and made to promise he will stop this practice. Our community workers recruit the man for one of their projects and he is now helping our efforts. Dynamite fishing by 'Palue fishermen' is presently on the decline in areas bordering the Park.

V. Ban the hookah compressor, the reef gleaning practices and the 'bubu' fish traps from the waters of Komodo National Park

This is our greatest challenge and is expected to have the greatest impact given the present situation. The compressor fishermen are fishing out all the lobsters and valuable reef fish, whether it be with cyanide or not. They also decimate the valuable shellfish like pearl oysters, abalone, and giant clams, the sea cucumbers, the whip corals and many other life forms, destroying marine habitat in the process (corals are broken in search of the lobsters and shellfish). The Park's authorities are still not doing anything against these practices and the local Fisheries Service is even giving out licences to fish with compressors inside the Park. Komodo National Park should not allow the compressor fishing in the Park to continue. There is no reasonable argument for fishing out lobsters, pearl oysters, barramundi cod and napoleon wrasse from this World Heritage Site and Man and Biosphere Reserve.

VI. Ban the use of gillnets and demersal hook and line from the waters of Komodo National Park, starting with a ban on fishing at the spawning aggregation sites

This will be a difficult task and can only be achieved when there is true political will to make a marine reserve out of the waters of Komodo National Park. At present the demersal fish stocks are under heavy pressure from these geartypes and population and community structures of these stocks are undoubtedly affected. Although complete closure for gillnets and bottom hook and line would be the logical intervention, it cannot be expected that this will happen soon. Better chances exist to achieve closure of fish spawning aggregation sites since the need for this measure is much easier to communicate to Park managers. It is therefore extremely important that as many spawning aggregation sites as possible are identified in the Park, and that the need for closure of these sites is urged upon decision makers.

VII. Introduce exclusive fishing rights for park inhabitants to use demersal gear in multiple use zones and for both inhabitants and surrounding communities to use pelagic gear in the National Park waters

TNC is initiating a legal study to find out what the scope is for a zonation system with exclusive fishing rights for inhabitants of National Parks in Indonesia. Implementation of such a system should coincide with a proper licensing system under the control of National Park authorities. Interventions on this level are only beginning to be discussed on a local level and will be part of the "long term planning" for a few more years.

5. Conclusions

Eventually, Komodo National Park should be closed for demersal harvesting techniques except for exclusive fishing rights for Park inhabitants in multiple use zones. The most urgent intervention is an active ban of hookah compressors for the entire Park, for which no new legislation is needed. Compressor fishermen from neighbouring fishing villages should be targeted in alternative livelihood programs such as the development of a fishery for large coastal pelagics or mariculture initiatives.

A second important intervention should be to stop the reef gleaning practices by Park inhabitants. The latter intervention may be facilitated by freeing local fishermen from the claws of middlemen so they can earn sufficient income from their bagan activities. Park inhabitants should also be directly targeted in alternative livelihood programs such as eco-tourism and/or extensive mariculture in multiple use zones.

The marine resources of Komodo National Park cannot be protected without an effective enforcement program including frequent patrols of all the Park's waters. If the Park management cannot afford or is not willing to organize these patrols, other institutes, including NGO's, can make sure that law enforcement is indeed implemented.

Corruption and lack of political will at the local level is a major barrier to be overcome before marine reserves can be successfully implemented in Indonesia. Community awareness and education therefore has to be taken to higher levels and should include government awareness and cultivation of political will.

The present status of the resource can be described with the following characteristics:

a. highly damaged and continuously degrading coral reefs,
b. continuing destructive fishing practices inside the Park,
c. high fishing effort and pressure on demersal stocks like lobsters, shellfish, groupers and napoleon wrasse,
d. few alternatives available to local communities and,
e. questions without answers on how to speed up coral reef rehabilitation.

Detailed management objectives should include:

a. stop degradation of the coral reefs and keeping the damage at a level which is not higher than what was recorded in 1996,
b. stop all destructive fishing practices, including compressor fishing, reef gleaning and fishing with 'bubu' traps,
c. implement full protection of demersal stocks, at least by banning the use of hookah compressors and by closing all known fish spawning aggregation sites to all types of fisheries,
d. promote a shift of fishing effort from demersal fishing inside the park area to pelagic fishing inside and outside the park area,
e. support members of local communities to enter in compatible enterprises like eco-tourism, mariculture or pelagic fisheries, and
f. develop a feasible methodology for the enhancement of coral reef rehabilitation.

With limited goals as described above, we can both prevent frustration and achieve a lot on a local level.

We need supporting materials from outside sources to convince the Park Management of the need for a hookah ban!

TOURISM: THE KEY PLAYER IN THE ECOLOGICALLY SUSTAINABLE DEVELOPMENT OF THE GREAT BARRIER REEF

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ABSTRACT

Tourism on the Great Barrier Reef is a major and growing industry. Currently, it is estimated as worth more than A$1 billion p.a. and attracts about 2 million visitors per year. Reef tourism is mostly nature-based and generally non-extractive involving about 600 tourism operators providing a wide range of activities.

The Great Barrier Reef, declared a World Heritage Area in 1981, has been actively managed since the establishment of the Great Barrier Reef Marine Park Authority 20 years ago. Management strategies are based on multiple use zoning and ecological principles. While most commercial use is subject to permit and regulation, an ethic of "education rather than regulation" is espoused. An evolving approach of industry self regulation, accreditation and codes of practice is being developed between managers and industry.

In 1993, a cooperative Reef research network was established as part of an Australian Cooperative Research Centre Program, bringing together major science institutions, management agencies and industry groups in a joint venture for ecologically sustainable development of the Great Barrier Reef World Heritage Area (GBRWHA).

The CRC Reef Research Centre undertakes an integrated program of research and development, training and extension, to expand Reef-based industries and provide information for better management and decision making. The Centre's programs are funded jointly by Reef industries, State and Commonwealth governments and research institutions.

The Great Barrier Reef provides a model for sustainable tourism in the context of national policies for ESD, the responsibilities for stewardship of the GBRWHA and for providing further opportunities tourism growth. The interaction of industry groups and Reef managers in dealing with challenges such as increased people pressures, use conflict and equity, benefits and disbenefits, is discussed.

KEY WORDS: marine tourism, Great Barrier Reef, marine park, cooperative research

ABSTRAK

Pariwisata di sepanjang Great Barrier Reef merupakan industri besar dan terus berkembang. Pada saat ini, diperkirakan bernilai seharga lebih dari satu milyar dolar Australia per tahunnya, dan menarik perhatian sekitar 2 juta pengunjung setiap tahunnya. Pariwisata yang berlandaskan pada terumbu karang itu kebanyakan berpijak pada keindahan alam dan lazimnya non-ektraktif (tidak mengambil apapun dari alam) dan menyangkut lebih dari 600 operator (bisnis) pariwisata yang menyediakan aneka ragam kegiatan.

Great Barrier Reef dinyatakan sebagai Wilayah Pusaka Dunia pada tahun 1981, dan dikelola secara aktif semenjak pendirian otoritas Taman Nasional Laut 20 tahun yang lalu. Strategi pengelolaan didasarkan pada zonasi pemanfaatan rangkap dan prinsip-prinsip ekologis (lingkungan). Sekalipun pemanfaatan komersial tergantung pada perizinan danperundangan, namun suatu kode etik yang berprinsip "Pendidikan (lebih baik) daripada peraturan" sangat disarankan. Sementara itu, pendekatan (yang terus berkembang) dari pengendalian diri, akreditasi dan aturan main oleh industri pariwisata itu sendiri, masih terus dibangun antara pihak pengelola dan industri.

Pada tahun 1993, suatu jaringan kerjasama penelitian mengenai terumbu karang telah dibangun sebagai bagian dari Program Pusat Kerjasama Penelitan Australia, yang telah menghimpun berbagai lembaga penelitian besar, dinas-dinas yang berkaitan dengan pengelolaan serta kelompok-kelompok industri yang berkepentingan dalam masalah tersebut, dalam suatu usaha raksasa bersama guna pengembangan yang secara lingkungan berkesinambungan dari Wilayah Pusaka Dunia "Great Barrier Reef".

Pusat Penelitian mengenai terumbu karang, CRC, memikul suatu program penelitian dan pengembangan secara terpadu, kegiatan pelatihan dan penyuluhan, guna memperluas industri -industri yang berlandaskan pada terumbu karang serta menyediakan informasi guna pengelolaan dan pengambilan keputusan yang lebih baik. Program dari Pusat Penelitian itu dibiayai secara patungan antara industri-industri yang bergantung pada terumbu karang, Pemerintah Negara Bagian dan Persemakmuran dan berbagai lembaga penelitian.

"Great Barrier Reef" menyediakan suatu model dalam industri pariwisata yang berkesinambungan dan akrab lingkungan dalam ruang lingkup (konteks) kebijakan nasional untuk ESD, tanggung jawaab para penyelia GBRWHA (otoritas dari Great Barrier Reef) serta memerlukan peluang-peluang kesempatan pengembangan pariwisata lebih lanjut. Interaksi dari kelompok-kelompok industri dan pengelola terumbu karang dalam menghadapi tantangan-tantangan seperti tekanan peningkatan jumlah penduduk, benturan kepentingan/pemanfaatan dan kepemilikan, keuntungan dan kerugian dan lain-lain dibahas tuntas dalam makalah ini.

Kata-kata kunci: pariwisata bahari, Great Barrier Reef, taman laut, kerjasama penelitian

INTRODUCTION

Tourism in Australia is a leading industry. The Great Barrier Reef (GBR) is a major region and contributor to the economic value of the industry. Tourism in the GBR has been active for many decades but it is only in the last decade and a half that it has matured to a highly professional and comprehensive range of enterprises. The GBR tourism industry of private sector operators and investors has developed in a framework of government management of the Great Barrier Reef Marine Park (and more recently, the Great Barrier Reef World Heritage Area). Like the GBR tourism industry, the Marine Park management agencies have been innovative and globally trail-blazing in their approach to their charter of conservation, protection and wise use of the GBR. The development of the industry and the Park have not been without conflict and this history provides a model for consideration in other parts of Australia and globally. Many of the elements of this development and the issues to be confronted in the future are not unique to the GBR tourism industry and Reef managers.

THE SETTING: THE GREAT BARRIER REEF

The Great Barrier Reef is not a single place or physical entity. It is an ecological region comprising a range of geomorphological structures (islands, cays, reefs, lagoons) and tropical-island and marine habitats (coral reefs, seagrasses, mangroves) with coral reef structures, ecosystems and processes predominating as the core natural features. The globally unique size and diversity of the natural structures, marine and terrestrial habitats, and the plant and animal species, linked through physical, chemical and ecological interdependency, create the ecological entity of the Great Barrier Reef.

The Great Barrier Reef World Heritage Area (Figure 1) extends more than 2000 km north-south along the continental shelf of Queensland covering 348 700 km2 - about 11/2 times the area of Great Britain - and is the world's largest marine protected area - the second largest protected region of the globe, after Greenland.

The Great Barrier Reef has an array of coral reef types (fringing, ribbon, platform) and a diversity of marine life forms, habitats and nesting and breeding grounds for birds, marine reptiles and mammals. The variety of physical and biological forms, habitats and species contribute to the special nature of the GBR and are fundamental to its attraction and opportunity as a tourist and recreational destination.

Regions of the Great Barrier Reef are readily accessible from the Queensland mainland. Towns and cities along the southern two thirds provide primary access points for passive and active Reef use; the northern third of the Great Barrier Reef is relatively less accessible. Urbanisation and coastal land use of catchments for agricultural (eg, sugar cane, bananas and other intensive crops) and grazing have, over the last 200 years of European settlement, contributed to changes in the quantity and quality in catchment discharge to the Reef waters. Coastal infrastructure (ports, marinas, aquaculture industry), and land-based industrial development is limited.

The Great Barrier Reef remains in a relatively pristine condition, in global terms and apart from small areas near major ephemeral river discharge and towns has been unduly affected by human activities (Kelleher 1990). The potential for impact from land-based activities and land use remains a major concern and is a constant focus for the responsible management agencies and research activities.

The Great Barrier Reef is recognised globally for its ecological value and importance, along with cultural and scientific importance. It has perceived and realised economic value to Australia (Geen and Lal 1991; Driml 1987, 1994; Hundloe et al 1988). Sustaining these values provides challenges for Australia in stewardship and management of the Great Barrier Reef World Heritage Area in order to ensure protection and conservation and access and use. The special nature of the Reef as a regional ecosystem entity and its relatively pristine condition are the key elements for the marine tourism and recreation industry. The challenge has been, and continues to be, the maintenance and retention of these special qualities.

THE INDUSTRY:
REEF TOURISM

Tourism is a major industry in the GBR with an estimated economic value in 1991/2 of about A$1.2 billion involving more than 2.2 million visitors (Driml 1994). Fishing and shipping/port industries in the GBR World Heritage Area are also significant economic activities.

The structure of the tourism industry is strongly based on vessels and boating accessing the Reef from the Australian mainland. However, 26 resorts on 22 islands are popular destinations accounting for 16% of the commercial accommodation in the GBR region, including mainland resorts, during 1989/90 (Otteson 1992). Green Island, the major day-trip island destination, attracts 300 000 visitors per year. Over the last 15 years, the number of resorts has increased by six (most islands are Queensland National Parks and sites are limited) and total bed numbers have more than doubled to 1991 (from 3 000 to 7 000) (Kelleher and Craik 1991). The mainland coast has experienced extensive resort development, especially in the Cairns and Whitsunday regions; visitor-nights in mainland and island resorts were 22.3 million in 1991/2; up 70% from 1984/5 (Driml 1994).

The tourism industry in the GBR is predominantly environmental or nature-based, and generally involves tourists in boat/vessel activities although helicopter and fixed-wing aircraft flights occur locally. Visitation by vessel-based day-trips predominate with extended and overnight cruises, cruise ships, yacht charter, island transits and charters for specific activities (eg, gamefishing) representing specialist and additional activities.

A special feature of the tourism industry in the GBR has been the development and installation of pontoons at reef sites throughout the area, especially through the Cairns to Whitsunday regions. The 19 pontoons throughout these regions serve as day-trip destinations serviced by modern, luxury high-speed (25 knots) catamaran and "wavepiercer" vessels carrying up to 300 passengers. Mainland-to-pontoon transits of up to two hours provide opportunity for "educational" briefings on the GBR and special features of the destination.

Major tourist activities at resort islands and pontoon destinations include: scuba diving, snorkel, "resort-dives", glass bottom boat semi-submersible trips, underwater observatories, and limited reef walking.

Elsewhere seasonal whale watching, sailing, windsurfing, and motorised sports (waterskiing, paraflying) and fishing are major demand activities. The diving industry has expanded enormously with more than one million scuba dives and two million snorkelling activities in 1992 (David Windsor, pers. comm.). Camping on coral cays and opportunities for "wilderness experiences" are niche markets of ecotourism operations.

Passive and active tourism opportunities and activities differ regionally throughout the Great Barrier Reef, reflecting Reef access and natural structure, and support infrastructure, such as international and domestic airports. Domestic visitations exceed international visitor numbers although there are regional differences, again reflecting direct airport access. The Cairns sector is strongly commercial with day-trips to Reef pontoons, Green Island and Low Isles and diving and fishing expeditions dominating over private recreational visits. The region attracts a high level of international tourists flying directly to Cairns International Airport. Domestic tourists predominate in the Whitsundays and southern region. Resort islands, reef pontoons, sailing and motor cruising activities are major attractions in the Whitsundays-Mackay region with its multitude of high islands and spectrum of beaches and cruising waters.

Even then it was an attraction, offering relatively low-key activities associated with resort islands, cruising and day trips, diving and fishing. Over the last 15 years, the industry has increased dramatically and is predicted to have potential to double again into the turn of the century, particularly with the Sydney Olympics in the year 2000.

Today's highly professional tourist industry in the Great Barrier Reef developed as a result of innovative approaches by private sector operators to sustainably utilise the unique natural features of the Reef. Key features have been the development of new technologies (vessels, pontoons, marine engineering infrastructure), improved and expanded transportation and infrastructure, and private sector investment for quality of visitor experience.

Technology improvements for new and faster vessels carrying up to 600 passengers at 30-40 knots is likely to expand the cruising-pontoon tourism activities. On the other hand, tourism demands for educational or scientific-based opportunities and total ecotourism experiences provides another direction for development.

THE CONTEXT: MANAGEMENT AND DEVELOPMENT

In 1975, the Australian Government enacted the Great Barrier Reef Marine Park Act which provided a legal framework for planning and managing the Great Barrier Reef. The Act provided for the establishment of the Great Barrier Reef Marine Park Authority (GBRMPA) to manage and plan for protection, conservation and "wise use" of the Reef, a Consultative Committee of interest groups and government agencies, specified functions of the Authority (including preparation of zoning and management plans, education and management programs), and provided for cooperative functions with the Queensland Government. In 1981, the Great Barrier Reef was entered into the World Heritage List.

The Great Barrier Reef Marine Park Authority is the principle management agency for the Area, with the Queensland Government's Department of Environment responsible for most day-to-day management activities and management of State marine parks and island national parks. Other Queensland authorities are responsible for relevant activities including fisheries.

The Great Barrier Reef Marine Park Authority has the goal "to provide for the protection, wise use, understanding and enjoyment of the Great Barrier Reef in perpetuity through the care and development of Great Barrier Reef Marine Park" (GBRMPA 1993). In practice its management objective has been to provide for conservation and multiple use. Human use is integral to the approach and managed to be "ecologically sustainable" (Craik 1992), whereby economic development and environmental maintenance are not antagonistic but that they are compatible goals in the sense of the Brundtland Report (WCED 1987; ESD 1990).

A cornerstone of management of the Great Barrier Reef has been zoning, to ensure separation of conflicting activities so that while some areas are protected from use, other areas are provided suitable for particular activities (Kenchington 1990) eg: General Use Zones, National Park Zones and Preservation/Scientific Zones. Commercial and recreational use (including fishing) is allowed in the General Use Zones. The National Park Zones allow "look but do not touch or remove" activities.

Zoning plans allow for tourism, under permits, to occur in 99.8% of the Marine Park. Zoning Plans are complemented by a range of special area/use instruments including: Regional Management Plans, Reef Use Plans, Special Management Areas, Site Plans and Reef Appreciation Areas (Otteson 1992). In practice, it has been estimated that tourism utilises 0.02% of the total Park area (Burgess 1993).

Enhanced public awareness over the last two decades of the unique and special qualities of the Great Barrier Reef is apparent in the wider community and in the boardrooms and actions of the Reef industry users. "Education not regulation" has been a deliberate approach by GBRMPA and other day-to-day management agencies. Putting aside this awareness and any sense of altruism, it makes sound commercial sense for the tourism (and other) industry, with investments of millions of dollars in expenditure, to ensure the sustainable nature of the Great Barrier Reef environment on which each enterprise depends.

The 25 Year Strategic Plan for the Great Barrier Reef World Heritage Area 1994 - 2019 helps "to ensure the persistence of the Great Barrier Reef World Heritage Area as a diverse, resilient, and productive ecological system, while retaining opportunity for a diverse range of experiences and was consistent with Australia's obligations under the World Heritage Area". The Plan is the product of three years consultation between more than 60 organisations representing management agencies (Commonwealth, Queensland State), Aborigine and Torres Strait Island groups, Reef user groups (tourism, fisheries, scientific) and interest groups (conservation, coastal land use and agriculture). The internationally acclaimed Strategic Plan has extensive "ownership" by the array of stakeholder organisations who individually and collectively are implementing the Plan in their activities of use and management.

Over the last few years the Australian government has been acting to enhance a range of international agreements, treaties and concepts relating to the environment and especially to the marine sector, for example, United Nations Convention on Law of the Sea (UNCLOS) (and EEZ commitments), International Convention for the Prevention of Pollution from Ships (MARPOL including "Special Area" designation for the Great Barrier Reef), United Nations Conference on Environment & Development (UNCED) (Agenda 21). National legislation dealing with Native Title (GBRMPA 1994) and Queensland State legislation for a revised Fisheries Act have implications for the processes and mechanisms of management and use of the Great Barrier Reef which are currently being evaluated.

Government actions have to date imposed a number of costs on users of the Reef, falling mainly on commercial operators rather than recreational users. Issuing of permits for

tourism and other commercial operations on the Reef include significant costs for applications and bonds are required on infrastructural development (eg, pontoons, moorings) to allow GBRMPA to remediate sites should the operator be unable or unwilling to remove damage or abandoned structures. Conditions of practice and often a requirement for independent environmental monitoring of sites are usually attached to operator permits.

In 1993, an Environmental Management Charge (EMC) was instituted by the Australian Government (through GBRMPA) levying a charge of $1 per head on tourism activities in the Marine Park to assist in meeting the increasing cost of management and associated research on the Reef. The introduction of the EMC was not without discontent in the tourism industry - it remains applicable only to commercial tourism and does not apply to recreational users of the Reef. Of the revenue 25% contributes to management activities and 75% is applied to key research issues through the CRC Reef Research Centre - a joint venture between the tourism industry, the management agencies (GBRMPA, Queensland State agencies) and research agencies (Australian Institute of Marine Science, James Cook University).

COOPERATIVE REEF RESEARCH

The CRC Reef Research Centre is one of over 60 Australian CRC's bringing together outstanding researchers from universities, research institutes, management agencies and private industry. Over $50 million is pledged for the CRC Reef Research Centre until the year 2000, and to help it continue to function independently in the future.

The Centre emphasises the importance of developing internationally competitive industry sectors, especially tourism and fishing, and offers some of the best research teams working with private industry. It is managed by a Board of nominated representatives from its partner orgaisations, a Director and various technical and users advisory groups. Each of its five programs has a Program Leader and individual research tasks are developed with industry input. The Centre uses a significant proportion of the Marine Park's environmental management charge (EMC) funds for research and development projects. In effect, 75 cents in the first $1.00 commercial operators pay to GBRMPA is directed to the Centre's program. Other government contributions will be over six times this amount, to a total of about $50 million. Companies can enjoy financial support under the CRC Program while retaining full research and development tax incentives normally available to them. The five programs are:

1. **Regional Environmental Program**
   Aimed at understanding and controlling water quality, sediment flow, effects of nutrients and pollution, impacts of cyclones, crown-of-thorns starfish, and other natural processes to the Reef.

2. **Operations Program**
   Aimed at finding solutions to problems associated with increasing human use of the Reef, particularly tourism and fishing activities.

3. **Engineering Program**
   Aimed at developing new engineering practices for the design, construction and operation of Reef facilities and coastal developments.

4. **Education and Training Program**
   Aimed at providing scholarships and support for outstanding tertiary students to conduct research into special areas. More than 25 PhD level scholarships are currently provided, and support is given to another 40 honours and masters level students.

5. **Communication and Extension Program**
   Aimed at facilitating interactive communication with Reef industry groups, researchers and management agencies, and distributing research results. A range of newsletters, technical reports, conference proceedings and training workshops - plus media and website services - are provided

The Centre was established to keep pace with rapid marine industrial, policy and technological change. It has increased private investment in R&D, and therefore industry involvement and commercialisation of research benefits. It has helped build new partnerships between knowledge providers and knowledge users.

Australia's national CRC Program is bridging the gap between reef researchers, educational institutes, government managers and private industries. It supports long-term high quality scientific and technological research which contributes to Australia's national objectives, including social and economic development.

But any type of network demands cooperation to be effective. The reason for undertaking collaborative research is to get some advantage - to achieve something that would be more difficult or more unlikely to achieve without collaboration. Advantages can flow to individuals, organisations and regions through collaboration. Collaboration helps:

* Get access to intellectual or physical resources
* Spread the risk or the cost of some ventures
* Learn from your partners
* Build community support and participation
* Access additional funds targeted at key issues
* Set new industry standards, methods or planning approaches

THE FUTURE:
TOURISM AND THE REEF

Tourism in the Great Barrier Reef region has potential to double over the next decade, particularly with the Sydney 2000 Olympics. Sustainable development will require the maintenance of balance between the conservation of Reef qualities and use by tourist and other industries.

Tourism activities on the Reef are mostly environmentally oriented towards appreciation of environmental features and qualities rather than resource harvesting. It is anticipated that the "ecotourism" direction will expand (Department of Tourism 1994) and as a consequence the tourism industry will be fully reliant on: maintenance of high water quality, relatively pristine environmental features and a diversity of settings, access to key resource sites on the Reef across the wide geographic range, and an ability to meet tourist expectations for a range of experiences and quality of experience within a variety of settings.

Managing the implications of the external issues on the sustainable development of the Reef will require an awareness and understanding of scientific findings and consultation by industry and Reef managers with other national and state management agencies. The internal issues will require information and consultation within the interest groups of the Reef. Here, resource allocation and an array of social elements largely dealing with access and amenity are the central issues.

The Reef area is not unique in having conflict between commercial and recreational fishing interests over access and entitlement to fish stocks. While commercial fisheries operate a major industry in the Great Barrier Reef (economically valued about A$400 million pa; Driml 1994), recreational fisheries are considered to be of about half that value and comprise a significant part of the tourism and recreational use of the Reef. Commercial operations are working to improve financial return with a constant or diminished catch by value-adding initiatives. Part of the recreational fishery (tourism sector) are practising catch and release, but resource harvesting for table use remains a primary goal. Access and allocation of the apparently finite fisheries stocks remains at issue.

Broad public concerns have been expressed about retention of areas of the Reef devoid of structures (moorings, pontoons), especially near population centres. In the Cairns region of the Great Barrier Reef, a No

Structure Sub Zone has been introduced covering 22% of the reefs in this relatively high visitation sector. "Carrying capacity" is a major issue; a current difficulty is understanding of the term and translation of perception to realities in a measurable way to guide Reef managers in the ecologically sustainable use of the Reef.

Resolution of the social issues (principally access, amenity and opportunity for a range of visitor experiences) through consultative processes seems less tractable at this stage; government determination looms large. The major difficulty is the lack of coherent databases and information to subtend the emotional arguments of interest groups.

Reef management agencies need to maintain a rational and dynamic approach to environmental and social balance in use of the Great Barrier Reef, gain enhanced knowledge of the ecosystems and their response to impacts and importantly, sustain an understanding of the thresholds for maintenance/growth processes in Reef ecosystems. Scientific research needs to actively address Reef issues through applied science, delivering timely and unambiguous outcomes to managers and industry, based on data, not dogma. The new joint venture - CRC Reef Research Centre - between the tourism industry, Reef managers and Reef research institutions, supported in part by the Australian Government will contribute significantly to the provision of useful scientific results from its issues-driven, applied research approach.

Continued and enhanced consultation and an adaptive management approach will assist the process and outcomes. Reef managers and the tourism industry are working to put in place codes of practice - for sectoral activities and key Reef sites. Industry self-regulation and accreditation schemes are being developed. These incremental and cooperative developments are part of the process of developing maturity in the tourism industry and Reef management agencies.

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INTEGRATED COASTAL MANAGEMENT IN THE PHILIPPINES: TESTING NEW PARADIGMS

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ABSTRACT

With fisheries declining, coral reefs battered, mangrove forests under threat, pollution levels rising and coastal communities experiencing increased poverty, the Philippines faces severe challenges in managing its coastal resources. Coastal management efforts began in the Philippines more than 20 years ago through various community-based projects. Now, integrated coastal management is expanding in the country and holds potential to reverse the trends. This paper analyzes the situation in relation to new approaches for coastal management being undertaken through the Coastal Resource Management Project supported by the United States Agency for International Development implemented by the Department of Environment and Natural Resources. This project, drawing on the lessons generated by past and ongoing coastal management initiatives, is emphasizing integrated approaches to management over narrowly focused fisheries management and habitat protection efforts. It highlights the increasingly important role of local governments and the changing roles of national government to effectively support integrated coastal management. Multisectoral collaboration is explained as standard procedure to achieve outcomes which are broad-based and sustainable. Local and national level activities are contrasted and shown to be essential complements in building institutionalization of resources management within all levels of government. A practical results framework is explained for measuring relative success at the local government level of implementing best practices for coastal management. Finally, lessons being learned related to collaboration, level of focus, education and communication, who is responsible and expansion of the project are highlighted.

Key words: Coastal resource management, integrated coastal management, coastal and marine management, municipal waters, coastal waters, fisheries, fisheries management, local government, coral reefs, mangroves.

ABSTRAK

Dengan menurunnya hasil tangkapan perikanan, terumbu karang terkoyak-koyak, hutan mangrove terancam kelestariannya, meningkatnya angka-angka pencemaran, sedangkan masyarakat pesisir mengalami kemiskinan yang terus bertambah, maka Filipina menghadapi bentuk-bentuk tantangan yang sangat keras dalam mengelola sumberdaya pesisirnya. Upaya-upaya pengelolaan pesisir diawali di Filipina lebih dari 20 tahun yang lalu, melalui aneka ragam proyek-proyek berbasis masyarakat. Sekarang ini, pengelolaan pesisir terpadu sedang berkembang di seluruh negeri dan memiliki potensi untuk membalikkan arah dari kecenderungan saat ini keperbaikan keadaan.

Tulisan ini menganalisa situasi yang ada dalam kaitannya dengan pendekatan-pendekatan baru guna mengelola pesisir yang sedang dilaksanakan melalui proyek Pengelolaan Sumberdaya Pesisir (CRMP, Coastal Resource Management Project) yang didukung oleh USAID (*United States Agency for International Development*) dan diterapkan oleh Kementrian Lingkungan Hidup dan Sumberdaya Alam Republik Filipina. Proyek ini, dengan mengambil pelajaran yang dihimpun dari pengalaman-pengalaman dahulu hingga sekarang, adalah menekankan pendekatan terpadu dalam pengelolaan, terhadap fokus yang sempit dari pengelolaan industri perikanan dan upaya-upaya perlindungan habitat. Proyek ini juga menonjolkan peran pemerintah daerah setempat yang semakin lama semakin penting, serta perubahan peranan Pemerintah Pusat untuk mendukung secara efektif pengelolaan pesisir yang terpadu. Kerjasama multisektoral diuraikan sudah merupakanprosedur standar guna mencapai hasil akhir, yang baisanya cukup luas dan bersifat berkesinambungan. Kegiatan-kegiatan di tingkat lokal dan nasional dikupas/diadu hasil-hasilnya dan terbukti merupakan komplemen yang tak terpisahkan (saling melengkapi dan harus ada), dalam

Hatziolos, Marea E, Anthony J. Hooten and Martin Fodor (Eds.) (1998) Coral Reefs: Challenges and Opportunities for Sustainable Management, Proc. Workshop 9-10 October, 1997, World Bank Washington D.C, 224 pp + x, ISBN 0-8213-4235-5

Coral Reefs: Challenges and Opportunities for Sustainable Management

Organized as a capstone event of the International Year of the Reef and a precursor to the International Year of the Ocean , this symposium record is a further reminder of the promise and difficulties of coral reef management. The meeting was supported by key global institutions concerned with coral reefs, including the World Bank, International Center for Living Aquatic Resources Management, Great Barrier Reef Marine Park Authority and Smithsonian Institution.

Keynote Speaker Ismail Serageldin (World Bank) observes…. *decisive action in the few years ahead is essential if we are not to irretrievably destroy or diminish one of the earth's most wonderful treasures* (coral reefs). The Bank, through initiatives such as the COREMAP project and support for the International Coral Reef Initiative is playing a leading role in improving coral reef management. Other global agencies and international donors describe a similar commitment. However, is it a case of too little, too late ?

Papers on the situation of coral reefs in Indonesia by Rili Djohani (TNC) and Herman Cesar (World Bank) describe rapidly accelerated direct pressures on coral reefs and our pitiful current capacity to respond to these pressures effectively. As a consequence, the inexorable rapid decline in reef health and quality continues largely unabated. Significantly, it seems that those coral reef users who cause most of the problems are not yet included in formulation and implementation of solutions.

In recognition of this dichotomy, various conference contributors outlined innovative approaches to coral reef management which require the better use of available knowledge, empowerment of key stakeholders, the formation of common purpose partnerships and the adoption of innovative approaches to resource management. Of particular note is the presentation by Stephen Colwell who proposed "entrepreneurial marine protected areas (MPAs)" - he describes these as small scale, commercially supported conservation areas in which commercial operators have a vested interest in achieving long-term economic and environmental sustainability (Kungkungan Bay resort in North Sulawesi is cited as an emerging example of this model).

The 35 papers reproduced in the proceedings are a valuable reference guide in their own right, but are even more valuable as the editors chose to include records of the subsequent discussions between presenters and participants. Those discourses allow the reader additional insights, especially into 'cross-cutting' conference themes and into the many judgement calls involved in coral reef management.

The work concludes with a tightly edited summary of the current state of knowledge of coral reef management issues and a succinct set of recommendations in relation to key management themes (e.g. destructive fishing, MPAs, marine information and education, etc.). These (and an appended set of conference recommendations) could be adopted as a set of 'best practice' guidelines for coral reef management in countries such as Indonesia where there are few current guidelines or management systems/models.

All-in-all a very timely contribution to the rapidly expanding coral reef management literature and a well compiled benchmark of the current status of management knowledge and practice for coral reef management. All Indonesian agencies concerned with coral reefs are encouraged to acquire a copy from the World Bank.

Ian Dutton
CRC/URI

Barbara E. Brown (Editor) (1997)
Integrated Coastal management: South Asia, Department of Marine Sciences and Coastal Management, University of Newcastle, Newcastle upon Tyne, U.K.,
ISBN 1 86192 040 7.

BOOK REVIEW

Integrated Coastal Management: South Asia

Barbara Brown and the University of Newcastle are well known in Indonesia - graduates of the Newcastle coastal program are now leading integrated coastal management (ICM) practitioners and trainers here. However, one of the little recognized aspects of the success of the Newcastle program has been that it is well grounded in the practice of ICM in tropical and developing countries; a notable achievement given the location of Newcastle !

That staff, students and associates of the Newcastle program maintain close and ongoing links with the practice of ICM is well demonstrated in this new manual for South Asia. With the support of the Department of International Development (U.K.), the editor and a talented team of contributing authors have compiled virtually an A-Z of ICM in Pakistan, Bangladesh, India, Sri Lanka, the Maldives and the British Indian Ocean Territory (BIOT).

Despite perceived imbalances in description and discussion of coastal management issues (e.g. Sri Lankan case studies appear more frequently than Indian, most likely due to better documentation of Sri Lanka ICM programs), the manual is an outstanding account of the regional evolution and experience of ICM. Following overviews of ICM theory (Chapter 1) and the Geography of the South Asian Seas region (Chapter 2), the work is divided into a series of 'issue-based' review Chapters; Coral Sand Extraction, Mangrove Conversion for Shrimp Aquaculture, Effects of Pollution, Reef Fisheries, Coastal Tourism and River Basin Management. Each highlights the current state of knowledge, the prevalence of key issues and the management response to date in various countries. Each chapter contains a wealth of case studies and a well-compiled set of explanatory tables and graphics.

These reviews are drawn together (in Chapter 9) with an overview of "good practices" in coastal management, case studies of general problems and proposed management actions (derived from preceding chapters), a critique of weaknesses in current management and a vision for the future of ICM in the region. The concluding chapter (10) of the manual is also one of the most innovative. Rather than supplying a simple list if reference material, the Editor has compiled (in A-Z fashion) a directory of further sources of information "for good coastal management practice". The directory includes information on contact networks (e.g. Global Coral Reef Monitoring Network), Industry organizations (e.g. International Tanker Owners Pollution Federation), classic reference texts (e.g. Kelleher and Kenchington on MPAs) and how to acquire them and organizations/individuals with skills or services of special interest (e.g. Applied Science Associates and their OILMAP program). These sources are described in sufficient detail to enable ICM professionals in developing countries

E. Odum (1998), Ecological vignettes: ecological approaches to dealing with human predicaments, Published by the Harwood Academic Publishers imprint, part of The Gordon and Breach Publishing Group. Printed in India, 1998, ISBN 90-5702-522-1, pp.269

Ecological Vignettes: Ecological Approaches To Dealing With Human Predicaments

Eugene Odum, a well respected ecologist whose is recognized for developing a new area of ecosystem ecology known as "integrative science", presents a series of ecological principles illustrated by cartoons and diagrams that would be a useful tool when examining how humans relate to, and interact with, their environment. While many of the essays should prove valuable to ecologists and environmentalists, some of the essays in the back of the book may prove a bit difficult to comprehend unless the reader has a thorough understanding of the United States and it's history. This said, I strongly encourage you to read the book, as I found it enlightening and interesting providing much food for thought and many relevant topics for discussion. Some of the key ideas presented are highlighted in the following paragraphs.

Odum clearly and repeatedly points out the many of the challenges we face today as environmentalists can be viewed in the context of quantitative growth versus qualitative growth. He states in Essay Twelve on page 167, that "quantitative growth must gradually give way to qualitative growth" if we are to realize a better quality of life for all. We must aim for a balance of people, technology and resource use that is sustainable, not new ideas certainly, but well thought through in an interesting format.

A second interesting point Odum makes in Essay Six (p. 105) is that "the source, amount, and quality of available energy determines the kinds and numbers of organisms in nature and ultimately the number and lifestyle of humans. Recognition that energy is not only the common denominator of humans and environment but also the ultimate limiting factor for development is of key importance if we are to maintain (or reach) human quality of life in the future".

A third interesting and relevant point made in Essay Eight (p.125) is that when we talk about endangered species, what we might want to consider when making policy decisions is that "what is really endangered and surely matters most is our and their (animals and plants) life-support system". Recognising that this 'life-support system' is a complex system and that managing, restoring or evaluating it in a piecemeal fashion on leads to poorly made decisions affecting its future and our quality of life and survival. Again, not new information but certainly well worth keeping in mind as we move through the many decisions affecting our environment.

Odum challenges all of us to rethink how we view the world, its inhabitants and their survival and quality of life requirements. His book provides lots of food for thought and hopefully ideas for action as he states "*if this book helps even in a very small way to improve environmental literacy at all levels….then it will have served the purpose intended."*

Karla M. Boreri

D. Bryant, L. Burke, J. McManus, M. Spalding (1998), Reefs at Risk: A Map Based Indicator of Threats to the World's Coral Reefs, Published by World Resources Institute (WRI), International Center for Living Aquatic Resources Management (ICLARM), World Conservation Monitoring Centre (WCMC), United nations Environment Programme (UNEP) Printed in the United States, 1998, ISBN 1-55963-257-4, pp. 56

Reefs at Risk: A Map Based Indicator of Threats to the World's Coral Reefs

The United Nations declared 1998 as The Year of the Ocean. This global declaration prompted many in the coastal management field to increase the promotion and visibility of the world's oceans focusing on their vital importance to humans. Some of these efforts included the hosting of special events, educational efforts, improving or starting up new ocean-related projects or through the publication of new literature. Reefs at Risk A Map Based Indicator of Threats to the World's Coral Reefs is one of many publications that were published that year. You should put it at the top of your to read list as it is definitely well worth reading from cover to cover.

The report is, as it's authors state is "a timely, scholarly treatment of a subject of public concern". Reefs at Risk: A Map Based Indicator of Threats to the World's Coral Reefs is a clear and easy to read tool for a coastal management professional or student interested in not only the latest concise global and regional coral reef health-related data, but also in new methods being used to capture and analyze recent data. Reefs At Risk explores four areas of potential concern to coral reefs; 1) coastal development, 2) over-exploitation and destructive fishing practices, 3) impacts of inland pollution and erosion, and 4) marine pollution using an indicator that measures potential risk associated with human activity, not the actual health of the reefs.

The current and comprehensive coral reef health facts will certainly prove extremely useful for coral policy-makers or managers interested in writing policy or management plans with up to date information affecting coral reef ecosystems. This reviewer believes the contents of the report will be most beneficial to a coral reef scientist, manager or policy-maker from Indonesia, because if contains useful update information including "Southeast Asian Region where over 80 percent of reefs in this region are at risk and more specifically most of the coral reefs of the Eastern Sumatra, Java and Sulawesi were assessed at high potential threat".

The topics covered that may be of particular interest to Indonesian coastal managers include the reefs at risk indicator, improving our knowledge base, and protecting the health of coral reef ecosystems. This publication also includes comprehensive maps which help us visualise some of the many coral reef issues; including coral bleaching observations world wide, and locations of destructive fishing area in Southeast Asia.

It was most recently presented and utilized at an informative session during the November 1998 *International Tropical Marine Ecosystems Management Symposium*

in Townsville, Australia, sponsored by the *International Coral Reef Initiative*, where it's value as a useful concise and clearly written document received much interest and attention. Reefs at Risk is a timely, concise publication that will certainly be referred to over and over again. The authors plan to undertake a further, more detailed, analysis of coral reefs in the South East Asian region in the coming year - that study should prove a valuable complement to initiatives such as COREMAP.

K. M. Boreri

to contact international organizations; a testament to the skill of the editor in tailoring this work to Asian audiences.

Is the manual worthwhile for ICM professionals outside the South Asia region ? A definite YES - this manual has universal value, but is especially useful for tropical developing countries such as Indonesia (which contrary to local opinion shares much in common with South and other parts of Asia - see Dutton, 1997). It is to be hoped that such manuals become more commonplace and readily available - Brown's emphasis on defining emerging 'best practices' in ICM is especially appropriate and immediately useful in Indonesia, particularly as the reform agenda for improved natural resources management evolves.

Ian Dutton

CRC/URI

Reference:

Dutton, I.M. (1997) Coastal Management in Sri Lanka: Lessons for Indonesia, Proyek Pesisir Training Report 97/02-E, Coastal Resources center, University of Rhode Island, Jakarta.

rangka membangun kelembagaan dalam bidang pengelolaan sumberdaya, di segala tingkat pemerintahan. Suatu kerangka acuan untuk hasil akhir di sini dibahas, yakni untuk mengukur secara relatip tingkat keberhasilan pada penerapan di tingkat pemerintahan setempat (lokal), cara-cara (praktek) pengelolaan wilayah pesisir yang terbaik. Dan yang terakhir, diuraikan tentang pelajaran-pelajarna yang dapat diserap dalam kaitannya dengan kerjasama, tingkat perhatian, pendidikan dan komunikasi, siapa yang bertanggung jawab dan pengembangan (ekspansi) dari proyek ini.

Kata-kata kunci: pengelolaan sumberdaya pesisir, pengelolaan pesisir terpadu, pengelolaan pesisir dan lautan, perairan kotamadya, perairan pesisir, pengelolaan perikanan, pemerintah setempat, terumbu karnag, mangrove.

PHILIPPINE SETTING

For the last 20 years a variety of government and non-government organizations have been conceptualizing and implementing an array of coastal management projects in the Philippines to address some of the crucial issues affecting its 18,000 kilometer coastline with its rich variety of productive tropical ecosystems (Ferrer *et al*., 1996; Christie and White, 1997). The issues of most concern are declining fisheries, mangrove forest and coral reef destruction, and poverty among coastal communities.

The Philippines is endowed with approximately 27,000 square kilometers of coral reefs of which only about 5 percent are still in excellent condition (Gomez *et al*., 1994). The numerous factors contributing to this decline are intertwined and not easily isolated for management purposes. Nevertheless, the primary issues affecting coral reefs, which are often used as symbols for the broader coastal management issues in the country, are various kinds of sedimentation and pollution stemming from upland and coastal development; illegal and destructive fishing practices; over-fishing due to an open-access fishery regime throughout the country; increasing poverty among coastal dwellers; a rapidly growing population and variable political will to squarely address the problems.

Mangrove forests are in no better condition. The original mangrove forest cover of about 450,000 hectares in 1920 is now diminished to less that 140,000 hectares. This decline is mostly a result of clearing for shrimp farming operations, other forms of aquaculture and habitat conversion for urban development (Olsen and White, 1997).

In short, the Philippine coastal zone is under siege from a variety of activities and impacts which are eroding the natural resource base and the area's potential for future sustainable use. The lack of control of almost all development in the coastal zone is symptomatic and indicative of what is to come if much stronger and more effective institutions and procedures for integrated coastal management (ICM) are not put into place in the near future. Coral reefs, the single most productive and economically important ecosystem in Philippine coastal waters, have already shown significant decline and will continue to do so in this scenario without much improved management support.

COASTAL MANAGEMENT IN THE PHILIPPINES

Coastal resource management (CRM) has been practiced in the Philippines over the last two decades to try to stem the increasing tide of damage to habitats and the decline of fishery production. CRM initiatives have been supported and nurtured by a variety of institutions, i.e., government, non-government, people's organizations, research institutions and by multilateral and bilateral donor organizations, employing different strategies and approaches. Such projects, working with coastal communities, have targeted near-shore fisheries and habitat management as a primary focus (Ferrer *et al*., 1996; White and Lopez, 1991). The Coastal Resource Management Project (CRMP) supported by the United States Agency for International Development (USAID) is building on the experiences of past efforts and introducing innovations for coastal management which build on the lessons of past projects.

CRMP espouses multidisciplinary, multisectoral (crossing political and institutional as well as environmental boundaries), multistage and participatory processes of planning, implementation and monitoring for sustainable coastal resource management. The present stage of coastal management activities in the Philippines is more appropriately referred to as integrated coastal management (ICM) used herein.

The multisectoral, multidisciplinary and integrated character of all processes leading to ICM planning and implementation is an essential prerequisite to success (Chua and Scura, 1992; Scura, 1994; Christie and White, 1997). The CRMP promotes these cross-cutting and integrated approaches with a focus on sustainable resource use which minimize impacts on coastal ecosystems from fishing, aquaculture, and tourism. It also considers land-based activities, such as deforestation and urbanization. This integrated approach is accomplished by collaborating with ongoing projects of the municipal and national governments and other donor-assisted projects focused on the coastal environment and its governance. Key strategies and activities include the following.

- Participatory coastal resource assessment
- Coastal resource management or integrated coastal management planning
- Economic development for coastal resource users
- Implementation of limited access regimes such as marine reserves and sanctuaries
- Training in skills relevant for ICM implementation
- Legal instruments required for effective support of ICM
- Policy analysis and formulation
- Monitoring and evaluation

Past experience in the Philippines shows that an essential element of successful coastal management is active participation by the entire community (Tobin and White, 1992; White *et al*., 1994). This includes day-to-day resource users such as fishers; local government units (LGUs); national government; non-government organizations; private sector; and, other stakeholders.

The project is assisting communities to develop resource management plans through a participatory process involving preparation of coastal area profiles using participatory coastal resource assessment and identifying and evaluating management options (Walters *et al*., 1998). Implementation of these plans is facilitated by assistance to local government units to institutionalize coastal resource management. Monitoring coastal resource use is being strengthened by assisting national government agencies and law enforcement branches of the government.

Supporting these key activities, CRMP is testing the following innovations.

- Development of a critical mass of local leaders who support and perpetuate ICM practices

- Encouraging a strong synergy between the project's national and local level initiatives to ensure that the development of local ICM regimes are consistent with national government policies and so the latter can be infused with practical experiences from the field level

- Insisting that local governments allocate budget and personnel for ICM activities

- Emphasizing expansion and replication of CRM through a variety of mechanisms rather than relying too heavily on site-based models

- Using an aggressive education and communication campaign at national and local levels which is integrated with all project components to achieve maximum and long-lasting influence on different interest groups

CRMP activities are being implemented at national and local levels to achieve strategic expansion of the project activities to 2,000 kilometers of Philippine coastline by the year 2000. Six "learning areas" serve as models for coastal resource management and represent the core of the field activities of the CRMP to achieve a threshold that will continue beyond the life of the project. The six areas include: Northwest Bohol; Olango Island, Cebu;

Malalag Bay, Davao del Sur; Southeast Negros Oriental; San Vicente, Palawan; and Sarangani Bay (Figure 1). These six field areas include 29 municipal government units and cover about 670 kilometers of coastline.

Work within learning areas entails a collaborative planning and implementation process which is centered around the role of the municipal government, community organizations and national agency initiatives. A typical agenda for a learning area and the roles of the various participants is detailed in Figure 2 and includes (White,1996; White,1997):

a. Defining memorandums of agreement between the CRMP and local governments which commit personnel and budgets for ICM;

b. Identifying local organizations and individuals (both public and private sector) who can potentially play key roles in the planning and management process;

c. Implementing participatory coastal resource assessment and mapping exercises with barangay (smallest political unit in the Philippines) level groups;

d. Developing coastal environmental profiles through local community participation and collaboration with local academic institutions;

e. Conducting ICM training for key government and NGO participants;

f. Promoting participatory planning at the barangay, municipal and learning area level;

g. Implementing an enterprise development scheme through community groups and the private sector which provides livelihoods outside of fisheries;

h. Defining ICM plans and projects within larger area plans; and,

i. Facilitating ICM interventions, monitoring and evaluation.

The CRMP identifies, cultivates and promotes the current and future coastal resource leaders in the Philippines through its training and planning programs. The five practices of effective leaders espoused by Kouzes and Posner (1995), are adapted for CRM leadership and used as a guide. These are:

Challenge the process. Search for answers to the open access problem and stop destructive practices. Take risks to achieve extraordinary results.

Inspire a shared vision. Enlist all stakeholders to share a vision of sustainable use of coastal resources where active participation and management is the norm.

Enable others to act. Foster collaboration in planning and implementing coastal resource management by soliciting participation and sharing information.

Model the way. Set an example by participating in and contributing to coastal resource management activities.

Encourage the heart. Recognize the hard work and commitment of others and advertise the successes to other coastal communities.

DEFINING THE RESULTS OF THE CRMP AT THE FIELD LEVEL

After two years of operation the CRMP has refined its operational objectives for field level interventions to help clarify all project activities. This occurred through the development and refinement of indicators for measuring project performance both for the benefit of the donor (USAID) and all the project participants. The indicator which measures project performance within its six learning areas covering 670 kilometers of coastline is shown in Table 1. The thrust of this indicator is that each municipality meets certain criteria indicating improved coastal management. The criteria are somewhat flexible to accommodate varying conditions in different areas and different propensities of different local governments.

Table 1. Performance indicators for CRMP for local implementation

OBJECTIVE*	Enhanced management of renewable natural resources
INDICATOR	Kilometers of shoreline where improved management of coastal resources is being implemented
UNIT OF MEASURE	Kilometers of shoreline and number of municipalities
INDICATOR DESCRIPTION	Improved local implementation of CRM demonstrated by: 1. Annual local government unit budget allocated for CRM 2. Resource management organizations formed and active 3. Best CRM practices are being implemented: a. CRM plans adopted b. Fisheries and coastal management ordinances implemented c. enforcement units operational d. marine sanctuaries established and functional e. mangroves under Community-based Forest Management Agreements f. municipal water boundaries enforced

* Overall objective is the same as "Strategic Objective No. 4" for USAID which covers all USAID natural resource management projects

CRMP is obligated to assist to improve coastal management along 2,000 kilometers of coastal areas which includes the learning areas and expansion areas. Learning areas are core areas of CRMP technical assistance and comprise approximately 760 km of shoreline. Expansion areas cover coastal areas and municipal governments along 1,240 km of shoreline where the CRMP is working to catalyze improved coastal management in collaboration with other projects and without an on the ground presence of personnel. Rather, CRMP is achieving this through dissemination of technical and educational materials, support of trained personnel, spreading examples of work in the learning areas and other means which are usually triggered by the demand of the local government or communities of concern.

Within CRMP learning areas, one of the favored forms of intervention is the establishment of marine sanctuaries which effectively reduce fishing effort and rehabilitate coral reef and near-shore marine habitats. To measure the relative success of the marine sanctuaries, the CRMP is monitoring change in fish abundance and average percent change in living coral cover inside and adjacent to the sanctuaries. These biophysical parameters reflect the effects of management and they are also useful in showing results to local participants. The monitoring techniques are performed collaboratively by Philippine scientists and local community members. The mangrove component of CRMP is measured by the hectares of mangroves under community-based forest management agreements, approved Protected Area Management Plans, or other tenure instruments.

The CRMP also has a large information, education and communication component which cuts across the entire program at both the national and local levels. A few of the activities and interventions include: publications, videos for national television and training, media events, contests, a moving exhibit on the value of marine and coastal resources and a variety of public seminars. The indicator of success for this broad set of activities is the percent of respondents from a survey of target groups that demonstrate knowledge of CRM and ICM problems and solutions. Although the ultimate goal of CRMP is behavior change in the coastal areas as a result of IEC interventions, the only effective measure of this is through actual improvements in management noted within the learning and expansion areas of the project. These changes are measured by the two indicators shown in Tables 1 and 2.

THE CRMP EXPERIENCE

The CRMP has undertaken many activities during its first two years of operation. Those activities and results which are directly leading to improved coastal management within the coastal target areas of the project include:

National policy related activities supporting coastal management

1. Legal and jurisdictional guidebook published and distributed
2. Mangrove management policies reviewed and revised to accommodate limited harvesting within management areas
3. National fisheries code analyzed and publicized for effective implementation by local governments and communities
4. National ICM awards among local governments undertaken
5. Several major workshops for national policy makers, judges and prosecutors with responsibility for law enforcement in coastal areas
6. National coastal master plan initiated
7. Set of booklets initiated on procedures for ICM in the country
8. Numerous publications and videos disseminated throughout the country to interested parties
9. A major exhibit on marine life and the important coastal and ocean habitats is touring the country to five locations and has been viewed by more than one million people

Field level activities in six learning areas

1. Memorandums of agreement signed with all 29 municipal governments
2. Participatory coastal resource assessments completed in each of 29 municipal areas covering 129 out of 274 barangays
3. Six coastal environmental profiles in final draft form
4. 150 graduates from 11-day ICM course active in learning area ICM projects
5. 152 barangay (community) level management groups formed and active
6. Various municipal ordinances drafted and passed by local governments which enhance coastal fishery and ecosystem management
7. One or more marine sanctuaries initiated or established in each learning area
8. 3000 hectares of mangrove habitat in Bohol Province initiated for community stewardship management agreements in 1999
9. Community level enterprise projects in seaweed farming started in 5 learning areas, with ecotourism as a theme with projects in two learning areas

Expansion area activities

1. Ten municipal governments outside of the learning areas have started their own ICM program with information and encouragement from CRMP

2. Two biodiversity-rich areas are progressing with marine park and area management plans in collaboration with other donors and the national and local government

3. Linkages have been formed with three major donor and government projects to collaborate in up to 50 municipalities using the CRMP products listed above

LESSONS BEING LEARNED BY CRMP FOR ICM IN THE PHILIPPINES

An important change in the manner that CRMP approaches the problems of ICM in the Philippines from past projects is that it is not only rooted in coastal fishing and resource user communities. The CRMP was designed from the outset with the realization that the issues facing Philippine coasts and their human communities are too complex and caused by too many factors to come to viable solutions by intervening only at the local community level. The CRMP is strategically orchestrating interventions at both the national and local levels with various government and non-government institutions. It is attempting to catalyze action at the local community level through collaboration with local government in a manner which will empower the local government and its partners to continue on alone without the assistance of the CRMP. Although the CRMP is less than 3 years in operation, there are some useful lessons being learned.

1. FOCUS BOTH ON NATIONAL AND LOCAL LEVEL WORK SIMULTANEOUSLY. Past CRM precursors either focused on national level setups or were too site-specific and/or community based. CRMP works synergistically and simultaneously at both levels. Thus, the practicality of field experience fuse with the generalities espoused at the national level. The processes related to the preparation of the Legal and Jurisdictional Guidebook for Coastal Resource Management in the Philippines (DENR, DA-BFAR, DILG, 1997) show this synergy. At the field level, problems pertaining to clarification, interpretation and implementation of laws affecting coastal resource use were identified through research and a series of technical working group meetings involving Department of Environment and Natural Resources, Department of Agriculture-Bureau of Fisheries and Aquatic Resources, Department of Interior and Local Government, and a host of non-governmental organizations, as well as the academic and scientific communities. These meetings provided a venue for the agencies to come to a common interpretation on a number of coastal environmental laws which are often perceived and treated differently.

2. USE MULTIPLE EDUCATION AND COMMUNICATION STRATEGIES TO BUILD A WIDE BASE OF SUPPORT FOR ICM. CRMP promotes ICM and its related issues to capture the interest of the mass of Filipino population by embarking on media and education campaigns that are designed to increase awareness and ultimately, mobilize the populace into action. The approach builds and enhances networks of constituency groups to support ICM initiatives thus ensuring sustainability beyond the life of the project.

3. ENCOURAGE COLLABORATION AND SYNERGY AMONG AGENCIES AND DONOR PROJECTS. CRMP started its policy component with (1) the development and application of legal and operational guidelines for CRM implementation; (2) setting CRM on the national social agenda; and (3) aligning resources and funding toward common objectives in consultation with counterpart government agencies and other donors. These efforts have resulted in most donors and government sponsored coastal projects at least attempting to coordinate and share plans before implementation starts. This has resulted in more effective field results in several instances.

4. PROMOTE EXPANSION BY SUPPORTING DEMAND FROM COMMITTED LOCAL GOVERNMENTS AND OTHER INSITUTIONS. CRMP is establishing a critical threshold of coastal municipalities who are actively implementing ICM to achieve the "snowballing" effect. At present, technical assistance at both national and local levels targets 2,000 km of shoreline or roughly 11% of national shoreline length. At this threshold level, ICM is anticipated to continue beyond project life because of the development, implementation and institutionalization of ICM tools.

5. SUPPORT LEADERSHIP IN ICM THROUGH TRAINING, EDUCATION AND LEARNING BY DOING. The CRMP is nurturing and developing a group of ICM leaders by providing skills and training opportunities at the local field level as well as provincial and national through training opportunities which emphasize hands-on planning and analysis within the context of the participants own geographical areas of responsibility.

These lessons are helping to draw up plans for present and future directions for ICM in the Philippines. The most important finding is that for ICM to be adopted by local governments throughout the country in a mode which enhances both quality of environment and life for people in coastal areas, it must be acceptable, understandable and mostly practical for local governments, communities, national government and private sector partners to implement. ICM cannot be empty concepts and ideas. It has to offer tangible solutions which produce results in terms of improved quality of coastal ecosystems and their production, improved livelihood opportunities and improved ability of the part of local and national participants to do the job themselves. Although the complexities are great, the vision cannot be clouded by objectives which overshoot their mark. Objectives of field projects must be achievable while providing real benefits.

ACKNOWLEDGMENTS

The CRMP is an initiative of the Government of the Philippines that began in March 1996 and is supported by the United States Agency for International Development. CRMP is implemented by the Department of Environment and Natural Resources in partnership with the Department of Agriculture-Bureau of Fisheries and Aquatic Resources, local government units, non-government organizations and other assisting organizations. Technical support and management are provided by Tetra Tech EM Inc. Useful comments in the preparation of this paper have come from Abbie Cruz-Trinidad, Policy Advisor to CRMP; Tom Bayer, Training Coordinator for CRMP; Jennifer Murphy, Research Intern for CRMP and many others who work directly with the project who are too numerous to mention.

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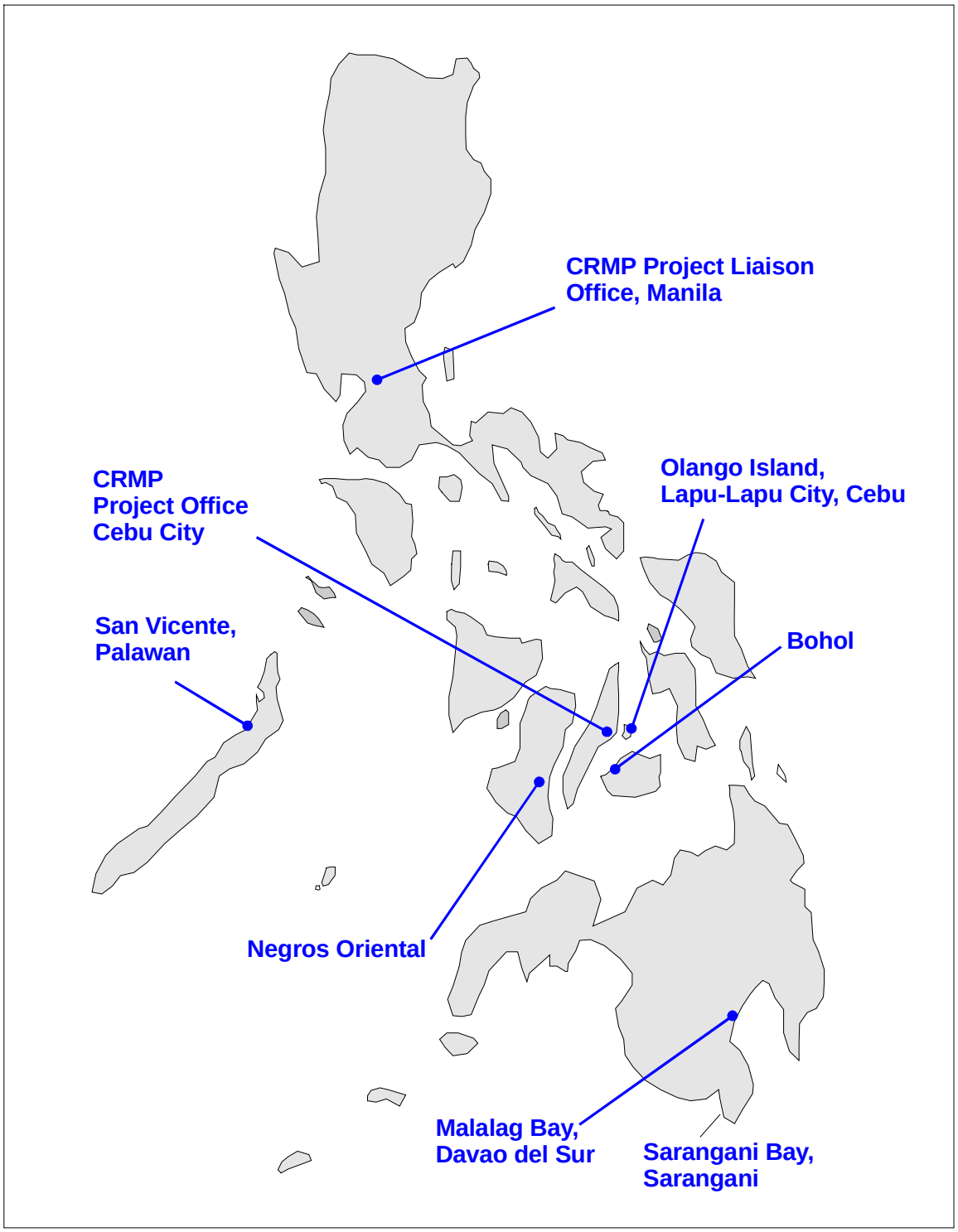

Figure 1. Six learning areas of CRMP and project offices

Phase	Activities and Outputs	Technical Assistance Roles of Non-Government Organizations, Academe, Donors and National Government	Roles of Community Local Government and Stakeholders
1. Program preparation	• Determine boundaries and scope • Make workplans/budgets • Assign personnel • Secure consensus on overall approach	• Prepare workplans • Formulate working agreements • Contract staff • Train staff • Facilitate consensus on	• Enter into memoranda of agreement • Participate in discussion • Communicate needs
2. Secondary information gathering	• Compile existing maps, reports, data • Interview information sources • Compile existing laws, agreements, plans	• Locate sources of information • Compile information in useful form • Coordinate activities	• Provide information • Assist to compile information • Begin to develop information storage and retrieval system
3. Field assessment/ study: Participatory Coastal Resource Assessment (PCRA) and other research	• Train practitioners • Conduct PCRA mapping and data collection • Contract special research studies on fish stock assessment, habitat condition, water quality	• Train practitioners • Facilitate PCRA • Conduct specialized research • Analyze research data • Make results available	• Conduct PCRA with technical assistance • Participate in special research and data collection • Assist to analyze data • Provide inputs to
4. Database and profile development	• Set up data storage and retrieval system • Compile coastal environmental profile • Use profile as planning base • Refine boundaries and	• Determine data storage site, personnel • Write profile • Distribute profile • Facilitate discussions on boundaries and research	• Provide information • Assist with profile analysis • Use profile for planning • Decide on boundary
5. Prioritize issues and analyze causes	• Conduct community and municipal-based planning sessions • Develop issue tree • Prioritize issues for management	• Facilitate process • Interject outside perspectives, research findings, policies, etc. • Help translate issues into causes	• Participate in process and provide major input • Participate in conflict resolution • Set priorities in real
6. Policy and plan formulation	• Conduct planning workshops to determine objectives, strategies and actions • Determine clearly stated goals, objectives and indicators • Interagency coordination • Determine composition of	• Facilitate planning process • Provide technical guidance • Assist to set up management bodies	• Provide basic policies • Provide major inputs to plan • Build consensus among community • LGU support to planning process
7. Plan/project implementation	• Design pilot projects • Test projects • Formalize and set up management council • Secure support as required	• Facilitate initial implementation • Provide seed funding • Provide technical guidance	• Take full responsibility • Participate in implementation • Provide local
8. Monitoring and evaluation	• Train monitoring and evaluation team • Monitor environment and ICM process and feedback to database and plan • Evaluate program results	• Assist to train LGU personnel • Assist to analyze data • Assist to set up sustainable system	• Collect data • Use data to refine plan and update database • Participate in process • Take responsibility

Feed-back to appro-priate phase

Figure 2. Phases, activities, and participant roles in a coastal management planning process (White 1997).