

Human Migration and Resource Use in North Sulawesi Fishing Communities¹

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Introduction

Coastal resources provide a wide variety of economic benefits to people living in the Asian Pacific region. These benefits include harvests of renewable and nonrenewable resources, non-consumptive uses (tourism, recreation, transportation), maintenance of biodiversity, shoreline protection, and opportunities for research and education. Coastal and marine resources support subsistence lifestyles and provide countless jobs in commercial fisheries and tourism. These resources are critical to the sustainable development of countries in the region by providing food, pharmaceuticals, construction materials and many other products. Yet, due to threats from over harvest, population, and habitat destruction, there is widespread agreement that these threats to sustainable resource use area related to demographic changes and development activities occurring throughout

the region.

The sustainability of coastal resources is closely linked to population changes. As Barton has pointed out, "The coastal zone is the main site of economic activity in most developing nations with a coastline. But as populations grow, the bounty of the natural resources found there is also a threat to their very own existence" (Barton, p.3) A collaborative study involving Duke University and Bogor Agricultural University is investigating the relationship between demographic changes and the use of marine and coastal resources in villages heavily dependent on these resources in North Sulawesi, Indonesia. The objectives of the study are : (1) to examine the economic importance of marine and coastal resource extraction for these communities, and (2) to investigate the relationship between demographic changes and the sustainability of resource extraction this paper will report on some preliminary results from a household survey about resource use and demographic changes. A later paper will address the sustainability issue using regional demographic projections based on the survey data and on a fisheries stock model based on weekly fish landings data, which are still being collected.

Study area

Indonesia (the largest island nation in the world, containing more than 17,000 islands) is an appropriate location for a study of this type. The country's coastline extends more than 81,000 km, and its coastal zone contains more than 22% of the nation's 200 million people. Coastal resources are especially important to the people who live on Sulawesi Island. Lying in the middle of the archipelago, Sulawesi Island extends north of Flores Island almost to the Philippines. Due to island's elongated shape and its rugged, mountainous interior, most of the 2.5 million inhabitants live along the island's 6000 kilometers of coastline. The island is ringed by coral reefs and rich breeding grounds for fish.

Sulawesi has very high global importance for marine biodiversity conservation, as recognized by the World Wildlife Fund's global 200 review of large ecosystems for priority conservation (Olson and Dinerstein). The Sulu-Sulawesi Marine Ecosystems, an area bounded by Sulawesi, Malaysia (Sabah) and the Philippines, may be *the center of marine biodiversity in the world*. The province of north Sulawesi was chosen as the location of the study, because it is the closest part of Sulawesi to this fertile marine area and has a large number of inhabitants heavily dependent on coastal resources (see Box 1). The importance of this region for marine biodiversity conservation was underscored by the recent discovery of a second population of coelacanth, a rare, primitive fish originating from the dinosaurs age and previously thought to only live in a small area off the coast of Africa. The fish was found along the coast of north Sulawesi

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Box 1. North Sulawesi Province	
Population	: 2.4 Million (1990), 1.7 million (1971)
Number of Migrants	: 153,466 (1990)
Capital	: Manado (population, 300,000)
Land area	: 27,484 sq. km.
Coastline	: 1985 km
Major Fish Products	: Tuna, Skipjack, Barramundi, Anchovy, Shrimp, Bastern Little Tuna, Gouramy, Common Carp, Tipalia, Puntius
Major Food Crops	: Rice, Corn, Peanut and Greenpeas
Major Cash Crops	: Coconut, Clove, Cacao, Coffee, Nutmeg and Seaweed
Forest Products	: Rattan, Resin, Incense and Timber
Mining	: Sulphur, Copper, Gold and Iron
Handicraft	: Embroidery, Carving, Rattan and Bam boo Plaitings
Tourism	: Focused on marine tourism and traditional Minahasa culture. Major attraction in Bunaken MarinePark

Economic Importance of Coastal Resources

There is a small, but growing, literature on the economic importance of coral reefs, mangroves, and near shore fisheries. Several of these studies from the Asian Pacific region are highlighted to illustrate the economic role coastal resources play. For the South Pacific Islands, Adams and Dalzell examined the economic value of near shore fisheries. They estimated the mean annual commercial catch of coastal fisheries to be \$83 million (1n 1991 dollars). The subsistence catch is nearly twice as large at \$160 million. For Papua New Guinea alone, the total subsistence and commercial catch was estimated to be \$64 million. Under-scoring the critical role coastal resources play in supporting low-income people, they noted that about 80% of the fisheries production is by rural villages and does not enter the formal cash economy.

At a more local level, Ruitenbeek examined the economic value of 300.000 hectares of mangroves in the Bituni Bay area of Irian Jaya. Mangroves in Indonesia area under increasing pressure for competing uses such as charcoal production, wood chip export, or conversion to fish ponds. Using a systematic survey conducted among households, he investigated the economic importance of traditional uses of mangroves in the area. He estimated that the mangroves were providing \$10 million per year for traditional uses (hunting, fishing, and gathering of foodstuffs and medicinal products) and \$35 million per year in commercial fisheries values (in 1990 dollars). The traditional mangroves uses were par-

ticularly important to low income households. He concluded that because linkages between total mangrove area and overall ecosystem productivity were poorly understood, an over-clearing of mangrove was likely in the absence of conversation efforts.

In Bunaken Marine Park in North Sulawesi, Saunders and colleagues examined alternative uses of the park's resources. Socioeconomic research was carried out in villages in and near the park. Nearly half of the population relied primarily on farming for their economic livelihood, while one third reported fishing or seaweed farming for their primary occupation. The authors estimated that the park's resources were providing \$6.4 million in annual fishing income in 1995 for subsistence and commercial fishers. This amount was far larger than expected by park planners and managers. Tourism values amounted to \$4.1 million for non-local tourists. Seaweed farming provided the major source of income for over 1400 families. The researches argued that research on the economic value of marine resources in the area and better information about underlying attitudes and belief of local people would assist park management and policy agencies in the development of effective people management strategies for resource conservation.

If marine and coastal resources were being used sustainably, these resources would be expected to continue to provide ample jobs and income for coastal communities into the future. Coastal and marine resources in the region, however, are under a variety of threats. For example, there is some recent work on the economics of coral reefs in Indonesia that

documents the millions of dollars of losses from destructive fishing practices (often from people outside the local communities). Cesar and colleagues estimated that dynamite fishing caused a net present value of loss (over 25 years) of \$98,000 – 761,000 per square kilometer of reef. This loss resulted from detrimental impacts on fisheries, coastal protection and tourism. Sedimentation damage from logging was estimated to have a net present value of \$273,000 per square kilometer. The study also showed that large economic gains could result from reducing the threats to Indonesia's coral reefs.

In a similar vein, Hodgson and Dixon examined development alternatives for a coastal area in the Philippines where the tourism and fisheries industries were in competition for resource use with the logging industry. They investigated the ecological impacts of coastal logging on the marine ecosystem of Palawan Island and the effects on fishery and tourism economics. They found that coastal logging imposed considerable social costs by reducing the productivity of fishing and tourism in Bacuit Bay. They estimated that a ban on logging would generate \$12 million more in economic benefits over a ten-year period than would continued logging (in 1985 present value dollars).

While these studies demonstrate the economic importance of coastal resources to million of coastal resident, they do not examine the sustainability of extraction in relation to future population changes. The effects of demographic change on resource use have been examined most widely in the context of agricultural land use. For example, in a review of the interrelation between environmental stress and demographic changes, Bilborrow and Geores conclude:

.....despite the outpouring of literature on population problems and environmental problems in Latin America, there appears to be little direct evidence on the linkages, i.e. showing a direct cause-effect relationship between population growth/density and environmental deterioration (p.85).

while the relationship between population and environment is not completely understood, this relationship appears to be influenced by the prevailing property rights system. In a study of population movements in Rajasthan, Chopra and Gulati found that differences in property rights affected the propensity of people to out-migrate from rural area. Better defined property rights can perhaps increase the carrying capacity of resources by increasing the productivity of common pool resources.

Conceptual Framework

The study uses a conceptual framework based on household production economics. This framework has been widely used to study rural households in developing countries (e.g. Barnum and Squire, 1979; Singh et al, 1986). The systemati-

cally allocating their labor time to produce products to be sold in markets, products for home consumption, and leisure. This analytical approach has proven useful in understanding how households organize their production and consumption activities and resulting implications for resource use (see Pattanayak and Kramer for an application to valuation of tropical ecosystem services). Evenson (1988) has extended this static model to incorporate the impact of changes in population density on agricultural development. In this study, we hypothesize that fishing households combine their inputs and outputs in different ways, depending on their migration status.

Study Design and Data Collection

To prepare for data collection, the principal investigators visited the study area in December 1998 to gather information on the use of coastal resources. Interviews were conducted with government officials, NGO members, development project staff, and other researchers. Two focus groups were conducted with fishermen to explore key issues and to collect information for the initial survey design. A survey was drafted and used for interviewer training. A pretest was conducted in the village of Bahowo in the sub district of Wori. Extensive debriefing of the pretest interviewers led to substantial revisions in the questionnaire.

Training was conducted over a three-day period in June 1999 with a group of interviewers recruited from Sam Ratulangi University. The interviewers were recent graduates in fisheries, economics, agriculture and related fields. The training was led by the principal investigators and included instruction in proper interaction with the principal investigators and included instruction in proper interaction with respondents, procedures for coding responses, and survey ethics. Interviewers were briefed on the purpose of the study and the use of the data they would be collecting. Training activities alternated between lectures, discussion, and role-playing.

The survey was implemented during three weeks in July 1999 with 601 households whose primary occupation was fishing. Stratified, multistage sampling was employed. The population of interest for the household survey was the fishermen of the district of Minahasa and the urban areas of Manado and Bitung in the province of North Sulawesi. Within this area are 34 sub-districts (Kecamatan) 17 of which are located on the coast. We chose the sub-districts as our first stage of sampling. Sub-districts villages were randomly selected.

For the final stage of sampling, interviewers were assigned a quota for the number of completed surveys per village. This quota was based on population weights to achieve a total sample of 600. The population weights were based on population estimates for each village obtained from secondary sources. Once in a village the interviewers proceeded to acquire (or, if necessary, create) a list of all the

fishermen currently living in the village. This list served as the sapling frame. They were told to randomly select the fishermen to interview by alternating between the top and the bottom entries of the list until they had exhausted the quota for that village (systematic random sampling). If they were not able to contact someone initially, they were to try again until their last day in that village, at which point they eliminated this person and added another (according to the above mechanism).

During the data collection period, the researchers were in regular contact with the interviewers to Monitor their performance. The interviewers traveled by public transportation to each village, and on most days, returned to Manado to meet with the research team. The research team checked their surveys for completion and debriefed the interviewers about their experience.

Results

The population growth of Kabupaten Minahasa from 1993 to 1997 is relatively low, 0.73% per year. However, in the study areas that area coastal areas, almost all have higher rate of growth compared to the rate of Kabupaten Minahasa (Table 1). This indicate that the growth in the coastal areas is higher than the rate in the highland (country).

sub-districts. The average age of the fishermen was 39, with the average education level being some secondary schooling. The average household size was 4.5, with a range of 4.3-4.7 across sub-districts. Over 22% (133) of the households reported having 4 or more children (Chart 1).

The prevalence of home ownership (86%) among the respondents indicates that most of the Minahasa fishermen have significant personal wealth. The exception is Bitung Timur, where only 60% own houses. Boat ownership is quite high in most of the sub-districts outside of the Bitung area, but most of the Bitung fishermen do not own boats due to their status as crew members, indoor toilet ownership is quite rare in the more remote subdistricts such as Wori and Tumpaan (2%) and close to 50% in the more urban areas.

We see two distinct types of fishermen n our sample. Individuals with small, mostly wooden boats or canoes, 3 to 6 meters long, rarely driven by a motor, compromise the majority of our survey respondents. They fish by themselves or occasionally with a family member and their catch ranges from a few kilograms of fish per day to a couple of hundred kilograms at most (on average). They usually fish closer to the shore (proximity to reefs) explaining their encounters with bomb and chemical fishing and a lower incidence of

Table 1. Study Area Population in the Kabupaten Minahasa, 1993-1997

No	Kecamatan	1993	1994	1995	1996	1997	%/yr
1.	Belang	27.053	27.733	28.365	28.252	28.861	1,637
2.	Tenga	32.786	32.621	32.466	33.602	34.582	1,359
3.	Tumpaan	19.367	19.498	19.939	20.266	20.313	1,203
4.	Wori	15.132	15.391	15.479	15.908	15.961	1,347
5.	Likupang	33.028	33.361	32.753	32.795	32.960	-0,046
	Kab. Minahasa	725.711	732.227	734.223	740.847	747.096	0,729
1.	Bitung Tengah	79.713	79.255	42.409	52.369	52.601	-5,78
2.	Bitung Timur	0	0	37.135	39602	39702	1,72
	Kodya Bitung	104.256	104.194	104.622	118.415	118.933	3,49

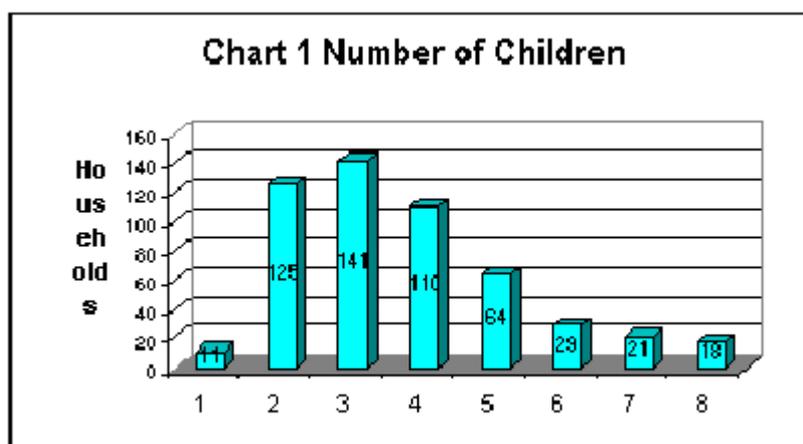
Between 1993 and 1997, it is shown that generally the growth rates in the study areas are higher that the average growth rate of Minahasa, with the exception of Kecamatan Likupang. Kecamatan Likupang has a negative growth rate that means a decrease in the population. This doesn't mean that the number of people in the area is decreasing, since in 1996 there was a partitioning so part of the area and people of the Kecamatan Likupang join the Kecamatan Lembean Timur. Nevertheless, in the last 2 households reported having 4 or more children (Chart 1).

Socioeconomic characteristics of the fishermen in the sample area reported in Table 2, broken down by different

encountering foreign fishermen. The second group is compromised of individuals seeking employment as crew on larger, motorized fishing vessels that head further off shore. Their daily catches are measured in metric tons. Since these commercial fishing vessels require ports, our 'crew' respondents are concentrated in the urban area of Bitung and to lesser degree around the city of Belang (desas Borgo and Buku). To the extent that these groups of fishermen are competing within the same fishery with very different technologies, the resource management decisions (or lack there of) take on a new prominence and will have major consequences on both future migration and resource use.

Subdistrict	Age (mean)	Educational Level ** (mean)	Number of Children (mean)	Household Size (mean)	Migrant Ratio (%)	House Ownership (%)	Boat Ownership (%)	Indoor Toilet Ownership (%)
Likupang	40.5	2.35	3.03	4.7	11%	91%	81%	33%
Tenga	39.3	2.61	2.71	4.6	27%	87%	67%	12%
Tumpaan	36.5	2.45	2.82	4.3	15%	92%	85%	2%
Wori	42.0	2.40	2.83	4.7	10%	88%	81%	2%
Belang	39.0	2.41	2.63	4.2	15%	85%	68%	13%
Bitung Timur	36.2	2.69	2.65	4.4	48%	60%	4%	46%
Bitung Tengah	37.5	2.56	2.22	4.3	51%	94%	23%	52%
Total	38.8	2.48	2.73	4.5	25%	86%	58%	27%

** Educational Level : 1 = No schooling, 2 = Primary school, 3 = secondary school, 4 = High school, 5 = University, 6 = Training -



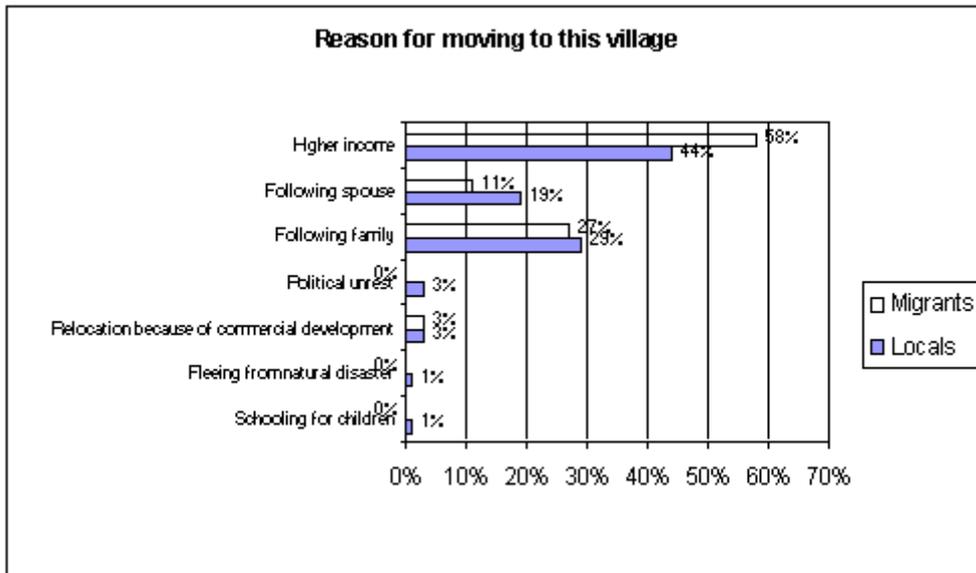
There are a variety of ways one can define a migrant, e.g. born in another village, another district, another province, etc. in this study, migrant was defined as someone born in another district, i.e. outside the Minahasa region² The mean percentage of migrants was 25%, with considerable variation across subdistricts³. The migrant ratio was as low as 10% in Wori and as high as 50% in Bitung respectively. The latter is an urban residential area near the Bitung port, and reflects and influx of fishermen who are working as crew members on large fishing vessels. The immigration into the urban area Bitung is of a more recent nature compared to the immigration into the rest of Minahasa.

(25% of the Bitung immigrants came within the last 10 years vs. 15% for other immigrants) There is no difference in migrant ratios across men and women in the sample households (Chart 2). The most common district of origin is Sanghi8he Talaud Islands where 75% of the male migrants were born. These islands area about 100 kilometers northwest of Manado, situated between Sulawesi and the Philippines.

When asked why they had moved to the village where they currently live, nearly two-thirds of the migrants indicated that it was for financial reasons (chart 3). The next most important reasons for moving were to follow family or spouse. Interestingly, only 3% of the migrants reported moving for political reasons. (It is likely this figure will rise in the future given recent ethnic tensions that have erupted in the nearby Maluku Islands.) If we look at the birthplaces of our respondent's parents we note that a majority are from outside the Minahasa region. This is the cause for an ethnic

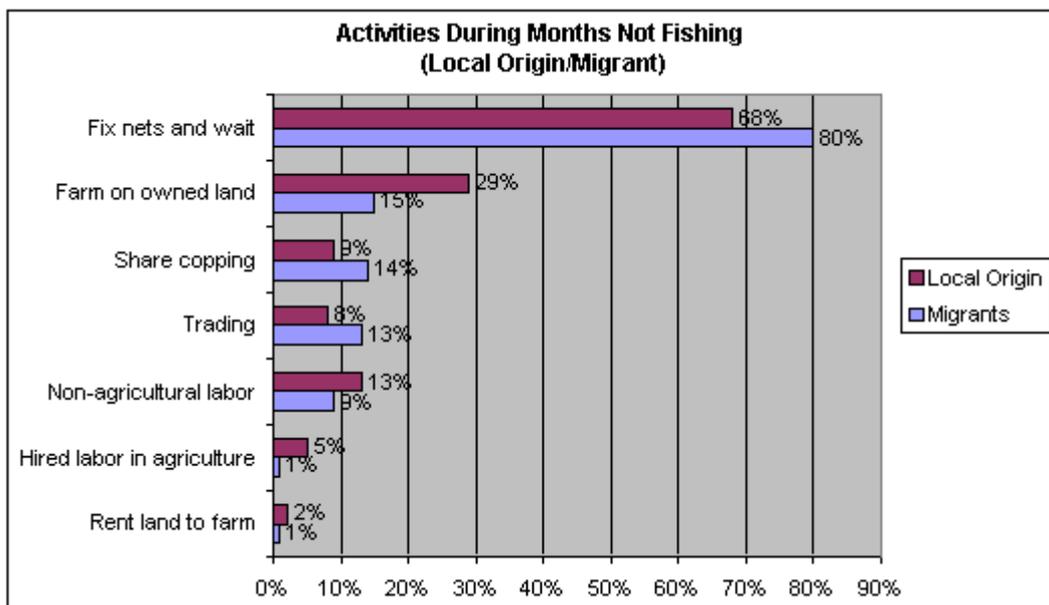
² There are four district within the province of North Sulawesi

³ If migration is defined at the village level (born in a different village), the percentage of migrants among our sample increases to 52%.



divide between the fishing and farming sectors, where the native Minahasan population predominantly does the latter.

while only 27% of the migrants engaged in farming. However, the most commonly reported activity was “fix nets and



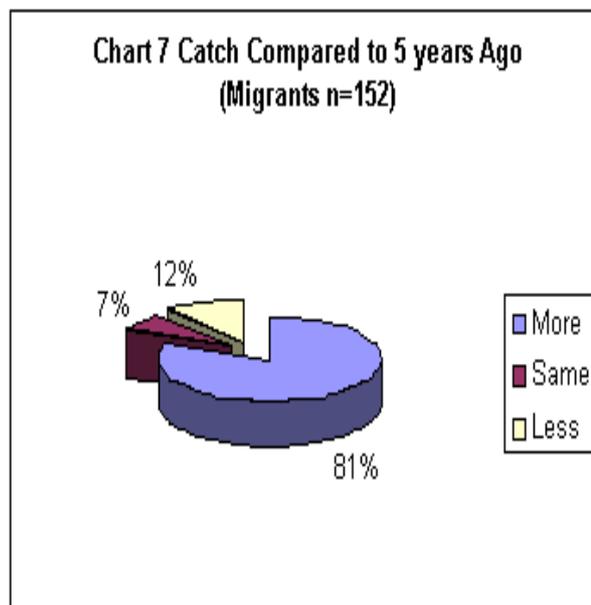
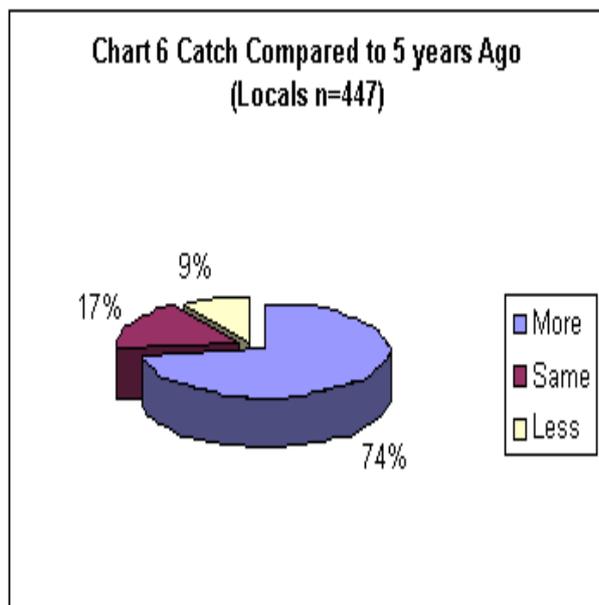
Results indicate that fishing remains the primary economic activity in the area, and there are some important differences in fishing behavior between migrants and those of local origin. The economic importance of fishing is indicated by the fact that 60% of the fishermen made daily fishing trips. Almost all fishing was for sale to traders or directly to consumers, with fishermen of local origin selling more to traders and consumers. Very few of the fishermen reported that were fishing only for their own consumption. When not fishing, a larger proportion of the non-migrant fishermen engaged in farming (due to access to farmland). Nearly 40% of the fishermen of local origin reported that farming activity,

wait” (chart 4). When asked in what they would invest excess income, over 80% of both groups said they would increase their fishing enterprise. We also see a tendency for sons of our respondents to choose the life of fishing. This suggests that the fishermen still view fishing as a viable business.

Both groups reported noticeable declines in catches over the past five years, with a higher percentage of migrants reporting such declines (charts 6 and 7). Overall, three fourths reported declining catches. This finding raises concerns about the possibility of over-fishing in the area. Relatively few of the fishermen reported conflicts with other villages’

fishermen, but 42% reported encounters with illegal dynamic fishing (a non sustainable fishing practice that destroys coral reefs and non-target fish species). One potential source of over fishing is the presence of foreign fishing fleets in the area. Some 41% of the migrants and 20% of the local fishermen reported encounters with foreign fishermen.

fishermen from other areas due to a combination of still fertile fishing grounds and strong fish markets in Manado and Bitung. Once migration sifts get underway, other migrants follow their friends and family. Not surprising, the local and migrant fishermen are quite similar in many ways. However, there are some notable differences. migrants are less likely to



Discussion

Fishing remains a vitally important source of income for residents of coastal communities in the Minahasa district of North Sulawesi. In times when they are unable to fish, most of our respondents spend their time repairing nets preparing to fish. There are indications of falling productivity based on our respondents' recollection of what fishing conditions were like five years ago. Some of this decline may be due to natural forces such as changing weather patterns. Other possible sources are human related; there is clear evidence of widespread use of destructive fishing practices. More sustainable fishing could be encouraged by increased attention to enforcement of laws that forbid the use of blast fishing and live capture of fish with cyanide. Another policy approach to encourage sustainable fishing would be reforms in national fishing policy that would allow use restrictions to protect local fishing grounds from fishermen from other areas (Simanjuntak). Such reforms may emerge under Indonesia's newly formed democratic government. In September 1999, President Abdurahman Wahid created a Ministry of Marine Exploration and Fisheries to develop a coherent national policy.

Population changes in the area are largely driven by an influx of migrant fishermen. Half of our sample was born in a different village from the one they live in, and one quarter moved in from other districts. The Minahasa area attracts

own houses and boats. They are less likely to farm during times of the year when they are unable to fish. Migrants are more likely to have encountered foreign fishermen. Our survey was completed before a recent influx of thousands of migrants coming to North Sulawesi to flee ethnic violence in the Maluku Islands to the east. The growing number of political refugees in this and other parts of Indonesia will likely increase pressure on the nation's coastal resources.

References

- Adams, Tim and Paul Dalzell
 1996 'Management of Pacific Island Inshore Fisheries,' in Patricia Summerfield, ed., *Blancing the Scales: Access and Equity in Fisheries Management, Proceedings of the Third Australasian Fisheries managers Conference*, Rottnest Island, Western Australia.
- Barnum, H.N. and L. Squire
 1979 'An Econometric Application of the Theory of The Farm-Household'. *Journal of Development Economics* 6(1): 79-102
- Barton, D.N.
 1994 'Economic Factors and Valuation in Tropical Coastal Resources', *SMR-report 14/94*, Bergen, Norway: Centre for Studies of Environment and

- Resources, University of Bergen.
- Bilsborrow, Richard E. and M. Goeres
1992 *Rural Population Dynamics and Agricultural Development: Issues and Consequences Observed in Latin America*. Cornell University.
- Biro Pusat Statistik
1992 *Statistik Indonesia*. Jakarta.
- Biro Hukum North-Sulawesi Province
1995 *Pengelolaan Wilayah Pesisir dan Laut di Propinsi DTI Sulawesi Utara*.
- Cesar, Herman, Carl Gustaf Lundin, Sofia Bettencourt and John Dixon
1997 'Indonesian Coral Reefs—An Economic Analysis of a Precious but Threatened Resource', *Ambio* 26(6):345-350
- Capra, Kanchan and S.C. Gulati
1998 'Environmental Degradation, Property Rights and Population Movements: Hypotheses and Evidence from Rajasthan (India)'. *Environment and Development Economics* 3:35-57
- Evenson, R.E.
1998 'Population Growth, Infrastructure and Real Incomes in North India'. In *Population, Food and Rural Development*, eds. R. Lee, W.B. Arthur, A.C. Kelley, G. Rogers and T.N. Srinivasan: 118-139
- Hoagland, Porter, Yoshiaki Kaoru, and James M. Broadus
1995 'A Methodological Review of Net Benefit Evaluation for Marine Reserves', *Environmental Department Paper* No. 027, World Bank, Washington, D.C.
- Hudgson, Gregor and John A. Dixon
1992 'Sedimentation Damage to Marine Resources : Environmental and Economic Analysis', in J.B. Marsh, ed., *Resources and Environment in Asia's Marine Sector*, Taylor and Francis, Washington, D.C.
- Johannes, R.E.
1994 *Local Marine Tenure: An Essential Ingredient in Nearshore Marine Resource Management in Indonesia*, unpublished paper, Mt. Stuart, Tasmania.
- Olson, D.M., and E. Dinerstein
1997 *The Global 200: Conserving the World's Distinctive Ecoregions* conservation Science Program, World Wildlife Fund-US, Washington, D.C.
- Pattanayak, Subhrendu, and Randall A. Kramer (in press). "Worth of Watersheds: A Indonesia," *Environment and Resource Economics*
- Ruitenbeek, H. Jack
1992 'Mangrove Management : An Economic Analysis of Management Options with a Focus on Bintuni Bay, Irian Jaya', *Environmental management Development in Indonesia Project (EMDI), Environmental Report* 8, Jakarta and Halifax.
- Saunders, Lindsay, Graham Usher, and Jeff Weber
1996 *Economic Valuation of Bunaken National Marine Park Resources: Learning to Manage the Effects of People*, unpublished paper, USAID Natural Resources Management Project, Jakarta.
- Simanjuntak, Sahat M.H.
1998 *Indonesian Coastal Governance Review*. Unpublished draft, USAID, Jakarta.
- Singh. I., L. Squire, and J. Strauss (eds)
1986 *Agricultural Household Models: Extensions, Applications, and Policy*. World Bank, John Hopkins University Press.