Human migration and resource use in Sulawesi fishing communities

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ABSTRACT

The relationship between human population changes and the use of coastal resources in several communities in North Sulawesi, Indonesia is examined using a combination of demographic and econometric analysis. The study area has some of Indonesia's richest marine biodiversity and a number of important coastal resources that support the livelihood of a large number of fishing communities. Following focus groups and pretesting, direct interview surveys were conducted in 1999 with 601 households whose primary occupation was fishing. Demographic analysis reveals that migration is the major driver of human population growth in the area. Econometric analysis is used to explore the effects of migration and other socioeconomic variables on fishing activity in the area. Recommendations for resource managers include greater monitoring of resource impacts of migrants and increased involvement of local communities in the development of regional fishing policies.

Keywords Migrants, Fisheries economics, Households, Population growth

Introduction

Coastal communities throughout Southeast Asia depend on coastal ecosystems for much of their economic base and way of living. The natural resources of these ecosystems have great economic and environmental importance and are currently under threat from global change including population growth, coastal development and climate related events such as El Nino. This paper reports on an ongoing study of the relationship between human population changes and the use of coastal resources in several communities in North Sulawesi, Indonesia using a combination of demographic and econometric analysis. Such relationships have been seldom explored in the literature, particularly the relationship between migration and fishing activity.

There are rich fishing grounds in the study area that have long supported the economic livelihood to many coastal villagers. Sulawesi is considered one of the most important areas in the region for marine biodiversity conservation. One assessment of conservation priorities concluded the Sulu-Suluwesi Marine Ecosystem, an area bounded by Sulawesi, Malaysia (Sabah) and the Philippines, may be the center of marine biodiversity in the world (Olson and Dinerstein 1997). The province of North Sulawesi lies close to this fertile marine area and has a large coastal population that is a heavily dependent on coastal resources (Pollnac et al. 1997). 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 previously thought to only live in a small area off the coast of Africa. The fish was found along the coast of North Sulawesi in July 1998 (Erdmann 1999).

The study is focused on the northern tip of North Sulawesi in the district of Minahasa. Minahasa contains the Bunaken Marine National Park, one of the most visited marine parks in all of Indonesia. The park attracts many dive tourists from Indonesia, South East Asia, Europe and North America (Natural Resources Management Project 1996). The Minahasa district had a population of 734,223 in 1995. It has approximately 350 kilometers of coastline and 110 coastal villages. Rapid increases in population in the area have led to increases in destructive fishing practices, coastal erosion, and depletion of mangrove and forest trees (Pollnac et al. 1997).

There are two distinct types of fishermen in the study area. Most are individuals with small, mostly wooden boats or canoes, 3 to 6 meters long, rarely powered by a motor. Their catches are generally less than 100 kilograms per trip. They fish by themselves or occasionally with a family member, and they usually fish close to the shore.

The second group is comprised 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, the crew respondents are concentrated in the urban area of Bitung and to a lesser degree around the city of Belang. While our sample included both types of fishermen, we focus on the first group of fishermen in this paper.

Methods

The study employs a conceptual framework based on the household production literature of economics, augmented by concepts from the demography literature. The household production model assumes that households seek to optimize their economic well-being by carefully allocating their labor time to produce market products,

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home consumed products, and leisure activities. This approach has been used in a number of different settings to analyze the relationship between household economic behavior and natural resource use (Bilsborrow and Geores 1992; for an application to forest ecosystems in Indonesia, see Pattanayak and Kramer 2001). In this study, it is hypothesized that fishing households combine their inputs and outputs in different ways, depending on their migration status.

Four types of social science empirical methods are employed in this study: (1) focus groups, (2) sample survey, (3) demographic analysis, and (4) econometric analysis. Each of these is discussed briefly below.

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. The focus groups revealed that fishermen were concerned about ecological and human factors affecting fishing conditions in the area. Participants were somewhat pessimistic about the future of fishing, but had a diverse set of explanations for why they perceived fishing quality to be declining in the area. A survey was drafted based on the researchers' previous experience with household surveys in Indonesia and on research conducted by others in the area including a rapid assessment of fishing villages by Pollnac et al. (1997).The survey included questions about household characteristics, mig-ration history, fishing gear and effort, fish catch, expen-ditures and opinions about fishing conditions. The draft survey was used for interviewer training. A pretest was conducted in the village of Bahowo in the subdistrict 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 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, multi-stage 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. The sub-districts were chosen as the first stage of sampling. Sub-districts where fishing was a minor economic activity were eliminated, reducing the relevant number to 11 sub-districts. These 11 sub-districts were assigned to two strata: east and west coast, and three sub-districts were randomly selected from each stratum. The final six sub-districts were Belang, Bitung, Tengah, Likupang, Tum-paan, and Wori. In the second stage of the sampling process, 18 of the total 58 villages in the six 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 target sample of 600. The population weights were determined from 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 sampling frame. Interviewers 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 replaced this in-dividual with another name from the sampling frame.

During the data collection period, the researchers were in regular contact with the interviewers to monitor their performance. The interviewers traveled by public trans-portation 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

Descriptive statistics about the sample are contained in Table 1. The average fisherman in the sample was 39 years old, completed primary schooling and lived in a household with 2-7 children. The fact that 86% of the fishermen owned their own houses and 58% owned their own boats indicates a significant amount of personal wealth. However, the housing structures are relatively simple, with less than a third having indoor plumbing. Fishing was the primary economic activity of most of the subjects interviewed, with 60% reporting daily fishing trips.

Table 1. Socioeconomic characteristics of sample

Age (mean)	38.8
Education	Primary school
# children (mean)	2.7
Migrant ratio	25%
Boat owners	58%
House owners	86%
Indoor toilets	27%
Daily fishing trips	60%

Table 2 reports some of the same characteristics broken down by sub-district. Average age and education are relatively constant across the study area.Household size is greatest in Likupang and Wori, both on the east coast. The migrant ratio varies from 10% to 50%. The highest

migrant ratio is found in Bitung Timur, a village in the municipal area of the fishing port of Bitung. This sub-district also has the lowest percentage of house ownership (78%). 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 sub-districts, such as Wori and Tumpaan (2%) and close to 50% in the more urban areas.

Table 2. Sample socioeconomic characteristics by sub-district

Sub-district	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%
Tanga	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	36.9	2.62	2.46	4.4	50%	78%	14%	49%
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

Simple demographic analysis was conducted with the survey data. The annual average population growth rate for the sample villages was computed to be 2.24% over the 1990-1999 period (see Table 3). This compares to a national annual growth rate of 1.4 percent for the same period (United Nations Population Fund). One reason for the relative high rate of growth in Minahasa district is that the district has been a popular destination for migrants from other parts of Indonesia.

Table 3. Demographic analysis of sample data

Population growth rate 1990-1999	2.24%
Migration ratio (born in another village)	54%
Migration ratio (born in another district)	25%

There are a variety of ways one can define a migrant, .e.g. born in another village, another district, another province, etc. In Table 3, the migrant ratio for those born in another village was 54% for our sample. The migrant ratio for those born in another district was 25%. Although there are no comparable national data on migration, these proportions represent an unusually high concentration of migrants. This study focuses attention on the definition of a migrant as someone born in another district, i.e. outside the Minahasa region. From the standpoint of managing coastal resources in the Minahasa area, fishermen moving among villages is less important than new fishermen moving into the area.

Although not shown in the tables, there is no difference in migrant ratios across men and women in the sample households. The most common district of origin is the Sangihe and Talaud Islands where 75% of the male migrants were born. These islands are about 100 kilometers northeast 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 (Fig. 1). In focus groups and other qualitative discussions, migrants based their expectations of higher income on either better fish markets or more productive fishing grounds. The next most important reason for moving was to follow family or spouse. Interestingly, only 3% of the migrants reported moving for political reasons. (It is likely this figure would have been higher if the survey had been done one year later, given ethnic tensions that erupted in the nearby Maluku Islands). If we look at the birthplaces of our respondents' parents, a majority is from outside the Minahasa region. This is the cause for an ethnic divide between the fishing and farming sectors, where the native Minahasan population is primarily engaged in farming.
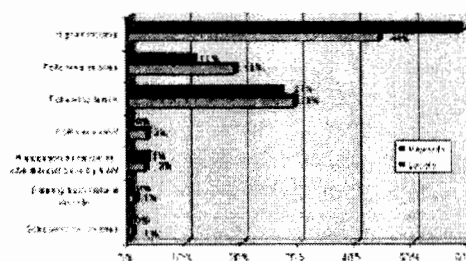
Fig. 1. Reasons for migrating to this village

Both migrants and nonmigrants reported noticeable declines in catches over the past five years. Overall, three fourths of the surveyed fishermen reported declining catches (not shown in tables). This reported decline raises concerns about the possibility of over-fishing in the area. The most commonly given reason for declining fish catch was the increasing number of Indonesian fishermen in the area (Fig. 2). This could be due to more fishermen moving to the area as well as increasing number of fishermen from other parts of Indonesia fishing in North Sulawesi

waters. Another potential source of over-fishing is the presence of foreign fishing fleets in the area. Some 33% of the migrants and 14% of the local fishermen reported encounters with foreign fishermen. Roughly one fifth of the fishermen reported other reasons for the decline, a category that included several types of illegal fishing such as blast fishing.
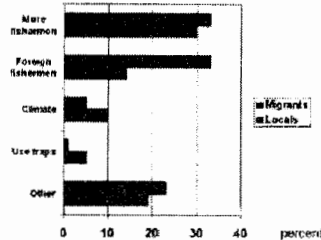

Fig. 2. Reasons for declining catch

In Table 4, we report an econometric analysis of a model of fishing behavior that examines differences across household in weekly catches. This can be thought of as a household supply function. Ordinary least squares regression analysis is used. The dependent variable is measured by taking each fisherman's reported average weekly catch in kilograms and multiplying by a weighted market price to make it quality adjusted. The sample of 347 is all boat owners among our respondents (non boat owning crew members are excluded). There are 3 sets of independent variables. The first set is price related.

Ordinarily, a supply function would include price as an independent variable. Because of a lack of household level price data, we include 2 price proxies: a dummy variable for pelagic fish as the primary catch and a dummy

Table 4. Econometric analysis of household catch (kilograms per week of fishing)

	Coefficient	T-ratio	P-value	Mean a
Constant	-11.44	-0.27	.979	
Price proxies:				
Catches pelagic fish	245.71	1.47	.144	.450
Sells to trader	353.64	2.16	.031	.519
Fixed inputs:				
Motorboat dummy	943.61	4.20	.000	.205
Circling net dummy	674.70	2.46	.014	.101
Light fishing gear dummy	767.44	1.85	.065	.049
Distance to fishing site	292.50	3.86	.001	1.564
Socioeconomic variables:				
Engages in farming activity	-94.74	-.554	.580	.559
Household size	-50.00	-.959	.338	4.55
Migrant	388.52	1.785	.0752	.167
Age	-6.99	-.891	.3734	40.62
Education dummy	-1.94.37	-1.05	.297	.294

Observations = 347; Adj. R-squared = 0.17

variable for selling to traders (as opposed to selling directly to consumers). Both of these factors should be related to higher prices. The second category of variables is made up of fixed inputs. These include dummy variables for the use of an outboard motor, the use of a circling net, and the use of light fishing gear. Also in this category is the distance to the primary fishing site. The final category of variables is comprised of socio – economic characteristics: involvement in farming, house-hold size, age, and education.

The weekly catch is greater when the fishermen sells directly to traders as opposed to selling door to door to other households. Those who concentrate on pelagic species catch more fish on average, but this effect is not significant at the 10% level. All of the fixed inputs have a positive and significant effect on household catch. The strongest of these effects is the use of a motorboat. This is not surprising since those who have greater mobility can spend more time fishing and less time traveling back and forth from their villages. The positive sign on one of the fixed inputs, distance to fishing ground, is surprising, but

may be due to the fact that some fishermen are traveling further to reach higher quality fishing areas. Most of the socioeconomic variables have insignificant effects on household catch. The exception is the dummy variable for migrants. The coefficient for the migrant variable is positive and significant at the 7.5 % level. This result suggests that on average migrant fishermen have a higher weekly catch.

Discussion

Fishing remains a vitally important source of income for residents of coastal communities in the Minahasa district of North Sulawesi. There are indications of falling productivity based on the respondents' recollection of what fishing conditions were like five years ago. While not examined in this study, we can speculate that some of this decline may be due to natural forces such as changing weather patterns. Other possible sources are human related; there is widespread use of destructive fishing practices in the area.

Human migration has had an impact on fishing communities in the study area. Approximately one half of the fishermen in our sample were born in another village and one quarter were born in another district. The Minahasa area attracts fishermen from other areas, primarily in search of higher income opportunities. Once migration shifts 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 more likely to have encountered foreign fishermen. They also catch more fish on average. 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.

Several policy implications emerge from our analysis. We would encourage greater monitoring of the impacts of human migration on coastal resource use in the area. Migrants are fueling the relatively high population growth in the area, and many are settling in coastal villages. This influx of migrants appears to be increasing the pressure of resource stocks, although little is known about the sustainability of the area's rich fishery resources. More sustainable fishing could be encouraged by increased attention to enforcement of laws that forbid the use of blast fishing and live capture of reef 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 1998). Such reforms may emerge under Indonesia's move toward greater democracy and increased decentralization, but will require active involvement of local communities if the policies are to be effective in a political environment that makes enforcement difficult.

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