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INTRODUCTION The purpose of this paper is to examine the effects of formal education and government services on income from aquaculture and the adoption of selected aquaculture practices. Numerous researchers have found that both formal education and exposure to extension services increase a farmer's level of productivity. For example, a recent summary article by Lockheed, Jamison, and Lau (1980) indicated that 31 of 37 farm data sets analysed manifested positive relationships between formal education and productivity. They also found that extension services were positively related to productivity in eight of 16 data sets. One of these latter analyses indicated that extension was negatively related, and the rest showed no significant effects between the two variables.

Many researchers have also found positive relationships between innovative behaviour and both level of formal education and change agent (e.g. extension service) contact. Although not the most recent, the most comprehensive summary of these relationships is provided by Rogers and Shoemaker (1971). They note that in 74 percent of 275 studies years of formal education was positively associated with innovative behaviour. In 87 percent of 156 studies reviewed change agent contact was positively correlated with innovative behaviour.

In this paper we examine the effects of formal education and government services on aquaculture practices in Region II of the Philippines. The

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Government of the Philippines (GOP) has been providing various informational services to aquaculture pond operators in the 2nd Region of the Philippines for the past several years. Some have questioned the efficacy of these services.

In the past, pond operators did very little to improve the quality of their ponds. The ponds were simply constructed, filled, stocked, and then harvested at some later date. The GOP, through various agencies has been trying to improve the production of these ponds by information programs aimed at convincing the operators that the intelligent use of pesticides, fertilizer, lime, and supplemental feeds can greatly improve yields.

METHODS Ideally, one would use time series data to determine the effects of formal education and the exposure to government services. Unfortunately, at this time there is no baseline data against which we can test for actual changes in behaviour. The analysis conducted here will therefore look for a relationship between formal education, exposure to services, and present behaviour. Given the fact that little or no pond improvement practices were conducted prior to government intervention, it is reasonable to assume that if there is a relationship between exposure and practices, it is the exposure that resulted in the practices and not the other way around.

Tests Two variables were used to determine degree of exposure to services: (1) Respondents were asked "What agencies that you know have rendered technical assistance and information dissemination on fishery technology in your locality?" The total number of visits was treated as an independent variable and (2) Respondents were requested to list the fish farming extension services they had participated in. This list was converted to a simple number reflecting the total number of services they participated in. Years of formal education was determined from response to a direct question.

The first dependent variable, aquaculture practices, was measured by asking respondents to indicate whether or not they used the following pond

improvement techniques: use of lime, fertilizer, pesticides, and/or supplementary feeding. Respondents were given a score of one for each practice engaged in, and these scores were summed resulting in an aquaculture practice scale with a potential range of from zero to four.[1] The measure of production is the total income received from aquaculture. Although this measure does not include fish used for home consumption it is an acceptable substitute for actual production figures.[2]

The sample was composed of 22 randomly selected pond operators from the 2nd Region of the Philippines. The sample is a subsample of a larger stratified random sample of fishery personnel in seven regions of the Philippines. All questions were posed in the local vernacular.

ANALYSIS Correlations between the independent and dependent variables can be found in Table 1.

Table 1. Correlations between independent and dependent variables.

		Visits	Services	Education	Income
1	Number of Extension Visits	---			
2	Number of Extension Services Used	.45*	---		
3	Years of Formal Education	.02	-.01	---	
4	Income from Aquaculture	.37	.26	.01	---
5	Aquaculture Practice Scale	.31	.48*	.05	.24

$P < .05$

Table 1 indicates that none of the variables are significantly correlated with aquaculture income. It is interesting to note that even aquaculture

[1]None of the Region II pond operators used lime, thus, the scale had a range of from one to three.

[2]Assuming that price structures do not vary widely in Region II.

practices, a factor which should have some effect on production, is only weakly, and not significantly correlated with income.[3] Additionally, it is noteworthy that education is not significantly correlated with either income or aquaculture practices. Even when the effects of the other independent variables are controlled, the partial correlations between education and the two dependent variables remain close to zero.

The only significant relationships in Table 1 are those between number of extension visits and number of extension services used (r= 0.45), and number of extension services used and the aquaculture practice scale (r= 0.48).

DISCUSSION Overall, the total number of fish farming extension services participated in by the respondent is the most important determinant of aquaculture practices. It also appears that number of extension visits helps determine participation, suggesting that number of visits is indirectly related to practices through participation.[4]

It was surprising to find that none of the variables considered were significantly related to income. This could be due to the fact that there was no control for pond area. For example, if individuals with relatively small ponds participated in government services and used practices which increased production, their production may not exceed the production of non-participants with larger pond areas who practice no pond improvement measures. It is therefore suggested that future analyses of this data control for production unit size.

The lack of significant relationship between formal education and the dependent variables was not totally unexpected. Several researchers have indicated that education is most likely to effect production under modernizing conditions (cf. Lockheed, Jamison, and Lau 1980; Shultz 1975). The analysis presented here has not taken into account the environmental context of the pond operators in Region II, and it is suggested that future analyses of this data control for the degree of modernization in the various Regions and communities.

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[3] The relationship would have probably been stronger if the dependent variable were production per unit area.

[4] It could also be that participants are visited more frequently.

In sum, the analyses presented here indicate that participation in extension services leads to improved pond management. The analyses concerning relationships between government services and production are inconclusive, and suggestions are made concerning improvements which could be made in future evaluations.

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