Drivers of Destructive Fishing Practices in District Charsadda, Khyber Pakhtunkhwa Province of Pakistan

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Abstract

This study has investigated the drivers of destructive fishing practices in inland rivers of district Charsadda, Khyber Pakhtunkhwa Province of Pakistan. Key informants interviews, focus group discussions and questionnaire survey with 286 fishermen were used to collect data. Four destructive fishing practices i.e. blasting, cyanide fishing, electric fishing and small mesh nets were employed to create an index which was used as dependent variable in this study. Thirty variables were identified as drivers of destructive fishing practices through literature survey but after multicollinearity tests only seven explanatory variables were selected for the stepwise multiple linear regression analysis. The results revealed that five variables including, number of alternative livelihood opportunities, fish stock in rivers, average household income, distance to water bodies and amount of culture fish in the market have negative impact on

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destructive fishing practices. The other two variables i.e. average years of formal education and the cost of gears have positive effect on the dependent variable. The findings of this study have significant policy implications for reduction in the intensity of destructive fishing practices in the study area. The study recommends proper implementation of the policies on licensing, awareness regarding conservation of fisheries resources and provision of alternative livelihood opportunities.

Key words: Destructive Fishing Practices; Freshwater fisheries; Khyber Pakhtunkhwa; Stepwise Multiple Regression

Introduction

Human actions have persistently degraded freshwater fisheries resources worldwide. Therefore, knowledge about the status and drivers of destructive fishing practices (DFPs) is crucial for formulating sustainable fisheries management strategies. There are various fishing practices, which include hand gathering, spear fishing, netting, angling and trapping etc., however recreational, commercial and artisanal fishers use different techniques. Contemporary fishing practices have grown out of the old practices, which are still used in artisanal fisheries but are different by being less capital, vessel, and fuel-intensive than the current mechanized fishing methods (Misund, Kolding, & Fréon, 2002). When the stock of fish in the rivers diminishes, fishing methods become increasingly severe and the use of destructive fishing gears become attractive (Munyi, 2009). Use of destructive fishing gears is one of the primary causes of fisheries decline globally (Mozumder, Shamsuzzaman, Rashed-Un-Nabi, & Harun-Al-Rashid, 2018), and is the key management concerns to deal with. Freshwater fisheries resources seem to be the most persistently degraded worldwide, with approximately 20% of freshwater fish species is becoming extinct, threatened, or endangered in recent decades (Revenga, 2000). Out of the total 200 species of the Indus River system, a total of 32 fish species are known to be endemic to Pakistan (GoP, 2013).

Destructive fishing practices have been given tremendous attention worldwide and there are varying explanations of what is meant by DFPs (Pet-Soede & Erdmann, 1998). DFPs are methods that easily result in irreparable damage to aquatic habitats and ecosystem (Akhtar, 2015). However, for the purposes of this study, a practice is considered destructive which results in direct damage to the fingerling destruction. Many fishing practices can be destructive if used inappropriately but some practices are likely to result in irreversible damage. This research investigates data on the proximate

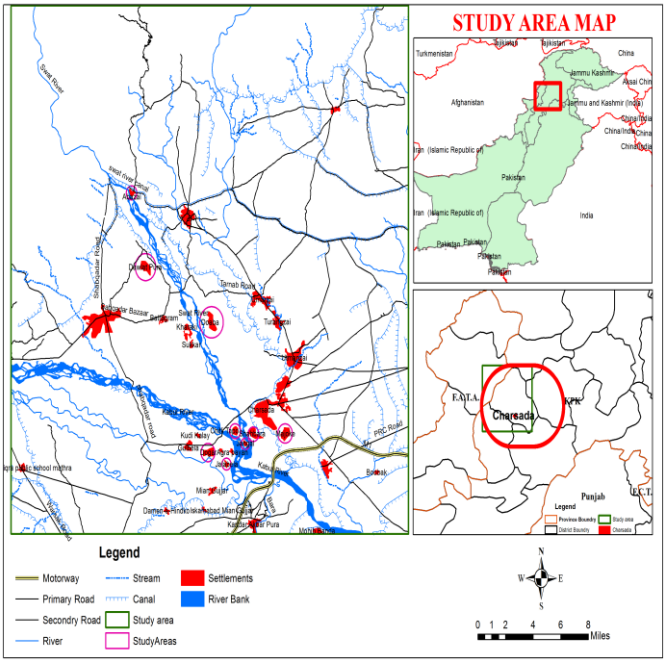
drivers, i.e. human actions that directly affect the loss of fisheries resource. There are several cultural and socioeconomic forces that have paved the way for the use of destructive fishing gears.

Materials and methods

Study Area

Charsadda District lies between 34 – 03' and 34 – 28' north and 71 – 28' and 71 – 53' east (Figure 1). The total area of the district is 996 square kilometers. The climate of the district is extreme i.e. summer is extremely hot with an average daily low of 27°C to an average daily high of 38°C in the month of June, and winter is cold with an average daily low of 5°C to an average daily high of 19°C. The Indus River with a total length of 2,750 km (GoP, 2013) is the most important supply of surface water and is considered as the lifeblood of Pakistan. The major tributaries of the Indus in Khyber Pakhtunkhwa i.e., the Kabul, Swat (*Khiali*) and Jindi rivers pass through Charsadda District.

Figure1: Study area map



Data collection

In order to get an overview of fishing activities in district Charsadda of Khyber Pakhtunkhwa a reconnaissance survey was carried out in the beginning. Interviews and group discussions with community leaders, elders, professional fishermen, government officers and fishery monitors were also carried out. Thirty variables were identified regarding drivers of DFPs through literature survey. However, most of these variables were excluded due to difficulty in measurement and operationalization of the variables. After multicollinearity test, only eight variables were found correlated with the dependent variable. Out of the eight variables one variable is dropped due to weak correlation with the dependent variable and seven explanatory variables were considered for stepwise multiple linear regression analysis. Primary data were collected between March and December 2016 through key informants interviews, Focus Group Discussions (FGDs) and household surveys. Firstly, in-depth interviews were conducted with key informants including village heads (*khans*), elders and government officials. Secondly, four FGDs were carried out to obtain key information on the socioeconomic characteristics, DFPs and institutional set up of fisher communities. Each group discussion lasted from 60 to 80 minutes until saturation was reached.

Sampling Techniques

Two stage cluster sampling was used to select a representative sample of households. In the first stage, fishing communities with distinct fishing characteristics i.e. location near water bodies, intensive fishing and presence of large number of fishermen labor were purposively selected. In the second stage, sample households were selected from those fishing communities. Targeted villages were taken from households living near the three rivers in the study area i.e. *Swat*, *Kabul* and *Jindi*. Due to non-availability of recent population data, cluster sampling was used, because, it is economical and is suitable for selecting a sample when the sampling frame of individual elements is not available. According to 1998 Census, the Population of district Charsadda was 1,022,000 (GoP, 2001). The equation used by (Tryfos, 1996) was used, i.e. $\mathbf{n}=\frac{N\pi(1-\pi)}{(N-1)(C/Z\frac{\alpha}{2})^2+\pi(1-\pi)}$, Where n is sample size, N is population size, π is ratio of a characteristic of interest in a population (e.g. literacy rate, fishermen population, and mortality), C is ±error rate (confidence interval), and $Z_{a/2}$ is tabulated value for confidence level. Plugging the proportion of 0.5 gives the maximum variance, 0.5*(1-0.5) = 0.25, error rate (confidence interval) of ±8% and 1.96 tabulated value of $Z_{a/2}$ for 95% confidence level and number of households of the above mentioned villages, sample sizes for each

village were estimated. The formula gave a sample size of 277 with error acceptance (d) value of 6%. However, a sample size of 286 respondents (Table 1) was chosen for convenience of calculations.

Table 1: Population Size and Statistical Sample

Rivers	Village Name	Population	No. of Household	Household types			
				Selected Sample	Farming Fishers 30%	Fishing Farmers 30%	Occasional Fishers 40%
Khial e Sard ary ab	*Abazai*	2,978	190	85	26	25	34
	Dawlat Pur	343	43	34	11	10	13
	Jangal	131	16	15	5	4	6
	Chitli Tapo	32	4	04	1	1	2
	Dogar	373	47	36	11	10	15
	Doaba	356	45	35	10	10	15
	Jala Bela	67	8	08	2	3	3
Jindi	*Shahbara*	495	62	44	13	14	17
	Majoke	238	30	25	7	8	10
Total		**5,013**	**445**	**286**	**86**	**85**	**115**

Selection of dependent and independent Variables

People residing near river bodies and fishermen have adopted several DFPs, which vary from one household to another and are used selectively based on their requirements and potential. Through literature review, semi structured interviews and FGDs with village elders and fishermen in the study area, four destructive fishing methods (blasting, Cyanide/use of chemicals, electric fishing, and small mesh/banned nets) were identified, which were adopted by majority of the fishermen. A score of "1" was assigned to practice adopted and "0" to practice not adopted by fishermen and then all scores were combined and divided by 4 to get a composite index of adoption of DFPs. This index was used as dependent variable in this study. Similar method for index construction and then using it as dependent variable has been used by Paudel, & Thapa, 2004; Yila & Thapa 2011; Mardia, Kent, & Bibby 1982. This index has revealed the range of practices used but not the intensity of their use.

In the beginning thirty variables or drivers of DFPs were identified through an in depth literature review. Due to measurement limitations and model specifications only seven variables were identified for the regression model.

Results

The results of Pearson correlation revealed that eight variables were found correlated with the dependent variable and these variables have no multicollinearity with the other independent variables. High negative partial correlation was found between DFPs and supply of

culture fish in the market (13.48±12.13), Inadequate alternative livelihoods (1.40±1.39), distance to water bodies (2.96±1.73 Km/s), and decline in fish stock (1.46±0.753), whereas the partial correlation between level of education (7.73±6.155), and cost of gear used (31941±30905) was positive. The partial correlation between Poverty (382624±179518) was moderate negative and level of savings (3796±2779) was moderate and positive (r (283) = 0.256, n = 286, p = .000). Among the independent variables selected for the model include level of education (r= 0.684), number of alternative livelihoods (r= - 0.658), supply of culture fish in the market (r= - 0.618), cost of gear used (r= 0.574), decline in fish stock (-0.520), distance to water bodies (- 0.503), poverty or average household income (- 0.370) and level of savings (0.256). Among the eight variables significantly correlated with the dependent variable, low level of savings was found significant at 0.05 confidence level, showing its weak correlation with the index of DFPs, while the other seven variables were significant at 0.01 confidence level, therefore this variable was dropped from the regression model.

Among the seven selected explanatory variables for the regression model, one variable (stock of fish) is a dummy variable, all others are continuous variables. This analysis has simple statistical procedure with high capability to integrate the impacts of independent variables on the use of DFs. To determine the impact of independent variables on the DFPs, the following model is specified;

$$DFPs = \alpha + \beta_1 E_d + \beta_2 L_n + \beta_3 F_s + \beta_4 C_g + \beta_5 H_p + \beta_6 D_w + \beta_7 C_f + \varepsilon i$$

Where, DFPs is the dependent variable, α is the intercept, β_1, β_2 β_3 β_4 β_5 β_6 β_7 are the coefficients of independent variables, E_d (average years of formal education of the household head), L_n (number of alternative livelihoods), F_s (fish stock), C_g (cost of gear used), H_p (average household income), D_w (distance to water bodies), and C_f (supply of culture).

Prediction of the models

The explanatory variables were entered step by step in to the regression model and all of the seven independent variables in the model have significantly influenced DFPs (Table 2). Both R and R square values have reasonable explanatory power on the models and their values have increased with the addition of explanatory variables from first variable to the seventh. The last model, with seven explanatory variables, have significantly high level of explanatory power, which was revealed in the adjusted R square value showing 74.1 percent variation in the use of destructive fishing methods has

been explained by the model. The model is also statistically significant with lower standard errors of the estimates.

The regression results revealed that out of the total seven variables five variables have negative effect on the adoption of destructive fishing practices. These include number of alternative livelihoods, fish stock in rivers, average household income, distance to water bodies and amount of culture fish to the market. With a unit increase in the number of alternative livelihoods, stock of fish in rivers, average household income, distance to water bodies and amount of culture fish in the market, there is a decrease of – 0.21, - 0.14, - 0.200, - 0.15, -0.13 units respectively in the adoption of destructive fishing practices (Table 2), which shows the importance of all these five variables in destructive fishing. However, average years of formal education and the cost of gears have a positive effect on the dependent variable. The higher "t" values also reveal the fact that all the seven variables are significant at 99% confidence level. The standard errors of the estimates also show a very small variation which is not explained by the independent variables.

Table 2: Coefficients of the explanatory variables included in the regression model

	Unstandardized coefficients		Standardized coefficients	t	significance
	B	Standard error			
(Constant)	0.727	.027		27.062	0.00
Average years of formal education	0.010	.001	0.287	7.352	0.00
Number of alternative livelihoods	- 0.033	.006	- 0.210	-5.400	0.00
Fish stock	- 0.041	.010	- 0.142	-4.072	0.00
Cost of gear used in fishing	1.426E-6	.000	0.216	6.060	0.00
Average household income	- 2.407E-7	.000	-0.200	-6.269	0.00
Distance to water bodies	- 0.009	.002	-0.146	-4.418	0.00
Amount of culture fish	- 0.002	.001	- 0.125	- 3.137	0.002

Discussion

The present model has captured only those causes which can be measured easily and can be analyzed through the selected regression models. However, tremendous research gap still exists in finding the

drivers of destructive fishing practices empirically. The variable, level of education of the household head was taken because in the study area the cultural values are strong and household head can influence and shape the behavior and outlook regarding use of destructive fishing practices. Previous research studies revealed that low level of education and environmental education or average years of formal education (Munyi, 2009; Johnson, 1998; Wagner et al., 1999) affect the use of DFPs positively. The findings of the study are not consistent with the previous research observations and investigations. This study find out that education do not play any role in reducing the use of destructive fishing gears rather shows a positive relationship between education and use of destructive fishing gears. The possible reasons for the higher adoption of destructive fishing gears by educated rather than uneducated respondents in the study area might be the higher mobility and awareness of educated respondents regarding DFPs. Secondly; educated people are mostly employed and have good contacts and access to the destructive materials and gears. The availability of alternative livelihood opportunities may reduce the pressure on the river resources. Analysis of the education and livelihoods opportunities in the study area reveal that over the past fifteen years the number of schools has been increased and due to education many fishermen have got jobs in police and law enforcement agencies.

Finding the stock of fish in rivers is a difficult job, however this variable was find out through interviews with fishermen and during focused group discussions and field visits to the study area and is based on fishermen perception. The fishermen revealed that fish stock has been reduced, which has led them to fish harder or use destructive fishing gears and small mesh nets in order to maintain their standard of living. Results show that the cost of gear is also positively correlated with the destructive fishing gears which support the previous research evidence, showing higher the cost, higher the efficiency in catch and use of destructive fishing practices (Sesabo & Tol, 2007; Munyi, 2009). Currently, the ban on sale and purchase of destructive fishing materials has resulted in reduced supply and elevated its prices. However, those fishermen and households who have good contacts with the law enforcement agencies not only get these materials but can use it anywhere in the rivers. People residing near to water bodies mostly use destructive fishing gears because people living distant to water bodies not only have to travel to water bodies but carry the destructive material which is difficult due to the present security situation in the study area.

Conclusion and recommendations

District Charsadda is endowed with three rivers and a number of canals with variety of fishes. However, during the past two decades

the size and amount of fish is continuously declining and is a matter of great concern. Being concerned to the adverse effects of DFPs, the fisheries department of Khyber Pakhtunkhwa has taken various steps to check the use of destructive fishing gears. These include increase in the number of monitors and inspectors, ban on the use of cyanide and blasting materials. However, destructive fishing is still undertaken especially by the rich and influential people and poses serious threats to the fisheries resources in this region. Keeping in view the findings of this study, the future fisheries management initiatives should be directed towards reducing the intensity and use of destructive fishing gears and enhancing awareness regarding conservation of fisheries resources for future generations. Alternative livelihood opportunities may be provided in the form of land for the landless fishermen, credit on soft terms and easy installments for micro enterprise development, including livestock rearing and agro based activities. Instead of traditional education the focus of education shall be on environmental education, conservation and sustainable development and these topics shall be included in the curriculum at school level. Fishing in local rivers shall be banned for at least some years through the encouragement of aquaculture investment and production and marketing of destructive fishing materials may be treated harshly.

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