Factors Influencing the Emergence of Collective Action in a Traditional Fishery of Oman: An Empirical Assessment of Three Coastal Fishing Towns in South Al-Batinah

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Abstract: Factors influencing the emergence of collective action are studied using survey data from individual boat owners from Barka, Masn'a and Suwaiq. Fishermen who adopt a cooperative strategy tend to be more risk averse and have high economic dependence on the common property resources. Social identity as a fisherman also appears to predict fishermen's willingness to cooperate to manage their fishery. Resource scarcity and possession of information about the status of the resource is also influential in fishermen's decision to cooperate. The results strongly suggest that group size does not have any significant influence on fishermen's willingness to cooperate to manage their fishery. The study findings also indicated that while the first two sources of heterogeneity (cultural division and difference in objectives and interests) are considered as causing a strong obstruction to collective action, the same cannot be said about the difference in the distribution of income. More inequality does not necessarily lead to more efficient use of natural resources. Thus, Olson's (1965) exploitation hypothesis was ruled out.

Keywords: common property resources, group size, fisheries management

1. INTRODUCTION

Fisheries exploited by small-scale fishing communities in Oman, as elsewhere in the world, are vulnerable to over-exploitation due to poverty and uncertainty of their occupation (Baland and Platteau 1996). The rapid depletion of fishery resources and the open access nature of inshore fisheries aggravate this situation. Consequently, this threatens not only depletion of the fishery resources but also the livelihood of the coastal fishermen.

To solve the problem of the commons, Hardin (1968) suggested strong state control to provide measures to regulate fishermen's activities. However, failures of state control to solve the problem of the commons are well documented in the literature all around the world (Baland and Platteau, 1996; Runge, 1986; Berkes, 1989 and Ostrom, 1990). But, in contrast, there are numerous instances of indigenous local groups who, with or without government support, have succeeded in conserving and managing their common property resources (for detailed cases see: Baland and Platteau, 1996; Berkes, 1989 and Ostrom, 1990). To cite a few examples we have the successful indigenous management institution *Senat Al-Bahar* which has been regulating the take from the coastal fishery in Oman for many centuries (Al-Oufi, *et al*., 2000); the innovative self-regulation of the coastal waters by the fishermen of Alanya in Turkey (Berkes, 1986), the artificial reefs of Kerala state, India (Kurien, 1995) and those in Loften, Norway (Jentoff and Kristoffersen, 1989). These local groups provide support and mutual help through sharing arrangements while they took communal decisions to punish individuals who attempted to violate the group rules by over-consuming or under-investing in common resources. In recent years, the problem of the commons and other environmental problems have rekindled interest in the study of collective action. This is because what the local group require to succeed in managing their resources is the coordination of efforts of some or all individuals to further their well-being. In Sandler's words, collective action problems are typically characterized by interdependence among the participants, so that the contributions or efforts of one individual influence those of other individuals (Sandler, 2001). This is exactly what is happening in a fishing community where the strategies adopted by one fishermen influence those of other fishermen.

This study focuses on understanding why fishermen choose to participate (or not participate) in local collective action to manage fish resources. The collective action consists of fishermen obeying the group rules and participating in collective effort to manage the coastal fish resources in South Al-Batinah.

2. FACTORS AFFECTING THE EMERGENCE OF COLLECTIVE ACTION

The notion that economic dependence on a common pool natural resource as a source of livelihood promotes the emergence of collective action has received considerable support in the literature. The more the user group depends on the resource, as a source of livelihood, the more likely its members will achieve endogenous solutions to the commons problems (Dasgupta, 2001; Baland and Platteau, 1996; Jodha, 1990; Runge, 1986; Shanmugaratnam, 1996 and Wade, 1987).

Economic factors such as income, debt levels as well as future discount rates and risk preferences, are potentially important determinants of a fisherman's willingness to manage fish resources (Ostrom, 1990; Baland and Plateau, 1996; Fernandez-Cornejo *et al*., 1994 and Kalaitzandonakes and Monson, 1994). For example, high debt and low income levels could prevent the fisherman from investing in conservation practices (changing his gill net to a larger mesh size to avoid catching juvenile fish). This is because the productivity gains due to resource conservation are usually not immediate. Fernandez-Cornejo *et al.* (1994) in their study of the factors that influence the adoption of Integrated Pest Management (IPM) technique argue that the perception of increased risk inhibits adoption among farmers.

One of the factors behind the success of collective action is the very strong community identity and a sense of mutual interdependence (Ostrom, 1990). The assumption made here is that when people from outside the fishing village enter the fishery (outsiders are not excluded as is the case in the open access situation) they will not be ready to comply with the rules devised by the local fishermen. As the number of outsiders increases, the function of the local institution is weakened. This eventually makes local collective efforts to conserve the fishery difficult to achieve.

A third essential condition for collective success is that fishermen must be aware of the status of their fishery and the potential benefit from participation in collective efforts to manage the resources. Possession of information about the status of the resource is important for the emergence of collective action, as this will reduce the transaction cost allowing agreements of cooperative behaviour to take place (Ostrom, 1990).

Although demographic variables may not have a crucial deterministic effect on the success or failure of collective action, some of these variables such as age, education and household size are expected to have some influence on fishermen's decision to participate in collective action. Due to the long-run nature of productivity benefits from resource conservation, long planning horizons are expected to positively influence fishermen's decision to participate in managing their resources (Kalaitzandonakes and Monson, 1994). This is because higher education is associated with greater information on the productivity implications of overfishing and the benefits of various collective conservation efforts.

One of the conditions for successful collective action that has received considerable attention in the empirical literature is group size. For many scholars, a small group is a prerequisite for successful collective action (Olson, 1965). In Olson's view the provision of public goods is reduced as the size of the group increases. However, there are others who disagree with Olson's view with respect to the relationship between group size and provision level (Barry and Hardin, 1982; Baland and Platteau, 1996; Chamberlin, 1974; Sandler, 1992 and Wade, 1988).

On the other hand, of fundamental relevance to the study of collective action is the relationship between group heterogeneity and the success of collective action. Based on the literature review, three sources of heterogeneity that hamper the capacity of resource users to participate in collective action were identified. These sources originate from the following: ethnic, racial, or other kinds of cultural divisions; differences in the nature of interests (full-time vis part-time) various individuals may have in a particular collective action and inter-individual variations in some critical endowments, that are reflected in varying intensities of interest (Baland and Plateau 1996).

3. METHODOLOGY

Data for this paper was gathered from a cross-section survey (Bulmer and Warwick, 1983) administered to fishermen between February and May 1998 in three coastal towns (Barka, Al-Masn'a and Al-Suwaiq). Some 194 vessel owners were selected and interviewed according to a pre-tested questionnaire according to the principles described in Nachmias and Nachmias, 1996. The survey instrument contains questions on socioeconomic and demographic characteristics as well as multi-items scales measured on Likert scale to measure fishermen attitude toward resource exploitation problems and an index to measure fishermen willingness to cooperate to manage their coastal fisheries. Respondents for this study were selected using a stratified sampling technique drawn from a sampling frame prepared from a list of vessel owners in the three

towns. Fishermen responses were analysed using SPSS® 9. In the computation of the multiple-regression equation, a *stepwise* procedure was used to decide the sequence of the entry of variables into the equation.

3.1 Measurement of the Dependent Variable

The dependent variable "cooperation" is measured as an index and is operationalised as fishermen's obeying the group rules and participating in collective efforts to manage the resource. Attitudes and beliefs towards issues such as returning under-sized fish, observing the distance rule, participation in conflict resolution, renewing the fishing licence, persuading others to follow fishing rules and many other issues are related to the fundamental values that form the individual's cooperation attitude. The index, which contains 11 statements, has Cronbach's alpha coefficient of 0.80, suggesting high internal consistency (reliability) for the index (Nachmias and Nachmias, 1996; Bryman and Cramer, 1997 and Bagozzi, 1994). The linear regression model chosen to test the relationship was:

$$y = \text{constant} + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_n X_n$$

Where: β_1 to β_n are the regression coefficients and X_1 to X_n are the independent variables entered into the regression equation.

3.2 Measurement of the Independent Variables

The independent variable "economic dependence" was operationalised as the relative importance of respondent's income from fishing to the overall household income. To operationalize the concept of risk perceptions using fishermen's attributes obtained from the questionnaire, the study considers two factors generally associated with fishermen's risk attitudes. The first is debt to asset ratio (D/A) which measures financial risk (Fernandez-Cornejo *et al*., 1994). Fishermen with a high D/A ratio are likely to be less risk averse (or they have a greater willingness to accept some risk). Therefore, fishermen with a large D/A ratio may be willing to accept greater business risks, and therefore they may be less willing to cooperate in managing their fishery. This is because the productivity gains due to resource conservation are usually not immediate. The second indicator used to measure perception of risk is the total number of fishing gear types owned by vessel owners[1].

Three indicators: fisherman's family involvement in fishing, his principal work, and his experience in fishing were devised to measure social identity of an individual fisherman. To measure family involvement, a value of one was given for each kin relation involved in fishing. The second indicator of social identity is operationalised as the number of years the respondent spent working as a fisherman (fishing experience) (Caffey *et al*., 1994). The more years the respondent has spent in fishing the stronger is his social identity. The third indicator of social identity was the respondents' fishing status. A value of one is given to a fisherman citing only fishing as the main occupation and identified here as a full-time fisherman. Part-time fishermen were given a value of zero, based on the assumption that a fisherman having a secure employment besides fishing (part-time fishermen) has a lower social identity as a fisherman. Fishermen's awareness of resources exploitation problems is operationalized in terms of their awareness of the factors that cause overfishing in the fishery. A multi-item scale containing a number of statements was administered to the fishermen and their responses were measured on a Likert scale.

The independent variable "group size" was operationalized as the total number of fishermen in each village. In this study, fishermen from 27 villages were included in the sample. It is interesting to examine the difference between fishermen's cooperation mean scores for those who live in villages of small user groups and those of large user groups. For the purpose of the analysis, the 27 villages included in the survey were divided into two groups: small and large. The small group includes villages inhabited by 40 fishermen or less and the large group includes villages with more than 40 fishermen living in them.

To elicit information about the two sources of heterogeneity examined in this paper, i.e., fishing status and variation in income, the fishermen were asked to report their fishing status, i.e., full-time or part-time. Income variation among fishermen was measured using Gini Coefficient which gauge the level of inequality

[1] Number of fishing gear types: discrete variable equal to the total number of fishing gear types owned by each vessel owners. The most six popular types of fishing gears used in the area are included in the index. These are: drift net for tunas, drift net for kingfish, drift net for mackerel, traps, encircling net for mackerel and encircling net for sardine. The index ranges from one (high risk-averse) to six (low risk-averse).

among fishermen following Cowell, 1977. Values for Gini coefficient vary between zero (perfect equality) and one (perfect inequality).

4. RESULTS AND DISCUSSION

The index of fishermen's cooperation (dependent variable) to manage their coastal fishery was an interval measure ranging between a score of 0 (no cooperation) to 11 (maximum cooperation). Univariate statistics of the index indicated that the mean level of cooperation among fishermen was 7.19 (+/- 2.75 S.D.). Thus, a relatively high level of cooperation was achieved in the group. Using mean score, little variation amongst the studied towns (Barka (7.48), Suwaiq (7.10) and Musn'a (7.02)) was observed (Table 1). Fishermen in the study area depend on fishing for 51.6 % of their total household income, with little variation amongst the three towns (Barka, 45%; Masn'a, 56.2 %; Suwaiq, 53.1%). The fishermen population of South Al-Batinah is characterized by high-income inequality, with few rich receiving the greatest wealth of the fishery and many poor deriving very little from their resources as shown by the Gini coefficient. They also characterized by low educational attainment (1.14 years) and large household size (12.4 head per house).

Overall, the results in Table 2 suggest that economic dependence on the resource has a positive effect on cooperation as demonstrated by the Pearson's r-value of 0.23, which was significant at the 0.001 level. Therefore, it can be stated here that those fishermen who are more economically dependent on fishing show more willingness to cooperate in solving their common problem. Fishermen not dependent on the fishery become detached from the village, since they are no longer bound by the condition of mutual vulnerability now because they have alternative sources of income. To some extent it can be said that for those who are less dependent on the fishery for their income, loss of reputation (when caught catching immature fish, for example) is not a threatening factor to deter them from doing so.

Table 1. Mean values for the dependent and independent variables (N=194)

Variables	Barka	Masn'a	Suwaiq	All sample
Economic dependence (%)	45.1	56.2	53.1	51.6
Perception of risk				
• dept/asset (ratio)	0.72	0.55	0.42	0.55
• no. of fishing gear owned (1-5)	2.43	2.47	2.41	2.43
Awareness of resources status (1-3)	2.82	2.71	2.53	2.67
Age (yrs)	43.4	43.9	45.7	44.4
Education (yrs)	1.34	1.08	0.90	1.10
Household size	12.4	11.9	12.8	12.4
Group size (no. of fishers/village)	81.6	32.7	47.6	53.7
Social identity				
• family involvement (0-5)	3.33	3.45	3.33	3.36
• fishing experience (yrs)	26.6	27.8	28.9	27.8
Group heterogeneity				
• income inequality (Gini coefficient)	0.34	0.37	0.40	0.39
• part-time/full-time (ratio)	0.74	0.40	0.28	0.44
Cooperation	7.47	7.02	7.10	7.19

The results presented in Table 2 indicate that among the factors related to risk, the correlation between debt to asset ratio and cooperation was statistically significant and negative. Therefore, the higher the D/A ratio (less risk averse), the lower the fishermen's willingness to cooperate. A fisherman with a high debt to asset ratio will not take the offer of a cooperating game, as there is no guarantee that others will not defect and make him a "sucker". When perception of risk is measured as the number of fishing gear types owned by the individual vessel owner, the Pearson's r coefficient is negative and statistically significant (Table 2).

Fishermen awareness about resource exploitation problems was positively and significantly related to fishermen's willingness to cooperate (Pearson's r was 0.32, $P< 0.05$). This moderate correlation suggested that those fishermen who have high awareness of the likely factors that cause the resource to deplete show more willingness to cooperate to avoid further damage to their fishery. The effect of demographic attributes has no

direct influence on fishermen's decisions. It was found that there is no statistical significant correlation between respondent's age and household size and their willingness to cooperate (Table 2).

Although, fishermen's cooperation mean scores for those who come from small villages (6.28) is slightly higher than the mean scores for those who come from large villages (5.91), though the difference is not statistically significant as proved by the results of the t-test technique (t-value = 1.01; P > 0.05). Hence, there is no significant difference between fishermen's willingness to cooperate according to their group size. For many authors one of the conditions for successful collective action is that user groups are small in size. Olson (1965) suggested that small groups would provide public goods; as the size of the group increases, individuals will not provide themselves with the public good required. However, there are many others who expressed strong disagreement with Olson's view with respect to the connection between user group size and participation in collective action. For example, Sandler (1992) has ruled out the direct effect of group size as the main predictor of the success or failure of collective action.

Another example from a real world setting is the findings of Wade in Andra Pradesh (India) when he stated that small size is not a necessary condition for success in collective action (Wade, 1988). Similar to Wade's conclusion is the finding of Baland and Platteau after they had reviewed many cases of collective action from communities of different group sizes (Baland and Platteau, 1996). Therefore, the finding of this study, which ruled out the direct effect of group size on the success or failure of collective action, is consistent with the findings of Baland and Platteau (1996); Wade (1988); Chamberlin (1974); Barry and Hardin (1982); Salim (1996) and Sandler (1992).

Table 2. Results of the statistical analysis of the factors influencing the emergence of collective action

Variables	Pearson's r	t-value	P-value
Economic dependence (%)	0.23*		<0.05
Perception of risk			
• dept/asset (ratio)	-0.33*		<0.05
• no. of fishing gear owned (1-5)	-0.30*		<0.05
Awareness of resources status (1-3)	0.32*		<0.05
Age (yrs)	0.13		>0.05
Education (yrs)	-0.14*		<0.05
Household size	0.03		>0.05
Group size (no. of fishers/village)		1.01	>0.05
Social identity			
• family involvement (0-5)	0.08		>0.05
• fishing experience (yrs)	0.17*		<0.05
• principal work		-2.46	<0.05
Group heterogeneity			
• part-time/full-time		-2.85*	<0.05
• income inequality (Gini coefficient)	0.06		>0.05

The results presented in Table 2 indicate that fishermen who consider themselves to have more social identity were significantly more likely to adopt a co-operative strategy. This was supported when social identity was measured using fishing experience (r =0.17, P<0.05) and principal work (t-value =-2.46, p<0.05).

Of fundamental relevance to the study of collective action is the relationship between group heterogeneity and the success of collective action. The results indicate that the t-test value of fishermen's cooperation (- 2.85; p < 0.05) is statistically significant, and therefore, there is a statistical difference between fishermen's willingness to cooperate according to their fishing status, i.e., full-time and part-time. The result of the test clearly shows that full-time fishermen have a higher willingness to cooperate mean score (7.56) than part-time fishermen (6.36). This indicates that full-time fishermen are more willing to cooperate to manage their resources, owing to their high dependence and interest in the resources, than part-time fishermen. The intuition behind these findings is that when two groups with different objectives appropriate the resource, the management of the resource is threatened. In such a situation, the first group (full-time fishermen) uses the resource with a long-term objective; thus they will be much more concerned about its sustainability. The other group (part-time fishermen), owing to their alternative sources of income, will appropriate the resource with a short-term objective (higher subjective discount rate); thus they are much less concerned about resource

management and will free ride on the efforts of the other groups. The same can be said about industrial fishing where there are sometimes many exit possibilities, because unlike traditional fishermen, owners of industrial vessels can move their fleets to other fishing grounds (Platteau, 1989). Cases of this type are found in developing countries, where industrial fishing has been given concessions to exploit fish resources (Lim *et al*., 1995; Baland and Platteau, 1996 and Ostrom, 1990), thus expanding the options open to skippers.

The third cause of heterogeneity originates from differences in skills, assets, income and access to credit markets. Olson (1965) advanced the exploitation hypothesis in which he argued that agents with high stakes in a public good are more willing to bear a large share of the costs of its production (see also Guttman, 1978). In an example provided by Baland and Platteau (1997a) it was found that rural cooperatives in the Netherlands were often created by better-off farmers who took the initiatives to start the cooperatives and contributed the bulk of the initial share capital. This pattern conforms well to the exploitation hypothesis advanced by Olson (1965) that the large is exploited by the small. Based on the literature review, the study will test Olson's (1965) exploitation hypothesis. The results in Table 2 suggested that there is no statistically significant correlation between variation in income and fishermen cooperation ($r = 0.06$ and $P > 0.05$). As argued by Baland and Platteau (1997a), the exploitation hypothesis should not be taken to mean that if the distribution of wealth were made more egalitarian, individual contribution would fall. Further, Cornes and Sandler (1985) argue that the optimal provision of a public good in a community of a given size is independent of income distribution (see also Cornes, 1993). In communities where wealth is made more equal, the cost of initiating regulatory tasks would be shared more equally among agents, whereas greater inequality makes some agents big enough to bear a greater share of the costs on a voluntary basis, while others are too small or attach too little value to their resource endowments (Baland and Platteau, 1997b).

In many instances from marine fisheries, wealth is associated with better availability of outside economic opportunities. Thus, a large elite, even though they attach greater value to their resource endowment, chooses to sacrifice conservation effort in order to derive quick gains in the present. In the context of coastal fisheries, for example, conservation effort may be seriously undermined by the presence of more endowed members. As their assets increase, they start to acquire bigger vessels and stronger engines, which allow them to exploit new fishing grounds away from their base village. Owing to this exit opportunity, they feel less concerned about conservation of local fish resources. Therefore, more inequality does not necessarily lead to more efficient use of natural resources (Baland and Platteau, 1996, 1997a and 1997b); thus, Olson's (1965) conjecture (the equilibrium in public-goods game often has small members free-riding more than large members) might not hold true in the case of CPRs.

The multiple regression equation estimated in Table 3 suggests several findings. Fishermen's awareness of resource exploitation problems appears to be the best predictor of cooperation (standardised Beta = 0.281). Perception of risk also appears to be important (Beta = -0.257). Less risk averse fishermen show less cooperation, since the sign of the coefficient is negative. Economic dependence on fishing (Beta = 0.181) came in third place, followed by social identity (Beta = 0.169) as fishermen; the sign of both these coefficients is positive. Thus, the standarised beta for perception of resource problems means that for each one unit change of perception of resource problems, there is a standard deviation change in cooperation of 0.281, with the effect of the other three variables in the equation controlled. The results in Table 3 suggests that around one quarter (24 %) of the variance in cooperation is explained by the four variables alone. Independent variables such as respondent's age, education and many others did not enter the regression equation because they failed to conform to the criteria for inclusion set by the stepwise procedure; although some of these variables were statistically associated with the dependent variable "cooperation".

Table 3 Regression equation modeling fishermen's willingness to cooperate (N=194)

Predictors	β	Beta*	R^2	F
Awareness of resources problems	0.243	0.281	0.09	19.77 P<0.05
Perception of Risk	-0.731	-0.257	0.14	16.76 P<0.05
Economic dependence on fishing	0.014	0.181	0.21	16.92 P<0.05
Social identity	2.37	0.169	0.24	14.48 P<0.05
(Constant)	2.94	-		

* Standardised Beta coefficients

5. CONCLUSION

The results provide some insight into the factors that influence the emergence of collective action to manage coastal fisheries. In particular, the analysis indicates that the higher the economic dependence on the fishery, the higher the effort one would provide to manage the fishery. The results indicated that there is a significant negative relationship between perception of risk and fishermen's adoption of a cooperative strategy. The findings in this study suggest that resource scarcity gives an incentive for cooperation. Possession of information about the status of the resource is vital for the emergence of collective action. This is in tune with findings of studies that look at the cooperative management of joint fishery resources around the world. A particular example that comes to mind is the shared management of Northeast Atlantic cod by Norway and Russia (see Sumaila 1997 and Armstron and Sumaila 2001). Regarding group size, the results strongly suggest that group size does not have any significant influence on fishermen's willingness to cooperate to manage their fishery. Social identity as a fisherman appears to predict fishermen's willingness to cooperate to manage their fishery. The study also considers the relationship between group heterogeneity and the success of collective action. The study findings indicated that more inequality does not necessarily lead to more efficient use of natural resources. Thus, Olson's (1965) exploitation hypothesis was also ruled out.

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