Investigation of Critical Issues Associated with Illegal Fishing Practices in Victoria Reservoir, Sri Lanka

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Abstract
As illegal fishing is a serious problem in aquatic resource management, a study was conducted to investigate the socioeconomic and management factors affecting illegal fishing practices in the Victoria reservoir in Kandy district. All fishers (N=55) representing all the landing sites were surveyed twice in January, 2014 and December, 2015 on their socioeconomic status; engagement in, benefits received from and the attitude on the present community based fishery management process. Chi-square procedure (α=0.05) was used to analyze the associations between survey data (treated as categorical variables) and involvement in illegal fishing. The main illegal fishing practices found were the use of monofilament nets; small meshed nets (<88 mm); water beating; and fishing with no license, unregistered boats, or at non-permitted time periods. About 33 percent of fishers were involved in illegal fishing with a maximum of 3 times/fisher. Fishers with primary education had more tendency to involve in illegal activities than others ($P<0.05$). Fishers having a positive opinion on present management practices of the fisheries organization were significantly less prone to engage in illegal practices ($P<0.05$). However, alcohol consumption, smoking, positions held in the organization, level of fishing, number of participations in meetings, training programs and raids with officials, subsidies received on nets and boats, licensing of boats, and registration for fishing had no significant association with their engagement in illegal fishing ($P<0.05$). Alternatively, a co-management strategy was proposed as an efficient reservoir management procedure in which the government and resource users share the responsibilities in the management of the resource.

Key words: Aquatic, Co-management, Fisheries Organization, Illegal fishing,
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Introduction

Illegal fishing and non-compliance of regulations are commonly considered as serious problems to fisheries around the world causing low income derived from the fishery. Sustainable utilization of aquatic resources assures the maximum output in the long run and should be the goal of management of those resources (Fernando *et al.*, 2015). For effective fisheries management, understanding the behavior of fisherman is a key ingredient. Kulatilake *et al.* (2010) have shown that the integrity of the ecosystem as well as the socio-economic basis of those who depend on the resources are threatened by various ways such as poaching, use of destructive fishing methods, zoning violations, and non-compliance behaviors.

In Sri Lanka, inland fishery acts as a cheaper source of animal protein and a primary source of income for a substantially large fishing community. However, the full potential of this resource has not been realized due to lack of proper management strategies (Kulatilke *et al.*, 2010). The main means of over exploitation are improper fishing practices (Wickremasinghe *et al.*, 2007). Illegal fishing has seen a rise in the reservoirs with the discontinuation of state patronage for the development of inland fisheries in Sri Lanka in 1990 which shows the necessity of a State-sponsored management system in Sri Lankan reservoirs (Amarasinghe and De Silva, 1999). In order to govern the fisheries and aquatic resources, the Ministry of Fisheries and Aquatic Resources has implemented the Fisheries and Aquatic Resources Act (Act No. 2, 1996) with subsequent amendments. In spite of the prevailing management issues, the fresh water fish production in Sri Lanka has increased from 38,380mt in 2006 to 75,000mt in 2015 (Fisheries Statistics Report-2015). Wickremasinghe *et al.* (2007) stated that identifying the problems and solving the management issues of reservoir fisheries is invaluable since most of those are distributed in the dry zone where majority of the low income people live. Objective of this study was to identify the socio economic and management factors affecting illegal fishing practices in the Victoria reservoir in Kandy district.

Materials and Methods

Victoria reservoir is distributed over four Divisional Secretariats in the Kandy District and has a characteristically deeper gradient and a large volume. Though the reservoir was primarily built for irrigation and hydroelectric power generation, it has become an invaluable resource for the surrounding fishing community. The reservoir has two major tributaries which are Mahaweli River and Huluganga.

Two frame surveys were carried out to gather the required socio-economic information associated with the fishers in January, 2014 and December 2015. A pre-tested questionnaire was used on all of the members of the fisheries organization (N=55) representing all the landing sites twice within the period. In addition to socio-economic data (including level of education, full versus part time fishing, habits such as consumption of alcohol and smoking), fishery related data such as number of nets and boats per fisherman, level of fishing, obtaining fishing and boat license, and subsidies received on fishing gear and boats were recorded. Information on management strategies such as training and welfare programs, involvement of fishers in management such as in meetings, raids and other organizing responsibilities as well as the opinion of fishers on usefulness of management practices and compliance were also obtained. The extent of illegal fishing activities was quantified using the information collected on frequent raids conducted by the responsible government agencies and fisheries organization. Issues related to fishery in the reservoir and fisheries organization were recorded by participating in monthly meetings. Opinions of fishers also were recorded on effectiveness of having a fisheries organization, usefulness of organization of communities to make decisions to improve their living standards, willingness to organize themselves into societies and agreeing to comply with fishery regulations.

For analysis, the raw survey data were edited, coded as discrete variables and the significance of association between no. of times a fisher was engaged in illegal fishing (0, 1, 2, and 3) and each of the other variables was determined using Chi-square analysis in Statistical Analysis System (SAS) package (α=0.05).

Results and Discussion

The main illegal fishing practices found in the reservoir were the use of monofilament nets, small meshed nets (<88 mm), water beating to harvest more catch, fishing without an operation license, use of boats without registering and fishing at non permitted time periods. Mesh sizes of 88.9, 101.6, 114.3, 127 and 139.7 mm gill nets were used by the fishers. These results were similar to the findings from Sorabora reservoir (Wickremasinghe *et al.*, 2009). Total number of times involved in illegal fishing was recorded as 37 among 18 fishers with a maximum of 3 per fisher.

Education level was significantly associated with illegal fishing: those with primary education being involved in more illegal practices ($P<0.05$). Relatively more educated fishers seem to better understand the undesirable results of the destructive fishing practices, similar to the findings on Sorabora reservoir (Wickremasinghe *et al.*, 2009). Therefore, conducting awareness programs with respect to illegal fishing activities and their damages to the resource is recommended.

It was evident that the opinions of fishers on effectiveness of having a fisheries organization, usefulness of organization of communities to make decisions to improve their living standards, willingness to organize themselves into societies, and agreeing to comply with fishery regulations were significantly ($P<0.05$) associated with improper fishing practices (Table 1). In line with the findings of Wickremasinghe *et al.* (2009), majority of the fishers were willing to organize into their societies and comply with regulations. Many were of the opinion that organizing as a society would enable the fishers to improve their living standard. Most of those engaged in illegal fishing were those of opposite view in the opinion poll. The personal view of the most fishers interviewed was that a fisheries organization could make important decisions for rational utilization of fishery resources based on collective agreement.

Contrary to common belief, it was found that addiction to alcohol and smoking, positions held in the fisheries organization, level of fishing, number of participations in raids with officials and attendance at general meetings were not significantly associated ($P>0.05$) with illegal fishing (Table 1).Subsidies received on nets and boats, licensing of boats, registration for fishing, and attending to training and awareness programs also have shown no significant association with (i.e. were unable to reduce) illegal fishing ($P>0.05$). Studies on Senanayake Samudra and Mahavilachchiya tanks also have reported similar cases of illegal fishing activities and have suggested remedial measures (Kulatilake *et al.*, 2010; Fernando *et al.*, 2015). Amarasinghe and De Silva (1999) and Fernando

Table 1. Percentages of fishers engaged in illegal fishing activities with respect to their attitudes and involvement in activities of fishery management.

Attitudes and involvement in fishery management activities	Yes/No	No. of times engaged in illegal fishing activities				Overall %	P-value of Chi-square test
		0	1	2	3		
Willingness to organize into fishery societies	Yes	81.1	10.6	2.3	1.5	95.5	$P<0.05$
	No	0.0	0.7	2.3	1.5	4.5	
Agreeing to comply with fishery regulations	Yes	81.1	10.6	3.8	2.3	97.8	$P<0.05$
	No	0.0	0.8	0.7	0.7	2.2	
Level of engagement in fishing	Full time	50.8	6.8	2.3	1.5	61.4	$P>0.05$
	Part time	30.3	4.6	2.3	1.4	38.6	
Participation in training programs on fishery	Yes	39.4	4.6	1.5	0.7	46.2	$P>0.05$
	No	41.7	6.8	3.0	2.3	53.8	
Participation in fisheries society meetings	Yes	80.2	11.4	4.6	3.0	99.2	$P>0.05$
	No	0.8	0.0	0.0	0.0	0.8	

et al. (2015) also pointed out that a community based organization in the form of fisheries cooperative society does not sustain well in our fisheries. Almost all the fishers who involved with these destructive fishing practices were well aware of the undesirable as well as harmful results of such activities but consider only short term benefits.

The existing management activities of the reservoir before January, 2014 were based on Community Based Management method where Government plays the major role in managing the aquatic resource. However, during the study period the management method had been transforming gradually into co-management as of Fernando *et al.* (2015), where all stakeholders take part in the resource management. The present study shows that effective management strategies should be derived with the contribution of all stakeholders while emphasizing the importance of strengthening the fishers' organization. Fishing communities will become organized and respond to co-management only if the strategies were shown to provide effective remedial measures to their resource management problems. Such results have been achieved success in Senanayaka Samudra, another large perennial reservoir in Sri Lanka (Kulatilake*et al.*, 2010; Fernando *et al.*, 2015).

Based on these findings, a stronger co-management strategy involving all stakeholders of the aquatic resources is proposed in which the government and resource users have equal responsibilities in the management of the resources.

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