

VIEWS OF FISHERMEN AND AQUACULTURE AUTHORITIES ON THE STOCKING OF TILAPIA AND CARP SPECIES IN THE DRY ZONE RESERVOIRS, SRI LANKA

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Abstract

A survey was conducted to find out the views of the fishermen and aquaculture authorities on the introduction of Tilapia or Carp species in the fresh water bodies in the Dry Zone of Sri Lanka. This survey explored the factors affecting the choice of either one of the two fish species for inland aquaculture using data collected from the regional aquaculture extension officers and inland fishermen by means of a structured questionnaire. Binary logistic regression was used to analyze the factors affecting the choice of Tilapia vs. Carp by fishermen and the authorities. A correlation analysis demonstrated strong ($r \geq 0.8$) positive and significant ($p < 0.05$) correlations between preference for Tilapia by fishermen and market demand ($r = 0.8$), size compatibility ($r = 0.9$) and consumer preference ($r = 0.8$). Correlations were insignificant with fishing effort and income. Market demand, size compatibility and consumer preference are crucial factors in the preference of fishermen for Tilapia over Carp. The same view was expressed by the regional fisheries authorities as well. A revision of the present contradicting stocking policy could therefore, generate more social and economic benefits.

Keywords: carp, tilapia, perception, social survey, stocking

Introduction

The fishery sector of Sri Lanka mainly consists of marine and inland fisheries. Sri Lanka has extensive fresh water and brackish water resources for carrying out fishing activities in the inland fishery sector. According to National Aquaculture Development Authority (NAQDA) the Sri Lankan fresh water bodies comprise of around 260,000 ha as inland reservoirs.

The inland fishes of Sri Lanka have, during their evolution, adapted to riverine conditions and not to lacustrine ecosystems. Hence, the endemic and indigenous riverine species give less production in the reservoirs. However, after the introduction of exotic fish species – such as tilapia and carp, an increased fish production was noticed in the inland reservoirs. Two tilapia species namely, *Oreochromis mossambicus* and *Oreochromis niloticus* were introduced to Sri Lanka in 1952 and 1956, respectively. Later, the introduction of the Chinese carp species such as the Grass carp and Big head carp in 1976 and the Indian carp species like *Catla catla* (Catla), *Labeo rohita* (Rohu), and *Cirrhinus mrigala* (Mrigala) in 1981 caused a significant development of the inland fisheries in Sri Lanka. The Tilapia species have natural breeding ability but the Chinese and the Indian carp do not naturally breed under the environment conditions of inland reservoirs in Sri Lanka (Silva, 1988).

To overcome this problem, therefore, breeding centres were established in Udawalawa (1975) and Ibbankatuwa (1982) with the intention of growing the post larvae of these species up to the fingerling stage. Tilapia constitutes more than 57% of the inland and aquaculture fish catch. Catla alone holds a share of 13%, while the other carps make up a share of 6%. The North Central Province, comprising the Anuradhapura and Polonnaruwa districts, dominates the inland fisheries sector, contributing nearly 39% of the total fish production in Sri Lanka (Fisheries statistic of Sri Lanka, 2014).

Tilapia has slower growth rate and low body weight at harvest when compared with the carp species. The government authorities stock carps rather than tilapia in the reservoirs because they believe that maximum benefits can be obtained from carp rather than tilapia. Thus, over the last two decades the contribution of tilapia to the inland fishery in Sri Lanka has gradually declined from over 70% to just over 50% and is replaced by the Indian major carps, which were introduced to Sri Lanka in 1980s (Athauda, 2010). However, tilapia still plays a major role in inland fishery sector as a dominant group of fishes, especially in areas where societies are largely dependent on freshwater fishery and also where low income earning rural communities are found in the country.

Aluthdivulwewa tank was purposely selected for this study because most of the actively functioning fishery co-operative societies are found here. Aluthdivulwewa tank is a medium size perennial tank which is situated in the North Central province of Sri Lanka close to the Galenbindunuwewa township. Fishermen of Aluthdivulwewa are willing to stock tilapia rather than the carp species but the government authorities insist on growing carp species in the inland water bodies. There is, therefore, a disagreement between the fishermen in the dry zone and the government authorities on the issue of whether to stock carp or tilapia in the fresh water reservoirs of the dry zone.

This survey was, therefore, conducted mainly to find out the true situation in the field based on factors which influence the opposing views of the fishermen and the authorities on the stocking policy for of carps and tilapia species in the reservoirs. This information is very essential to policy formation on stocking reservoirs with fish in order to promote more social and economic benefits from the inland fresh water fishery sector of Sri Lanka.

Material and Methods

Study area

The study was carried out in the area surrounding the Aluthdivulwewa tank which is one of the medium sized perennial dry zone tanks located in the Galenbidunuwewa secretariat division, in the Anuradhapura district of Sri Lanka.

Sampling & data collection

The entire fishery community consisting of 30 fishermen and the seven Regional Aquaculture Extension Officers (RAEOs) were selected for the study as major stakeholders in the Aluthdivulwewa tank fishery. The field survey was carried out by having face to face interviews with fishermen and RAEOs, supported by filling of structured questionnaires. Two different questionnaire formats were used to interview each stakeholder group to collect primary data. In addition, personal observations were also used wherever it was appropriate as research data. Secondary data were collected directly from the records of the Fisheries Societies and Regional Aquaculture Extension Offices, searching books, journals as well as the internet.

The analytical framework

The fishermen’s view point on the tilapia vs. carp species issue is defined as a discrete decision. The preference for either tilapia or carp is a binary variable and the analysis was done based on a binary choice model. The response is qualitative in nature. Normally fishermen’s perceptions would have been analyzed by the chi-square method, although in this study only a descriptive analysis was carried out because the response was 100% biased towards tilapia or carp in this survey. The relationships between the fishermen’s views and the factors which affected their views were analyzed by a nonparametric categorical rank data analysis method such as the probit model and Pearson correlation method. Because of this all variables which affected to fishermen perceptions were obtained as categorical rank data.

The variables were studied regarding fisherman’s annual income from each fish species, market demand for each fish species, size compatibility for consumer requirement (size of fish), consumer preference, and catching effort for each fish species. All these variables are independent variables and measured as categorical rank data by using the Likert scales. Fishermen’s views and perception levels are the dependent variables.

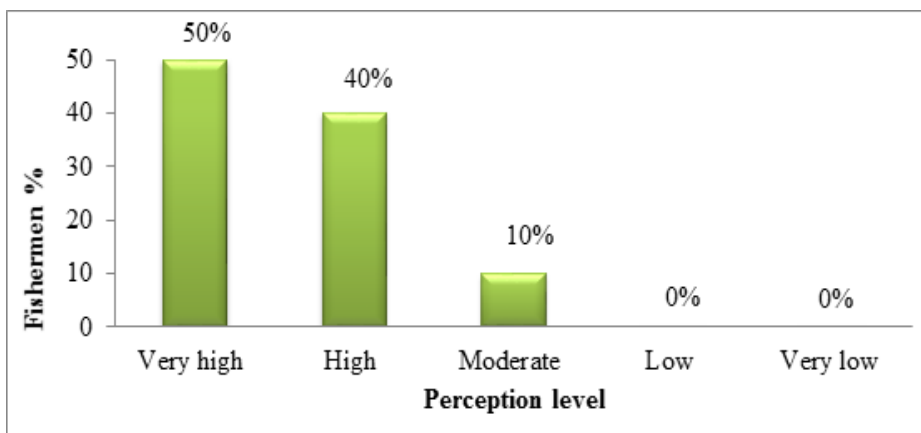
Data Analysis

The descriptive analysis was carried out using Microsoft Excel package and Minitab version 16.1 was used for statistical analysis. Binary logistic regression was used to find out the relationship between the views of the fishermen, the authority and the socio economic factors. Pearson correlation analysis was used to assess the significance of the correlation between the variables. Regional Aquaculture Extension Officers’ perceptions were also analyzed in the same way.

Results and Discussion

Fishermen’s perception

According to the results of the survey, all the fishermen preferred the stocking of tilapia in the reservoirs. But their preference levels ranged from very high (50%), high (40%) to moderate (10%). No one had low or very low perceptions levels of preference for tilapia.



**Figure 1: Stated preferences by fishermen for tilapia
Factors affecting fishermen’s perception**

The average annual income (Rs. 245,650.00) from tilapia was higher than the average annual income (Rs. 50,955.00) from carp species. The fact that the tilapia harvest was higher than that for carp throughout the year and the unit price of carp was lower than that for the tilapia species were the reasons for this difference in annual income from the two species. There were 5 levels of income within the two specified annual incomes, each showing the relative contribution from the two fish species. The highest income was recorded from tilapia with 27% and 73% of fisherman obtaining an annual income of Rs. 180,000-240,000 and >240,000 respectively. The contribution of income from carp was less than Rs. 60,000 for all fishermen.

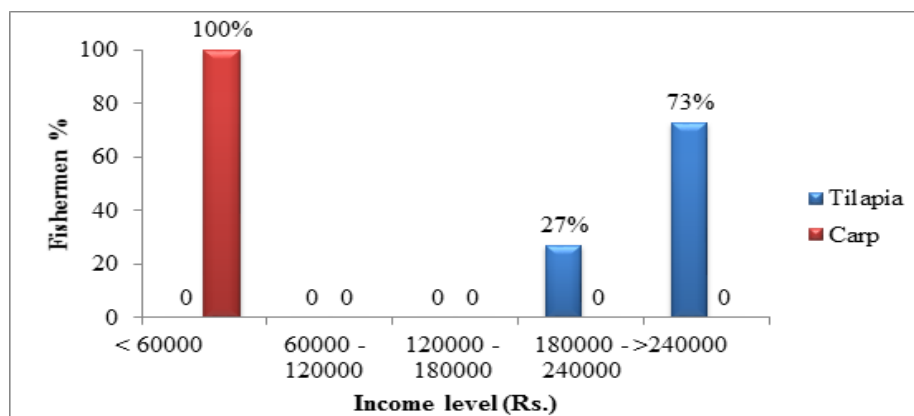


Figure 2: Distribution of fishermen income

It is evident from the results that the income contribution of tilapia is at least three times more than that from carp. The relationship between fishermen's perception levels with fishermen income was insignificant ($p > 0.05$). This is because income changes are more related to fluctuations of fish harvest from season to season rather than to the type of fish. The distribution of market demand for each fish species ranged from very high, high, moderate and low to very low levels.

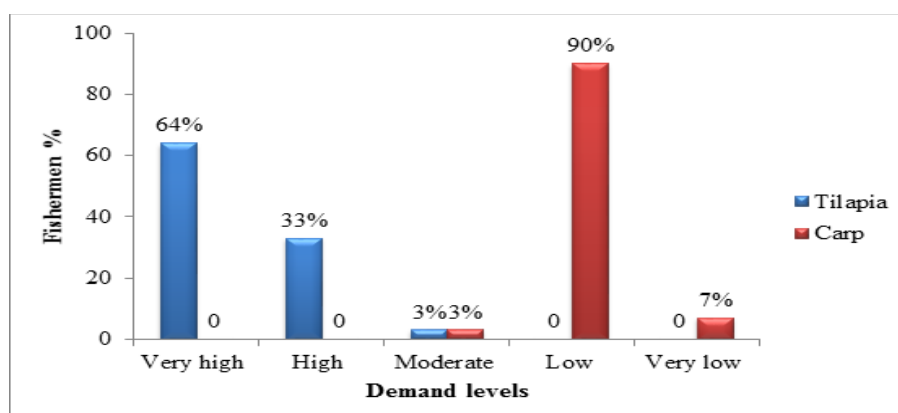


Figure 3: Distribution of market demand

64% of fishermen stated there was a very high demand for tilapia while 33% and 3% fishermen thought there was only high and moderate demand for tilapia respectively.

Nonetheless, 90% and 7% fishermen considered the demand was low and 7% very low for carp. There was a strong positive ($r=0.799$) relationship between fishermen perceptions on tilapia and market demand. It is clear from this result that fishermen had a high preference for tilapia because of its high market demand.

The consumer preference for the two species was categorized in to five levels. Majority of fishermen (60%) believed tilapia had very high level of consumer preference while 30% and 10% stated high preference for tilapia respectively. In contrast, 7%, 53% and 40% of fishermen considered there was moderate, low and very low consumer preference for carp. There was a strong positive (0.824) relationship between fishermen's

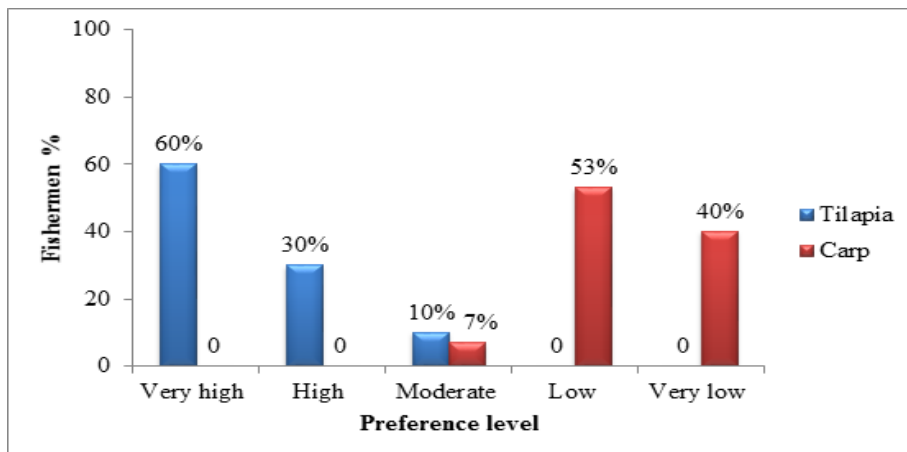


Figure 4: Distribution of consumer preference

perceptions on tilapia and consumer preference. Accordingly the existence of high consumer demand could be another reason for the preference for tilapia over carp by the fishermen.

Fishing effort which is needed to catch each fish species was assessed under five effort levels. This fishing effort referred to the way of handling gill nets at fishing, gathering and collecting fish from the net. Results indicated 70% of fishermen were of the opinion that only a moderate level of effort was required to catch tilapia while 93% of fishermen were of the opinion that a high level of effort was required to catch carp. Because of the larger size of carps (around 5 kg) harvesting of carp is laborious than tilapia. However, there was no significant ($p>0.05$) relationship between fishermen perception levels with fishing effort. The reason for this could be that the fishermen did not pay much attention to effort spent on catching fish.

Size compatibility was determined by the individual size of the each fish species at their market stage. Size compatibility of each fish at the marketing stage was assessed by using five compatibility levels. 53% of respondents believed that tilapia had very high size compatibility and 33% said tilapia had high size compatibility. Majority of respondents (86%) indicated that size compatibility level of carp was low.

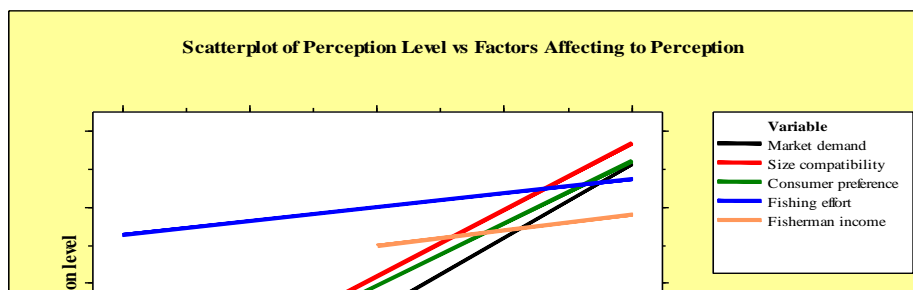


Figure 5: Perception level of tilapia vs. factors affecting to perceptions

This elicits the suitability of tilapia as a table fish which the consumer can buy in the right quantity as a whole fish without cutting it. There was a strong positive (0.932) relationship between fishermen's perceptions on tilapia and their size compatibility (figure 1). Size of fish could also be one of the key factors affecting the marketability of each species.

According to the respondents, tilapia has good size compatibility at the marketing stage. Normally 2-3 numbers of tilapia were included in 1kg but average market size of the carp species is around 5kg to 10kg. Therefore slicing is needed to obtain 1kg of carp but consumers do not like to buy fresh water fish slices compared to sliced marine fish species. Also most retailers were unwilling to portion the fish due to fears of rapid spoilage. Consumers do not like to buy the head portion of carp because of its large size and hence it has no market value. Large sizes of carps have demand at special occasions like festivals, family get together or funeral occasions only. Also, carp has a lower consumer preference due to their taste compared with tilapia especially among the dry zone consumers. According to the respondents, Rohu (*Labeorohita*) has poor consumer demand compared with other carp species due to its specific "Y" shape spines in their body. Common carp (Golden carp) and catla are preferred by the consumers in comparison to rohu, but their high fat content makes them unfavorable.

Perceptions of regional aquaculture extension officers (RAEOs)

It is evident that, 100% of the respondents preferred to stock carp fingerlings annually in the dry zone tank. Therefore RAEOs perceptions were 100% biased towards the carp species. RAEOs indicated that tilapia species naturally breed in the local environment and stocking of tilapia species is unnecessary. Also they mentioned that carp species have higher growth rate and feed conversion ratio compared with the tilapia species. So market weight of carp is higher than tilapia, therefore the final income from the individual carp fish is higher than from an individual tilapia fish. Further, they mentioned the attitudes of the people towards carps especially the low preference for carp slices, low taste of carp and high fat content of carp would be the reasons for the low preference for carp in the dry zone. They suggested that these attitudes may change with time and people can be encouraged to buy more carps in the future.

Stocking and yield

According to the stocking data obtained from the Regional Aquaculture Extension Office (RAEO) and Aluthdivulwewa Fishery Society (AFS) (2014), carp species were only stocked free base (as a donation to increase the density of carp species in reservoirs) by National Aquaculture Development Authority (NAQDA) and tilapia and shortage amount of carp species were stocked payment base (by purchasing from NAQDA) by AFS. According to the fishermen’s view, 1,000,000 of total fingerlings including 700,000 of tilapia and 300,000 of carp are needed for better production. Authority recommendation is 360,000 of fingerlings (1,500 fingerlings per ha) for the Aluthdivulwewa tank, considering its volume (239 ha). In the opinion of the RAEOs, tilapia stocking is unnecessary due to their natural breeding ability but carp stocking is very important because they cannot breed naturally in the Sri Lankan reservoirs. Therefore, they stock carp fingerling in free base, although tilapia stocking is also important to overcome the dwarfing behavior which is results from inbreeding. According to the Fishermen’s view, existing tilapia population is not enough for them. Therefore, they have to practice payment base stocking for tilapia also to cater to their requirements.

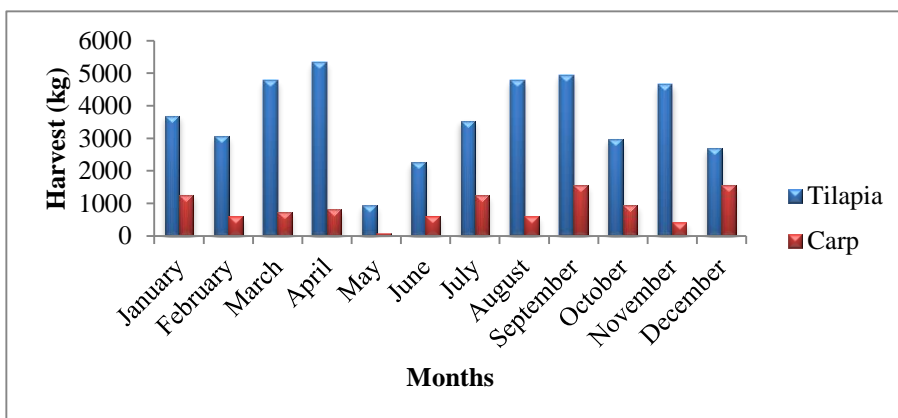


Figure 6: Annual fish harvest details in Aluthdivulwewa tank - 2014

Fish harvest during year 2014 is shown in Figure 2 and these data were obtained from records available at the fishery societies. According to Figure 2, tilapia harvest was higher during the periods January to April and August to November compared to other months in the year. Carp harvest was uniform through the year in 2014 without any changes. Thus, a vast gap of harvest amount can be identified between tilapia and carp yield. According to the fishermen’s view, significant harvest can be obtained during July to December. Especially carp harvests were high between August to September due to the lower water level of tank in dry season and cloudy environmental condition in beginning of North-East monsoon rainy season in October to November months. Because of that, mostly carp species prefer to come in to the top of water level due to the environment stimulants in these months.

Conclusions

There was 100% response from the fishermen and all preferred tilapia. On the contrary 100% of the RAEOs preferred carp species. Market demand, size compatibility and consumer preference are crucial factors in the preference of the fishermen for tilapia over carp species. Higher growth rate and the higher feed conversion ratio of carp species as well as the higher final income which come from the individual carp fish rather than tilapia are crucial factors that affected the responses of the RAEOs

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