Indian Journal of Social Research Vol.58 (2) (March - April, 2017) (131-142)

Academic and Law Serials

ISSN : 0019-5626
e-ISSN : 2454-3624

PERCEPTIONS AND WILLINGNESS TO ADOPT BRACKISHWATER AQUACULTURE TECHNOLOGIES AMONG AQUA FARMERS IN SOUTH GUJARAT

P. Mahalakshmi

ICAR-Central Institute of Brackishwater Aquaculture
75, Santhome High Road, R.A.Puram
Chennai, Tamil Nadu

C. Gopal

ICAR-Central Institute of Brackishwater Aquaculture
75, Santhome High Road, R.A.Puram
Chennai, Tamil Nadu

M. Muralidhar

ICAR-Central Institute of Brackishwater Aquaculture
75, Santhome High Road, R.A.Puram
Chennai, Tamil Nadu

M. Kailasam

ICAR-Central Institute of Brackishwater Aquaculture
75, Santhome High Road, R.A.Puram
Chennai, Tamil Nadu

Prem Kumar

ICAR-Central Institute of Brackishwater Aquaculture
75, Santhome High Road, R.A.Puram
Chennai, Tamil Nadu

P. K. Patil

ICAR-Central Institute of Brackishwater Aquaculture
75, Santhome High Road, R.A.Puram
Chennai, Tamil Nadu

H. G. Solanki

Soil and Water Management Research Unit
Navsari Agricultural University
Navsari, Gujarat

R. V. Borichangar

Soil and Water Management Research Unit
Navsari Agricultural University
Navsari, Gujarat

J. G. Vanza

Soil and Water Management Research Unit
Navsari Agricultural University
Navsari, Gujarat

Abstract

Demonstration of culture of banana shrimp, seabass, milkfish and cobia, nursery rearing of seabass in hapas, cage farming of seabass and pearlspot are conducted under the collaborativeprogramme of ICAR-Central Institute of Brackishwater Aquaculture, Chennai and Navasari Agricultural University, Navsari. An impact analysis was undertaken for the assessment of perceptions and willingness-to-adopt (WTA) brackishwater aquaculture technologies among aqua farmers of South Gujarat. A total of 95 aqua farmers from 9 coastal villages of South Gujarat viz,Kabilpore, Kusdsad, Pathri, Danti, Mor, Bharuch, Navipardi, Onjal and Surat were randomly selected for the present study. Based on the percentage of difference for adopting the brackishwater aquaculture technologies before and after the collaborative programme initiation of the study showed that there was 100% adoption with respect to the technologies such as usage of immunostimulant - CIBASTIM, banana shrimp culture, seabass farming in ponds, seabass farming in cages, nursery rearing of seabass in hapas, cobia and milkfish culture in ponds, milkfish and pearlspot in cages, polyculture with seabass and carp, milkfish and carp, and milkfish and shrimp culture. The logistic regression model results suggested that the decision to WTA of brackishwater aquaculture technologies is a function of education, access to aquaculture inputs, ownership, marketing behaviour, extension media contact, training exposure, knowledge in culture practices, participation in aquaculture activities and willingness to pay for adoption. Moreover, the Wald values of the model revealed that knowledge in culture practices (8.105) and marketing behaviour (6.654) were two most important variables leading to WTA of brackishwater aquaculture technologies among the aqua farmers in Gujarat. Thestudy revealed that the socio-economic condition of the coastal population has been improved in the South Gujarat through brackishwater aquaculture technologies.

Key words: Willingness-to-adopt, Tribal, Regression, Brackishwater and aquaculture.

Introduction

Gujarat is having 1,600 km long coastline and a vast stretches of brackishwater area (3.76 lakh hectare) throughout the coastline which is ideal for shrimp culture. Shrimp culture activities developed fast in the last decade. Numbers of shrimp farms have been constructed in the coastal districts of the state. Major activities have been carried out in South Gujarat coast than on Saurashtra coast (Vadher and Manoj, 2014). Diversification of species and culture systems assume significant importance in terms of sustainability for coastal aquaculture as it provides alternative income generation and livelihood. Tidal amplitude of Gujarat coast is higher than other parts of coastal India. This natural phenomenon had created vast stretches of marshy and saline lands all along the coast. Most of the potential brackishwater resources in Gujarat are still yet to be explored and developed for brackishwater aquaculture in Gujarat as these water bodies are potentially highly suitable for farming of various finfish species (Mahalakshmiet al., 2014).

In view of this, ICAR-Central Institute of Brackishwater Aquaculture (ICAR-CIBA)came forward with a collaborative project proposal with Navsari Agricultural University (NAU), Navsari, to develop a sustainable brackishwater aquaculture in Gujarat and up-liftment of socio-economic status of aqua farmers of Gujarat. Through a Memorandum of Understanding between the Institute and NAU, CIBA- NAU team had demonstrated the culture of banana shrimp as winter crop, milkfish, nursery rearing of seabass in hapas, seabass in cages and pearlspot in cages. In addition, the common water bodies in the coastal hamlet with the available resources has been improved through cage farming of seabass and pearlspot for income generation for tribal community from Navipardi, Varethi and Kanyashi, and Kabilpore, Dharagiri, Valoti and Pathri villages from Surat and Navsari district, respectively. The demonstration and adoption by farmers of brackishwater aquaculture technologies evinced interest in other group of farmers for adoption in their community pond.

Against this background, an impact analysis was undertaken for the assessment of perceptions and willingness-to-adopt (WTA) brackishwater aquaculture technologies among aqua farmers of South Gujarat. The assessment of perceptions and willingness-to-adopt an technology gives an understanding the impact and the analysis gives the success of the technology so introduced. The assessment can encourage comminutes towards the positive impact associated with the sustainable development of brackishwater aquaculture in Gujarat.

Materials and Methods

A total of 95 aqua farmers from 9 coastal villages of South Gujarat viz, kabilpore, kusdsad, Pathri, Danti, Mor, Bharuch, Navipardi, Onjal and

Surat were randomly selected for the present study. The data were collected from target groups by employing a well-structured and pre-tested interview schedule. Eighteen independent variables (Table 1) such as age, marital status, education, family size, family type, type of house, occupation, farming experience, farm size, access to aquaculture inputs, ownership, marketing behaviour, family income, extension media contact, training exposure, knowledge in culture practices, participation in ICT activities and willingness to pay for adoption were measured and analysed.

The age of the respondent was defined as the period of time from their birth to the time of the interview (expressed on years). Marital status was indicated by married (1) or unmarried (0). Education was directed by 6 point scale namely illiterate (0), can read only (1), primary (2), middle school (3), high school (4) or graduate (5). Family type was indicted by nuclear family (1) or joint family (2). Family size was measured by the number of individuals who lived in the same household and ate together. Type of house was measured by using 5 point scale *viz.*,no own house (0), concrete (1), thatched (2), titled (3) or mixed (4). Occupation was determined by selecting one of the options in the survey: labour (1), agriculture (2), aquaculture/fishing (3) or combined (4). A respondent's experience was determined by the total year of experience in farming. Farm size was indicated by the scale of <1ha (0), 1-5ha (1), 6-10ha (2) or >10ha (3). Access to aquaculture inputs was indicated by yes (1) or no (0). Ownership of a respondent was measured by own farm (1) or leased (2). Marketing behavior was determined by selecting one of the options in the survey: sold in local market (1) or procured by experts (2). Family monthly income was indicated by <5000 (1), 5001-10000 (2) or >10001 (3).

In measuring the extension media contact of a respondent, 7 parameters were considered. Among these, two related to individuals (extension officer and field extension agent), three to groups (group discussion, training session and demonstration meeting) and the remaining two related to mass contact (reading extension materials and listening/ watching aquaculture programmes). A respondent's extent of contact to particular media was determined through the checking one of the following options in the survey: frequently (3); occasionally (2); rarely (1) or not at all (0). The scores obtained by a respondent in all parameters were added together to compute the overall extension contact score.

Training exposure referred to the total number of days that a respondent received aquaculture related training in the previous five years. Their knowledge in aquaculture was determined using a Teacher made Knowledge test as adopted by Tesfaye et al. (2010). The test consisted of 9 items. For every correct answer on the knowledge item, a score of '1' was given and for every incorrect answer a score of '0' was given. The total score for each respondent for all the 9 items gave the knowledge score for that particular respondent. A 4-point rated scale was used where a respondent was asked to indicate their extent of participation in aquaculture activates. The possible scores were 0 for 'not at all', 1 for 'rarely', 2 for 'occasionally' and 3 for 'frequently'. Willingness to pay for adoption was indicated by yes (1) or no (0).

The farmers taking part in the survey were asked to indicate their perceived extent of adoption of brackishwater aquaculture technologies based on before and after the CIBA-NAU interventions along a three point continuum namely fully adopted, partially adopted and not adopted scores were assigned to these responses as 2, 1, and 0 respectively. The adoption behaviour was measured using the adoption quotient formula, which can be defined as

$$QA_i = \frac{\sum_{j=1}^{M}\left(e_j \times W_j\right)}{M_j} \times 100$$

where i is the number of brackishwater aquaculture technologies; j = 1 to M=3, is the number of scales used; AQ_i is the adoption quotient of i^{th} brackishwater aquaculture technologies; e_{ij} is the number of responses of j^{th} scale of i^{th} brackishwater aquaculture technologies; W_j is the weightage assigned to j^{th} scale; and M_j is maximum score assigned to i^{th} brackishwater aquaculture technologies. After calculating the adoption quotient, the percentage of difference between the adoption quotients based on before (BFQ_i) and after (AFQ_i) the CIBA-NAU interventions was calculated by

$$\text{Percentage of difference} = \frac{(\text{AFQ}_i - \text{BFQ}_i)}{(\text{AFQ}_i + \text{BFQ}_i)} \times 100$$

The socio-economic variables were examined using a logistic regression model. A multivariate binary logit model (Adeogun et al., 2008; Owombo et al., 2012) was used to establish the factors affecting WTA responses because the responses are continuous and dichotomous in nature. WTA is a binary response of either yes or no and the outcome is a probability which is expressed as Prob (Y = 1) when answer is yes and as Prob (Y = 0) otherwise. The WTA variable is dependent on other 18 explanatory (independent) variables of the respondent are depicted in Table 1.

Marital status, education, family type, type of the house, occupation, farm size, access to aquaculture inputs, ownership, marketing behaviour, family monthly income, extension media contact, knowledge in culture practices, participation in aquaculture activities and willingness to pay for adoption were entered in the model as dummy variables. The other four variables such as age, family size, farming experience and training exposure were entered as continuous variables. Where the dependent response variable is dichotomous, taking 0-1 values, one of the widely used models is the logistic model

$$P_i = \text{Pro}b(Y=1) = \frac{e^{\beta x}}{1+e^{\beta x}} = F(\beta x)$$

$$Logit(P_i) = L_{WTA} = \ln\frac{P_i}{1-P_i} = \beta_0 + \sum_{i=1}^{18}\beta_i X_i$$

where L_{WTA} is the likelihood of willingness to adopt, β_i are variables to be estimated and X_i is a vector of explanatory variables.

Results and Discussion

The selected independent variables of the respondents are presented in *Table 1*. The respondents were, in average, young to old leading to an interface that all age groups of farmers will be interested to adopt the brackishwater aquaculture technologies. The average education level (7.28) was quite large. Overall, most of the respondents had high secondary qualifications or the other. Vadher and Manoj (2014) observed that majority of the shrimp farmers of the state are literate, experienced and interested in the shrimp farming business seriously.This implies that almost they were all literate which leads to understand the importance of adoption of brackishwater aquaculture technologies for sustainable development in aquaculture and to know about their alternative livelihoods in aquaculture. Chi and Yamada (2002) observed that one of the important factors that trigger adoption of new technologies is the participation of progressiveeducated male farmers. Zanu et al. (2012) found that a relative high level of literacy has a positive impact for influencing innovativeness among farmers.

Table 1: Definitions of variables and its mean values

Variables	*Definitions*	*Mean*
Dependent variable	Yes = 1; No = 0	
WTA, Willingness to adopt	Are you willingness to adopt the brackishwater aquaculture technologies	
Independent variables		
X1, Age	Number of years of age	28.5421
X2, Martial status	Married (1) unmarried (0)	0.7789
X3, Education	Illiterate (0); can read only (1); primary (2); middle school (3); high school (4); graduate (5)	7.2842
X4, Family Type	Nuclear (1); Joint (2)	1.5158
X5, Family size	Number of family members	3.4842
X6, Type of the House	No own house (0); concrete (1); thatched (2); tiled (3); mixed (4)	2.6947
X7, Occupation	Labour (1); agriculture (1); aquaculture/ fishing (3); combined (4)	1.9872
X8, Farming experience	Number of year of experience	3.9864
X9, Farm size	<1ha (0); 1-5ha (1); 6-10ha (2); >10ha (3)	3.8576
X10, Access to aquaculture inputs	Yes (1); No (0)	4.2345
X11, Ownership	Own farm (1); leased (2)	1.6882
X12, Marketing behaviour	Sold in local market (1); procured by experts (2)	3.6822
X13, Family monthly income	<5000 (1); 5001-10000 (2); >10001 (3)	2.7368
X14, Extension media contact (used 7 parameters)	Not at all (0); rarely (1); occasionally (2); frequently (3)	5.3263
X15, Training exposure	Number of days	3.4947
X16, Knowledge in culture practices (used 9 items)	Correct (1); incorrect (0)	4.4894
X17, Participation in aquaculture activities	Not at all (0); rarely (1); occasionally (2); frequently (3)	5.7356
X18, Willingness to pay for adoption	Yes (1); No (0)	7.6580

The average family size, experience, farm size, marketing behaviour and training exposure was around average value of three. Around 40% of the respondents are having more 1-5ha of farm size. Most of the respondents (60%) had attended training programme organized by the CIBA, NAU and KVK. The average extension media contact score (5.33) was high. The average knowledge in culture practices (4.49) and participation in aquaculture activities (5.74) were high. The farmers especially tribes felt that they are having exposure in aquaculture activities only through the CIBA and NAU collaborative programs. The average willingness to pay for adoption (7.66) was high. Most of the respondents are willing to spend the amount for adopting the brackishwater aquaculture technologies for improving their farming practices and also alternative livelihoods.

The adoption quotient obtained from the respondents for adopting the brackishwater aquaculture technologies based on before and after the CIBA-NAU interventions ranged from 0 to 42.11 (mean value is 5.49) and 16.84 to 83.68 (mean value is 46.25) respectively (*Table 2*). It also shows that the percentage of difference in adoption behaviour of the respondents was 100 per cent with respect to the technologies such as usage of CIBASTIM, banana shrimp culture, seabass farming in ponds, seabass farming in cages, nursery rearing of seabass in hapas, cobia culture in ponds, milkfish culture in ponds, milkfish culture in cages, pearlspot in cages, polyculture - seabass and carp, polyculture - milkfish and carp, and polyculture - milkfish and shrimp. The respondents felt that culture practices of brackishwater finfish technologies were started

Table 2: Adoption behaviour of respondents based on CIBA-NAU interventions

Brackishwater aquaculture technologies and advisories	*Adoption Quotient*		*Percentage of difference in adoption quotient*
	Before (BFQ_i)	*After (AFQ_i)*	
Advisories Usage of minerals during culture	23.68	36.84	21.74
Usage of probiotics during culture	21.05	35.79	25.93
Technologies Usage of CIBASTIM	0.00	25.79	100.00
Ammonia removal technology - Baggase	1.05	15.79	87.50
Monodon shrimp culture	42.11	27.89	-20.30
Banana shrimp culture	0.00	25.79	100.00
Seabass farming in ponds	0.00	83.68	100.00
Seabass farming in cages	0.00	82.63	100.00
Nursery rearing of seabass in hapas	0.00	60.53	100.00
Cobia culture in ponds	0.00	16.84	100.00
Milkfish culture in ponds	0.00	77.89	100.00
Milkfish culture in cages	0.00	66.84	100.00
Pearlspot in cages	0.00	70.53	100.00
Polyculture - Seabass and carp	0.00	36.32	100.00
Polyculture - Milkfish and carp	0.00	38.42	100.00
Polyculture - Milkfish and shrimp	0.00	38.42	100.00

only after the initiation of collaborative programme in South Gujarat. They also expressed that after seeing the success of these technologies adoption by the farmers the other group of farmers from Saurashtra and Kutch regions came forward for adopting the shellfish and finfish technologies. The respondents expressed that the adoption behaviour of monodon shrimp culture (-20.30%) was reversed after introduction of vannamei and finfish culture in South Gujarat.

The results of the logistic regression model (*Table* 3) indicted that the overall predictive power of the model (80.4%) was quite high, while the significant Chi square (P<0.01) was indicative of the strength of the joint effect of the covariates on probability of WTA of brackishwater aquaculture technologies among the farmers in South Gujarat. The results also suggest that the decision to WTA of brackishwater aquaculture technologies is a function of education, access to aquaculture inputs,

Table 3: Logistic regression coefficients of the factors affecting WTA of brackishwater aquaculture technologies

Variables	*Parameter estimate*	*Standard error*	*Wald*	*P value*
Age	-0.048	0.031	2.112	0.141
Martial status	0.406	0.895	0.364	0.507
Education	0.025	0.038	3.594	0.054 *
Family Type	0.294	0.448	0.430	0.512
Family size	-0.054	0.034	2.476	0.114
Type of the House	0.287	0.853	0.119	0.698
Occupation	-0.121	0.236	0.254	0.613
Farming experience	0.103	0.184	0.308	0.567
Farm size	-0.057	0.033	2.567	0.107
Access to aquaculture inputs	0.175	0.005	4.588	0.034 **
Ownership	0.204	0.016	4.706	0.019 **
Marketing behaviour	0.304	0.114	6.654	0.008 ***
Family income	0.265	0.185	1.892	0.149
Extension media contact	0.013	0.027	3.689	0.059 *
Training exposure	0.153	0.002	3.579	0.043 **
Knowledge in culture practices	0.588	0.212	8.105	0.005 ***
Participation in aquaculture activities	0.198	0.009	4.897	0.024 **
Willingness to pay for adoption	0.198	0.011	3.978	0.047 **
Constant	-1.984	2.357	0.724	0.456

*** P < 0.01; ** P < 0.05; * P < 0.10 ; -2 log likelihood = 172.76; chi-square is 49.45; Overall correct prediction 80.4%

ownership, marketing behaviour, extension media contact, training exposure, knowledge in culture practices, participation in aquaculture activities and willingness to pay for adoption. Swathi et al. (2013) found that education has a positive impact on open sea cage culture adoption among *Sidi* tribes in Gujarat. Noorhosseini and Allahyari (2012) found that the availability of extension services has a positive influence on the probability of adopting farm technologies. Results from other research also indicate that there is a significant relationship between innovations adopted by farmers and contact with an extension agent (Boahene et al., 1999; Faraji and Mirdamadi, 2006; Adeogun et al., 2008). Furthermore, Kapanda et al. (2005) reported that the lack of fish farming extension staff was an important problem for fish farmers in Mchinji, Malawi. Training and technical support would help to increase the knowledge of farmers, improve profitability, and reduce risks (Ahmed et al., 2009). Respondentsrevealed that aquaculture sector has contributed significantly in employment generation and infrastructure development of the coastal community and overall development of the coastal areas. Theyalso expressedthat the socio-economic condition of the coastal population has been improved in the South Gujarat through brackishwater aquaculture technologies.

The majority of farmers pointed to access to aquaculture inputs and facilities, and believed that fishery organizations should support the farmers. Based on some of their statements, greater access to aquaculture inputs would have led to more willingness to incorporate new technologies or methods. Extension media contact, training exposure, knowledge in culture practices and participation in aquaculture activities are among the most important factors that increase one's understanding of innovations and influence their process of decision making towards adoption of new technologies and processes (Rogers, 1995). This finding is further supported by some other works conducted in Bangladesh (Rahman and Naoroze, 2007). Moreover, the Wald indicating the relative contribution of individual variables to the probability of WTA of brackishwater aquaculture technologies revealed that knowledge in culture practices (8.105) and marketing behaviour (6.654) were two most important factors leading to WTA of brackishwater aquaculture technologies among the aqua farmers in South Gujarat. The respondents felt that in Gujarat the scope of domestic marketing of finfishes is relatively low compared with other states. So the marketing behaviour of finfishes is important factor for adopting the milkfish, seabass and pearlspot among the farming community. Noorhosseini and Allahyari (2012) reported that majority of the fish farmers in North Iranrequired expertise and scientific information as well as marketing places and linkages for successful fish farming.

Conclusions

It can be concluded from the present study that the farmers from South Gujarat showed better adoption of most of the brackishwater aquaculture technologies. Results from a binary logit regression model suggested that education, access to aquaculture inputs, ownership, marketing behaviour, extension media contact, training exposure, knowledge in culture practices, participation in aquaculture activities and willingness to pay for adoption were the main factors that are correlated with farmers' willingness to adopt brackishwater aquaculture technologies. The results also revealed that the aquaculture sector has contributed significantly in employment generation and infrastructure development of the coastal community and overall development of the coastal areas of South Gujarat. The socio-economic condition of the coastal population has been improved in the South Gujarat through brackishwater aquaculture technologies. Moreover, the farmers from Saurashtra and Kutch regions have also came forward for adopting the shellfish and finfish technologies as was revealed from the findings of the study. Hence, government and extension agencies should undertake more efforts to involve farmers from other regions of Gujarat to stimulate them to adopt sustainable farming practices. Technical guidance in the form of extension training will also enhance adoption of the technology.

REFERENCES

Adeogun, O. A., Ajana, A M, Ayinla, O. A., Yarhere, M. T. and Adeogun, M. O. (2008): Application of logit model in adoption decision: A study of hybrid clarias Lagos state, Nigeria. *American-Eurasian Journal of Agricultural & Environmental Sciences*, 4(4): 468–472.

Ahmed, N. and Luong-Van, J. (2009): Can rice-fish farming provide food security in Bangladesh?.*Aquaculture Asia*, 14(1): 18–23.

Boahene, K., Snijders, T. A. B. and Folmer, H. (1999): An integrated socioeconomic analysis of innovation: The case of hybrid cocoa in Ghana. *Journal of Policy Modeling*, 21(2): 167–184.

Chi, T.T.N. and Yamada, R. (2002): Factors affecting farmers' adoption of technologies in farming system: A case study in OMon district, Can Tho province, Mekong Delta, Japan *Omonrice* 10: 94-100.

Faraji, E. and Mirdamadi, S. M. (2006): Assessing the role of extension in adoption of the insurance by apple producers in the Damavand area. *Journal of Agricultural Science*, 12(3): 489–500.

Kapanda, K., Matiya, G., N'gong'ola, D. H., Jamu, D. and Kaunda, E. K. (2005): A logit analysis of factors affecting adoption of fish farming in Malawi: A case study of Mchinji Rural Development Program. *J. Appl Sci*,5(8): 1514-1517

Mahalakshmi, P., Borichangar, R.V., Solanki, H. G. and Vanza, G. J. (2014): Opportunities in brackishwater aquaculture finfish technologies among tribal and aqua farmers through family and community farming. Training manual on Polycultre of brackishwater finfishes: An alternative entrepreneurship in coastal regions of Gujarat. *CIBA Special Publication*. 78, CIBA, Chennai, p. 25-28.

Noorhosseini S A. and Allahyari M S. (2012): Logistic Regression Analysis on Factors Affecting Adoption of Rice- Fish Farming in North Iran.*Rice Science*, 19(2): 153–160.

Owombo P.T., Akinola A.A., Ayodele O.O. and Koledoye G.F. (2012): Economic Impact of Agricultural Mechanization Adoption: Evidence from Maize Farmers in Ondo State, Nigeria. *Journal of Agriculture and Biodiversity Research*, 1(2):25-32;

Rahman, M.H. and Naoroze, K. (2007): Women Empowerment through Participation in Aquaculture: Experience of a Large-scale Technology Demonstration Project in Bangladesh. *Journal of Social Science* 3(4): 164-171.

Rogers, E.M. (1995): *Diffusion of Innovations*. 4th edn. The Free Press, New York. P.518.

Swathi Lekshmi, P. S., Ramachandran, C., Narayana Kumar, R., Mohammed Koya, K., Sreenath, Gyanaranjan Dash, K. R., Swati Priyanka Sen, Suresh Kumar Mojjada,Sangeetha, B., Makwana Nayan, P. and Syda Rao, G. (2013): Post-frontline demonstration impact analysis of open sea cage culture among *Sidi* tribes in Gujarat. *Indian J. Fish.*, 60(3): 35-40.

Tesfaye Tsion, Ranjan, S., Karippai and Teklu Tesfaye (2010): Farmers training effectiveness in terms of changes in knowledge and attitude: The case of Holeta, Melkassa and Debrezeit Agricultural Research Centres, Ethiopia. *J. Agric.Ext. Rural Dev.*, 2 (5): 89-96.

Vadher, K.H. and Manoj, K. (2014): Study on socio-economic profile of shrimp farmers of Gujarat state, India. *International Journal of Fisheries and Aquatic Studies*. 2(2): 202-205.

Zanu, H. K, Antiwiwaa, A. and Agyemang, C. T. (2012): Factors influencing technology adoption among pig farmers in Ashanti Region of Ghana. *J. Agri..Tech.*, 8(1): 81-92.

* * *

Received on 6.9.2016 and accepted on 26.9.2016