Technical Efficiency of Culture-based Fisheries Production in Village Irrigation Systems of Sri Lanka

Kularatne M. G. , **Sean Pascoe** and **Clevo Wilson**

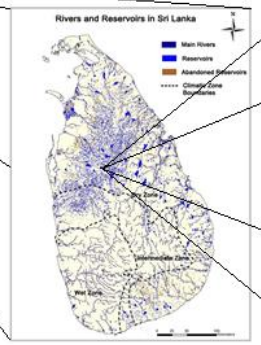
The 19th International Biennial IIFET 2018 Conference

Seattle, Washington, USA, 16-20 July 2018

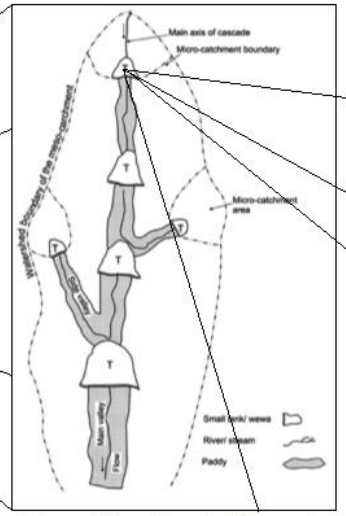
We examined the technical efficiency (**TE) and the factors influencing efficient use** of village **reservoir water** in Sri Lanka

Introduction: Water resources, Fisheries and Agriculture Potential and VISs in Sri Lanka

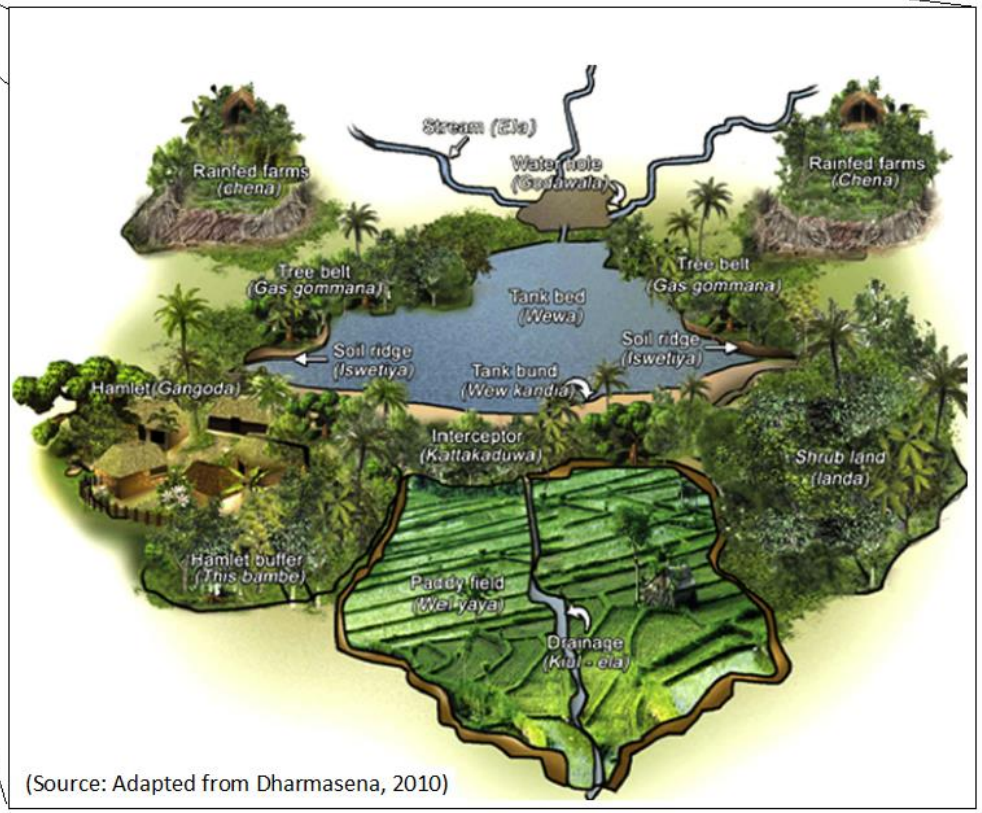
(Source: Google Earth)



(Source: National Atlas)



(Source: Adapted from Panabokke et.al., 2002)

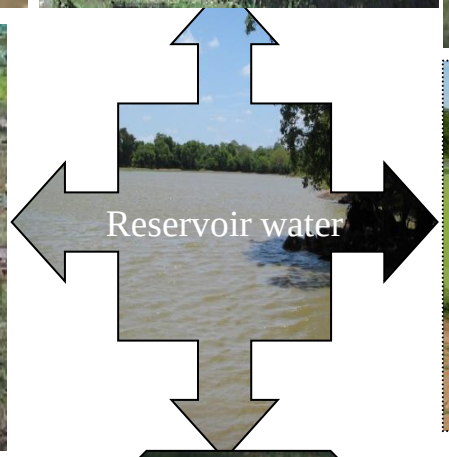


(Source: Adapted from Dharmasena, 2010)

- Rich in coastal fisheries but optimally used
- Now Inland fisheries in a higher priority
- The reservoir density is about 2.7 ha per km^2 .
- Four types of reservoirs: Large, Medium, Perennial
- And **Village Irrigation systems** (10000 -12000)

Basic characteristics of Village Irrigation Systems

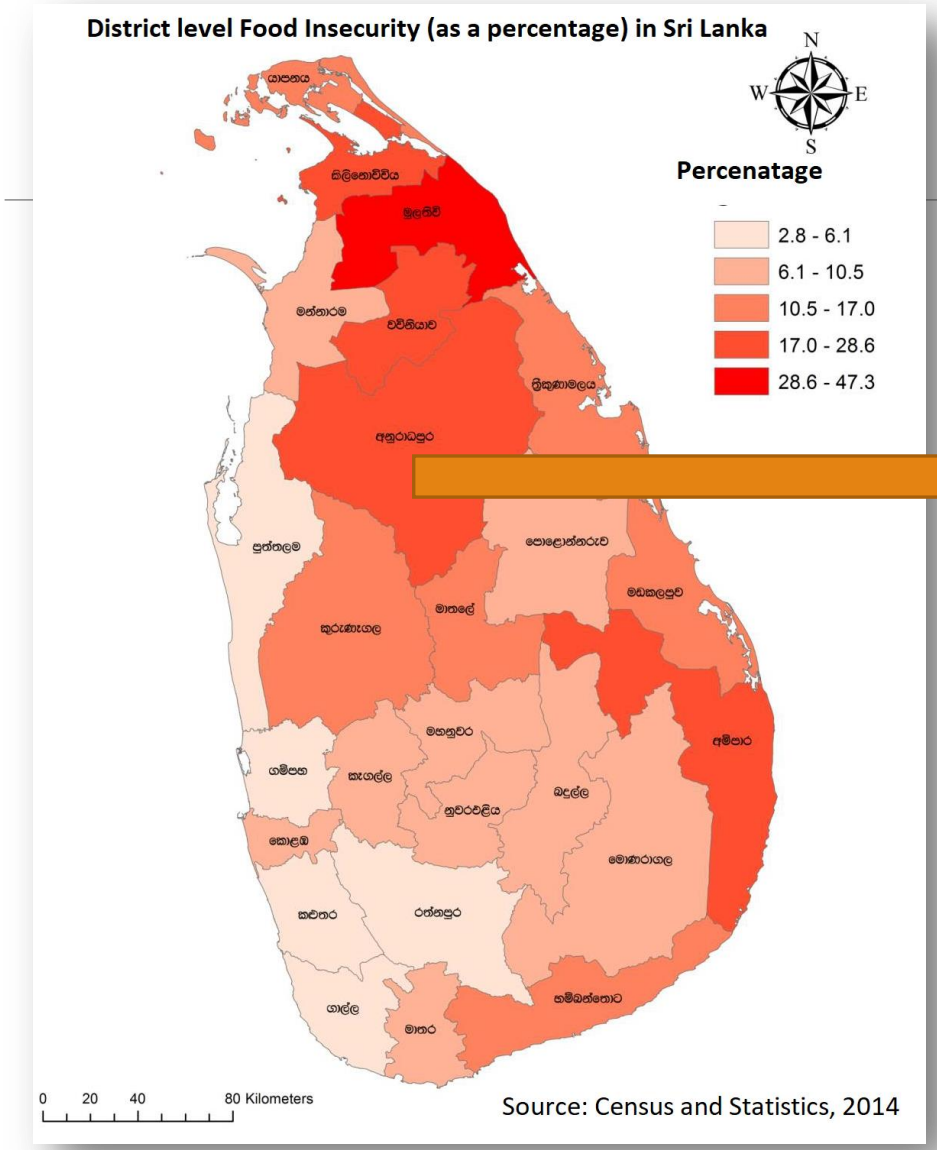
- Multiple uses
- Common Property
- Biologically highly productive (Mendis, 1977)
- The main uses are rice farming and fishery
- potential to develop Agri-fish system

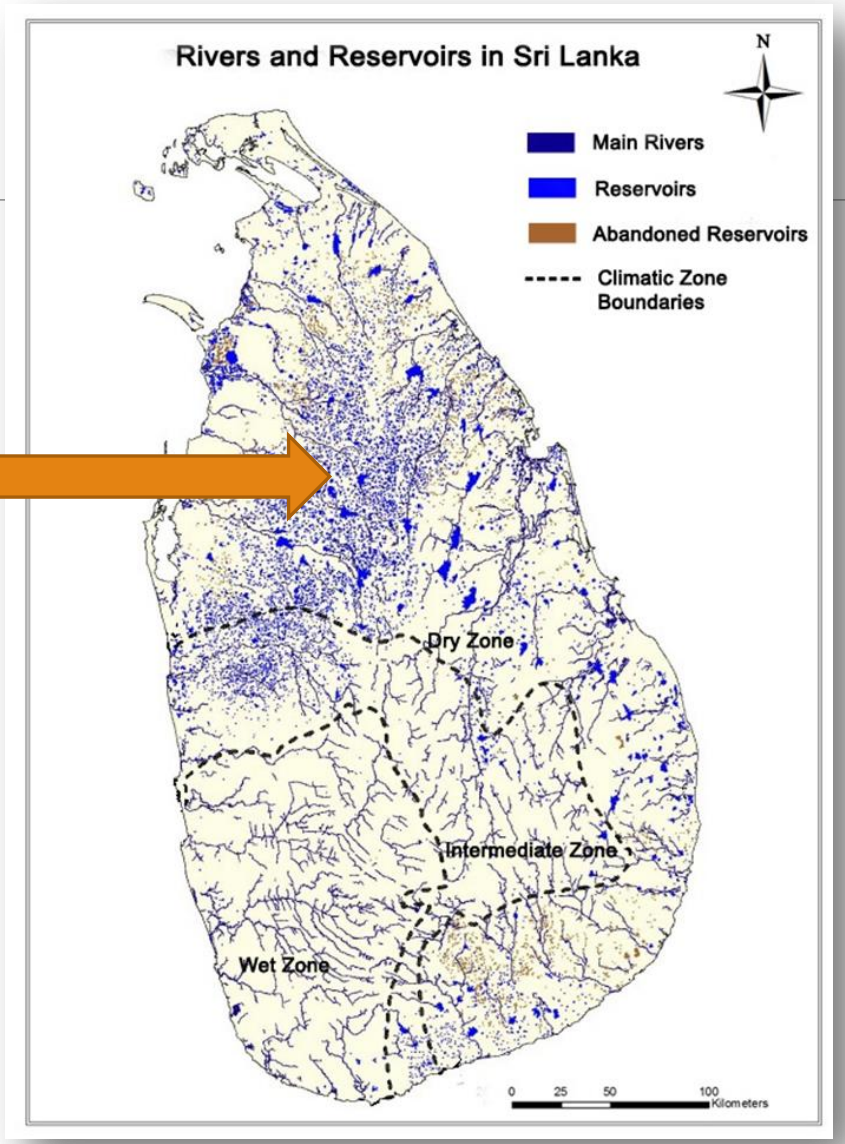


Importance of VISs

- Fishery is a main source of protein (Mendis 1977; De Silva 1988,2003)
- Latest technology: CBF (**A form of stock enhancement**)
- CBF increases the value of water
- CBF reduces **rural food insecurity**

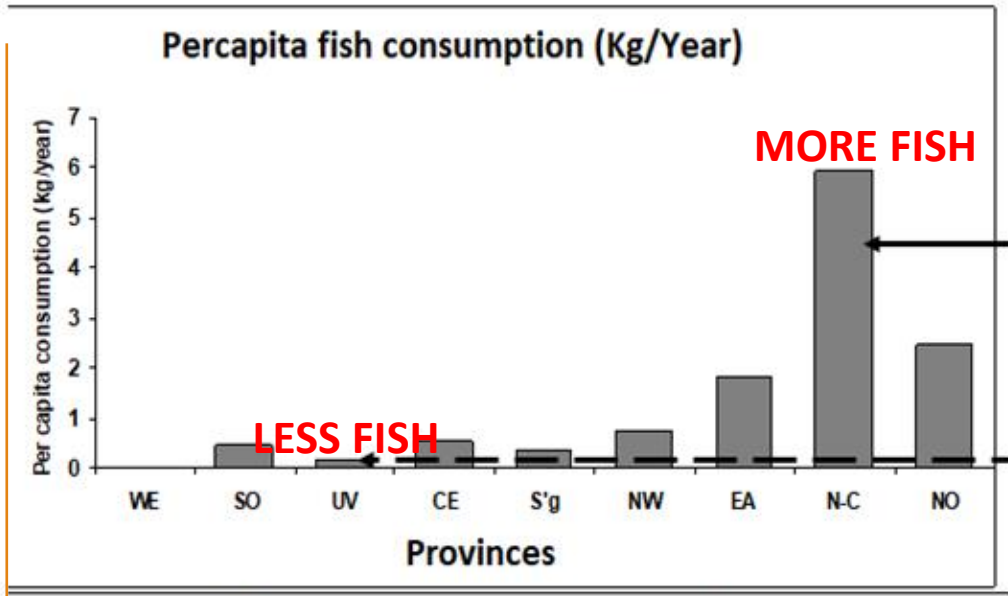
Maps of Food insecurity in Sri Lanka and reservoir density

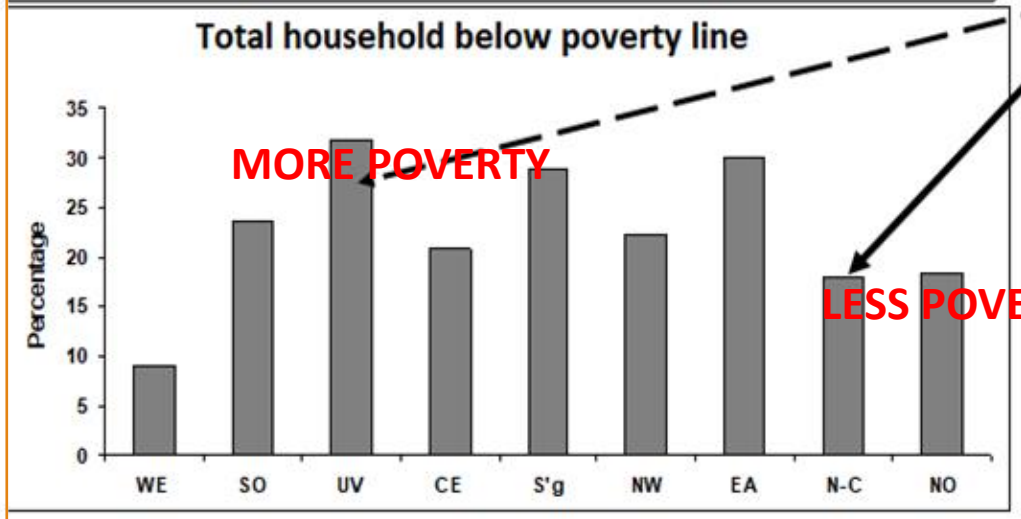


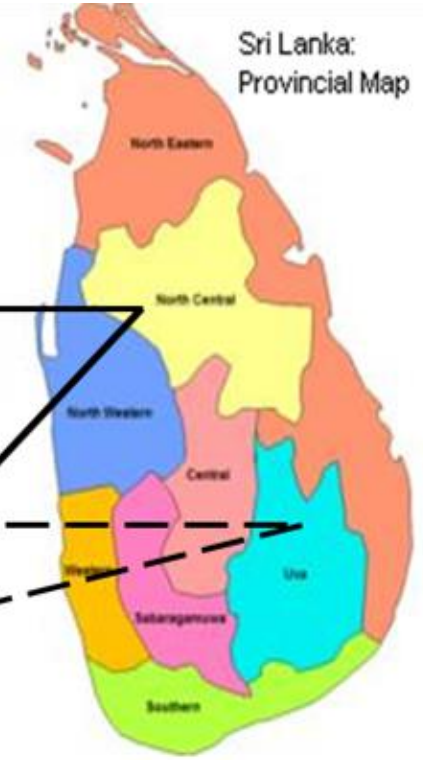


Relationship between fish consumption and Poverty levels

Negative relationship between **fish consumption** and the rural **poverty level**

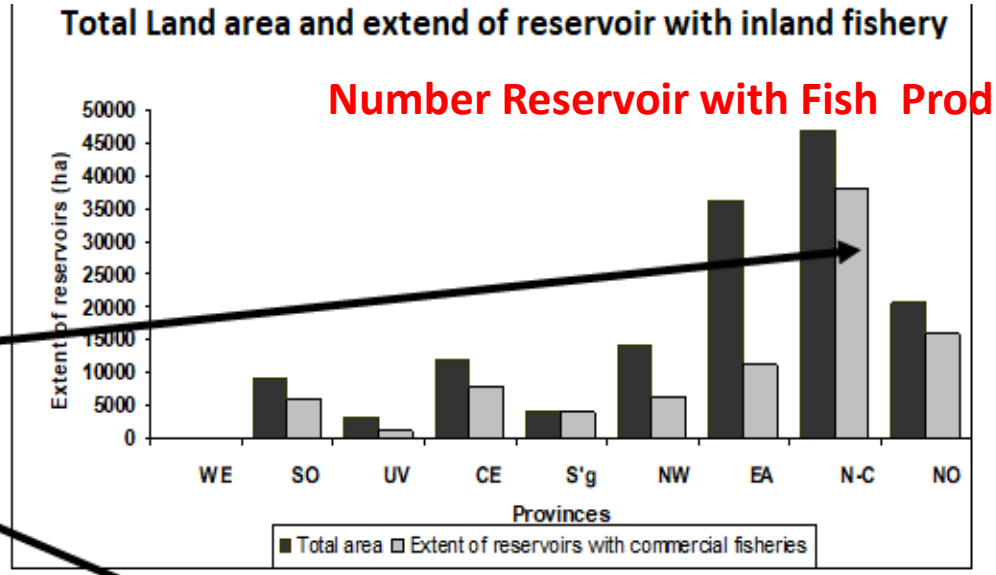


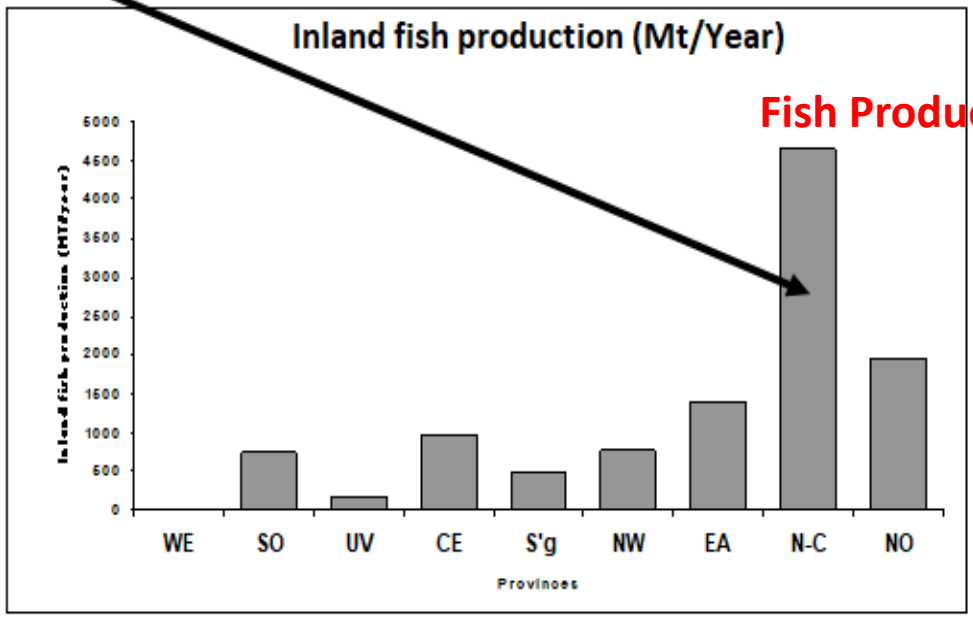




Relationship between extend of **reservoirs with fishery** and **fish production**

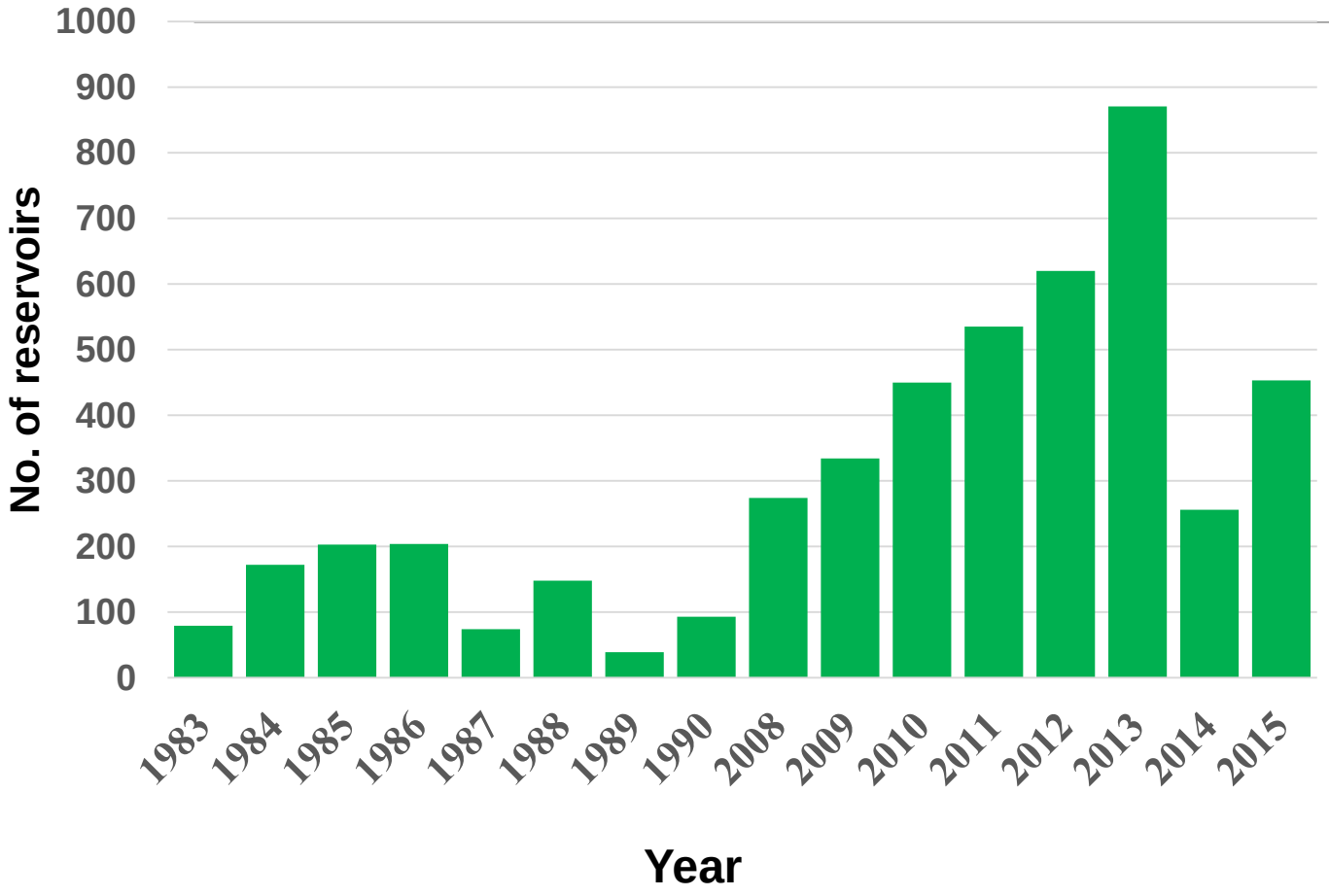
Positive relationship between extend of **reservoir** with fishery and **fish production**

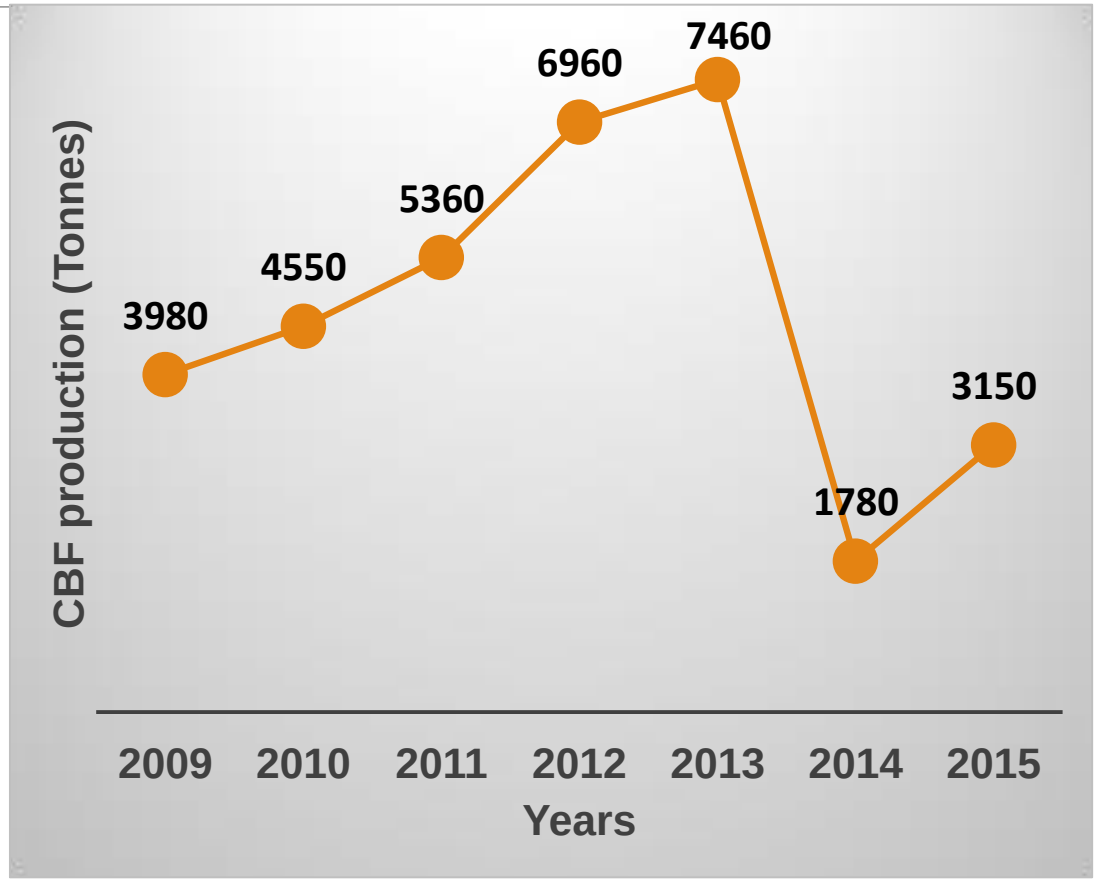




However ,

Number of reservoirs used for CBF production and production unstable and **why?**





Research Method

Sample and the data collection

Face to face interviews were conducted using pre-tested questionnaires to collect data from **325 fish farming groups** which have been selected from two agrarian districts using a **multi-stage cluster sampling** method.

Data Analysis

Estimated **stochastic translog production frontier** to measure the TE and the factors influencing TE.

A three step procedure was employed to estimate the frontier while imposing monotonicity (Henningsen and Henning, 2009).

Model Estimation and Results

$$\ln Y_i = \beta_0 + \sum_{i=1}^{3} \beta_i \ln x_{i,k} + \frac{1}{2} \sum_{i=1}^{3} \sum_{k=1}^{3} \beta_{i,k} \ln x_{i,k} \ln x_{i,l,} + v_i - u_i$$

where y_i is the quantity of output produced by farm group *i*,

x_{r1} = **Water** (Individual share of water use by i th reservoir for CBF is estimated as 0.37 out of the total reservoir capacity measured by metres ha.).

x_{r2} = **Labour** (Man days for a culture cycle)

x_{r3} = Total number of **fish fingerlings** seeded

β_i = Parameters to be estimated.

u_i = Technical efficiency

v_i = random error

Results

- The mean TE of CBF production of CBF in Sri Lanka is 0.33 (33%)

- This is considerably lower than that found in other studies of efficiency conducted in Asia.

- More farmer communities are in less efficiency levels.

- Therefore, examine the factors influence in TE are important

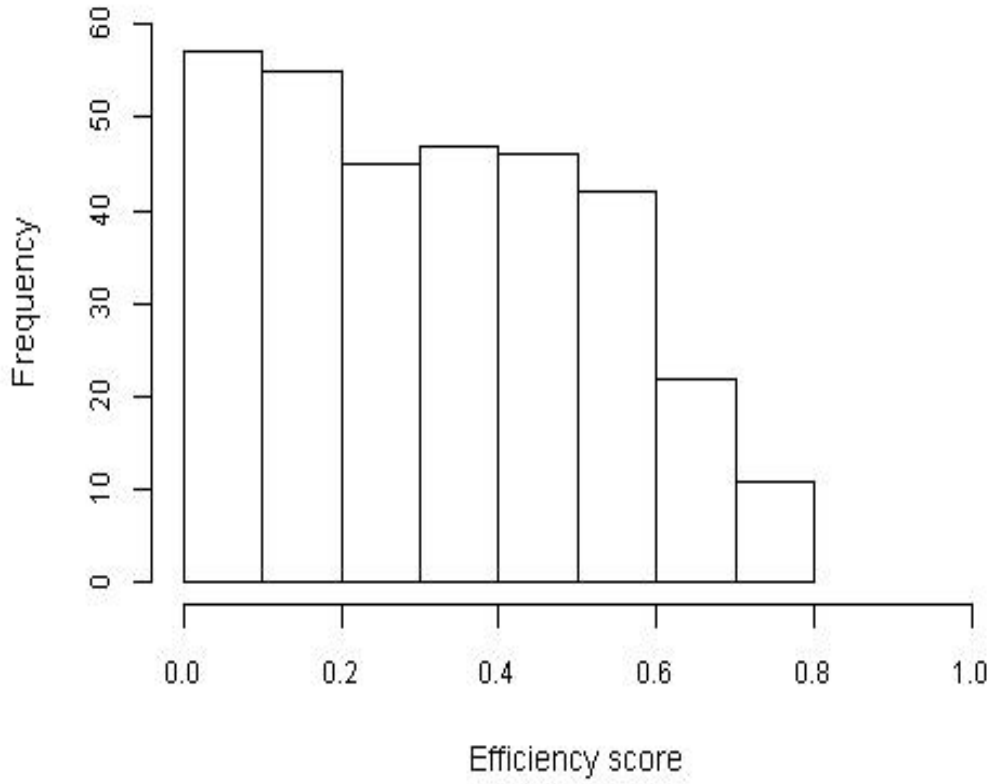


Fig. Frequency distribution of TE estimates

Inefficiency model $u_i = \delta_0 + \sum_j \delta_j Z_{ij} + w_i$

Where Z is a set of *j =1,…,J* firm-specific variables which may influence the firm's efficiency,

δ_j is the associated inefficiency parameter coefficient, and w_i is an iid random error term (Battese and Coelli, 1995).

	Final estimates		
Variables	Coeff	Std. Error	
Group stability	-0.3862	0.3249	
Time spent meeting officials	0.0166	0.0066	**
Rain water risk for CBFs	0.3188	0.2947	
Supply of subsidized fingerlings	0.8909	0.3140	***
No. of cattle and buffalos	-0.0012	0.0007	*
Slow growing fingerlings	-0.1651	0.3021	
Fast growing fingerlings	0.5506	0.4406	
Number of months of other water use	-0.0408	0.0409	

* significant at 10% level; ** significant at 5% level; *** significant at 1% level

Take home message

- The time spent meeting officials, the supply of subsidised fingerlings, are negative factors that lead to technical inefficiency.
- Therefore,
  Subsidies and transaction costs are two drawbacks in improving technical efficiency.
- In order to achieve a higher level of efficiency gain, it is important to strengthen improve the quality of consultation with officials and promote independent investments in CBF.

Thank you

ACKNOWLEDGEMENTS

Financial support from the QUT Business School and FRDC (Project 2008/306) is gratefully acknowledged. The officers of the Agriculture Development Division for their assistance in data collection and the Farmers' Organisations who participated in the surveys in Sri Lanka.

ALSO

To

IIFET 2018 Support Programme