Technical efficiency in Victorian Abalone Fishery

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Paul Mwebaze | Research Economist
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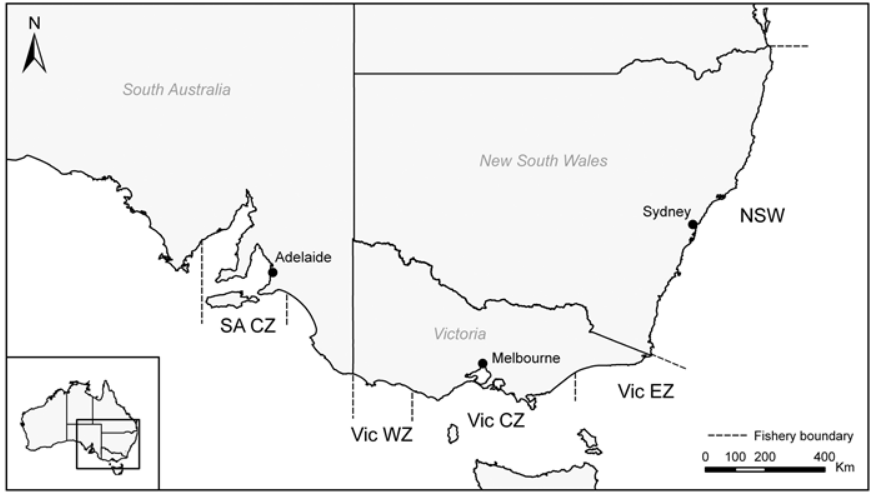
Background: Victorian Abalone Fishery

- Commercial fishery divided into 3 zones
- Target species: blacklip abalone (99% of commercial catch) and greenlip abalone
- Gear: commercial diving equipment. Surface air supply (hookah system) supported by small, high speed fishing boats

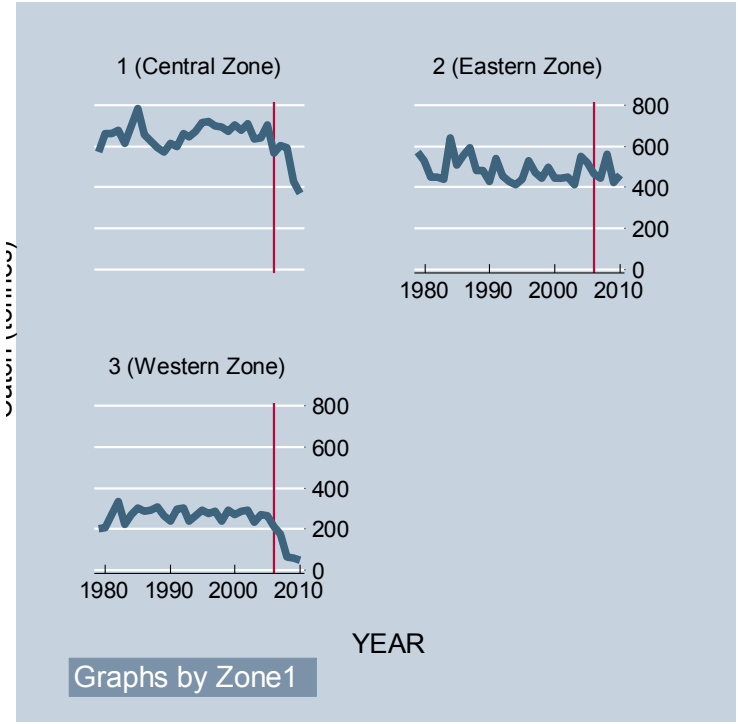


Victorian Abalone Fishery (cont)

- Commercial harvest and value: 778.75 tonnes≈ $20 million in 2012. The majority is exported to Asia (Japan, Hongkong, Singapore, China).
- Commercial licences: 71 fishery access license holders in the three zones.
- Management: Input and output controls
- Annual contribution to Gross State Product≈ $81-$104 million.
- Industry employment : 1,100 jobs (835 FTEs).

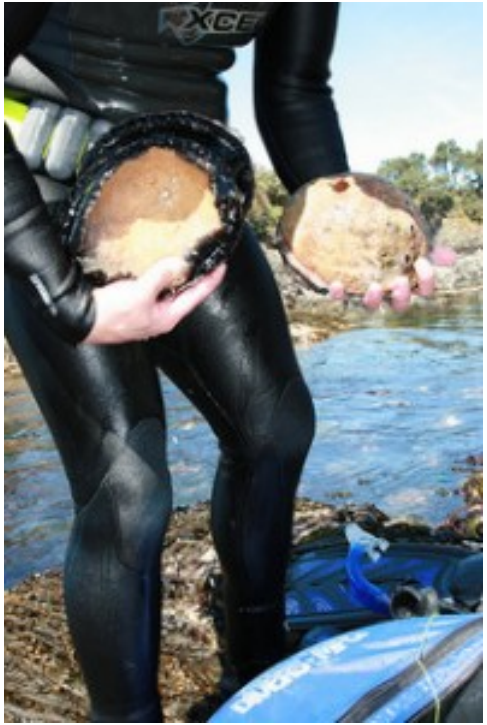
Impact of abalone viral outbreak

- Outbreak of abalone viral ganglioneuritis (AVG) in 2006.
- Negatively impacted the stock biomass in the western and central zones
- Led to reductions in the TACC
- The western zone experienced the most significant quota reductions.



Research questions

- What is the level of technical efficiency in the Victorian abalone fishery?
- Differences in technical efficiency between zones?
- What was the impact of the AVG outbreak on technical efficiency?



Methodology

- We examine technical efficiency using a stochastic frontier production model for panel data (Battese & Coelli, 1992, 1995).
- We consider four time-varying inefficiency specifications.
- The Battese and Coelli (1995) SF model for panel data.
- The normal-half normal model of Kumbhakar (1990), a random effect model by means of the FGLS method.
- The Cornwell et al (1990) model estimated through the modified LSDV technique.
- The Lee and Schimdt (1993) model estimated using ILS

Stochastic frontier production model for panel data (Battese and Coelli, 1995)

$$Y_{it} = f(X_{it}, \beta, T)e^{(v_{it} - u_{it})} \qquad (1)$$

$$\mu_{it} = \delta_0 + z_{it}\delta + \omega_{it} \qquad (2)$$

For time t, Y_{it} is the output (or catch) of fishing firm i, X_{it} is a vector of inputs and β is a vector of parameters to be estimated. The error term v_{it} is assumed to be independently and identically distributed $N(0, \sigma^2_v)$. The error term u_{it} represents technical inefficiency. It is assumed to be non-negative and independently distributed as non-negative truncations at Zero $N(u_{it}, \sigma^2_\mu)$. ω is the inefficiency parameter ditributed $N(0,\sigma^2_\omega)$; z_{it} is a vector of firm specific effects

Model specification

$$\ln Y_{it} = \beta_0 + \sum_{j=1}^{j=4} \beta_j \ln x_{jit} + \frac{1}{2} \sum_{j=1}^{j=4} \sum_{k=1}^{k=4} \beta_{jk} \ln x_{jit} \ln x_{kit} + \sum \beta_t YEAR_t - u_{it} + v_{it} \qquad (3)$$

where j and t subscripts denote fishing firms and years, respectively. The output variable is given by the catch per year (tonnes). Four inputs employed in the production frontier:

- Effort: number of fishers (x1); number of diver days (x2); number of diver hours (x3),
- Fish biomass (x4)
- Dummy variables to account for fishing zones
- Time dummy variable is included to control for neutral technical change

Preliminary results: stochastic frontier

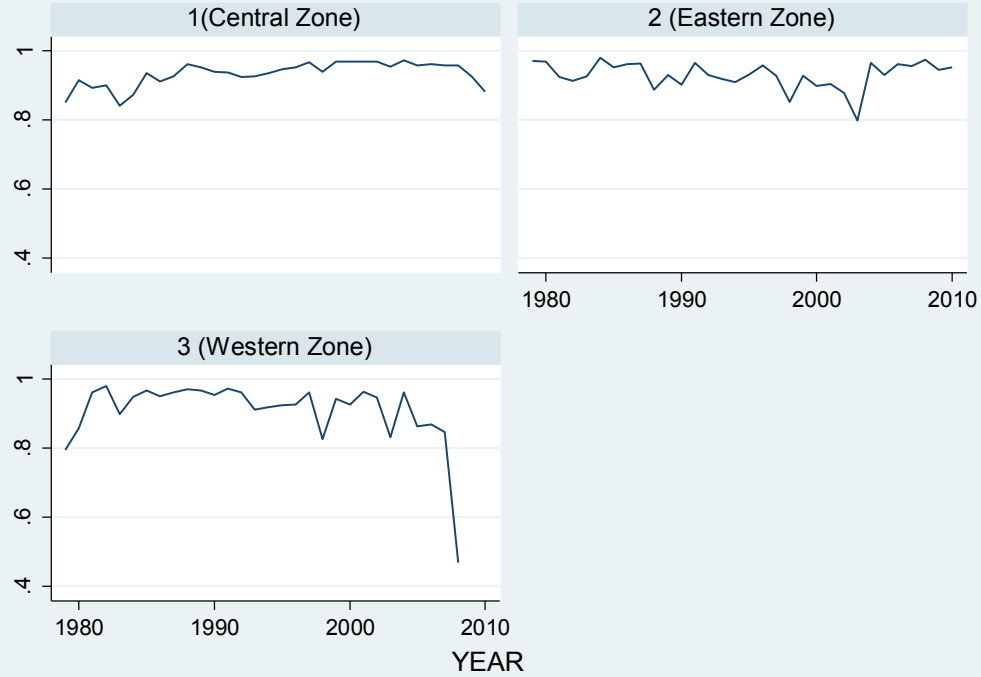
	Coefficient/s.e	t-ratio
Constant	2.00 (0.60)**	3.32
Effort	0.23 (0.03)***	7.30
Biomass	0.75 (0.29)**	2.78
Central Zone	0.03 (0.04)	0.59
Western Zone	-0.17 (0.08)**	-2.19
AVG Outbreak	-0.15 (0.04)**	-3.87
AVG outbreak*Central Zone	-0.10 (0.07)**	-2.45
AVG Outbreak*Western Zone	-0.31 (0.08)***	-4.05

Stochastic frontier (cont)

	Coefficient /s.e	t-ratio
Time trend	0.01 (0.01)**	2.00
Sigma-squared	0.42(0.19)**	2.85
Gamma (γ)	0.92 (0.008)**	7.50
Log-likelihood	-85.45	
Mean technical efficiency	0.92	

Mean technical efficiency

- Mean technical efficiency is 0.92
- Results suggest the Victorian abalone fishery's TE is high.
- Significant decline in TE in the western zone post-outbreak in 2006



Summary

- Stochastic production frontier is significant and appropriate. The translog functional form is appropriate and the null hypothesis of no technical inefficiency component is rejected

- Production depends positively on the amount of effort and the stock biomass.

- There are significant differences between fishing zones and the AVG outbreak has a negative impact on technical efficiency in the western zone.

Thank you

Division/Unit Name
Presenter Name
Presenter Title

t +61 2 9123 4567
e firstname.surname@csiro.au
w www.csiro.au/lorem

Division/Unit Name
Presenter Name
Presenter Title

t +61 2 9123 4567
e firstname.surname@csiro.au
w www.csiro.au/lorem