Technical efficiency in the Victorian Abalone Fishery

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Introduction

The Abalone Fishery is one of Victoria's most valuable commercial fisheries and most of the catch is exported to international markets in Asia (Japan, Hongkong, Singapore, China). Target species consist of blacklip abalone and greenlip abalone (<1% of total catch). The fishery is quota managed, and the total allowable commercial catch (TACC) for the 2017/18 was about 694.5 tonnes, with a market value of $22 million. A number of declines in abalone abundance have occurred in recent years, due to the impacts of Abalone Viral Ganglioneuritis (AVG), fishing pressures and expanding urchin barrens. However, there has been little economic analysis done of the fishery. The aim of this study is to examine technical efficiency, capacity utilisation and impacts of the viral disease outbreaks in the Victorian Abalone fishery in Australia.
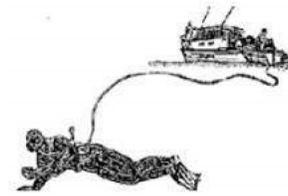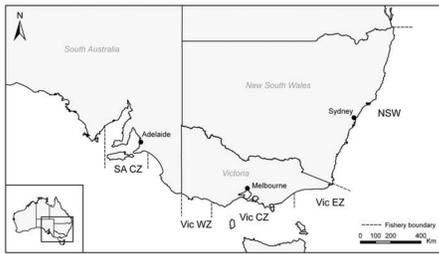
Methods

Methodology

The study examines technical efficiency in the Victorian Abalone Fishery with an input-oriented data envelopment analysis (DEA) using panel data for the period from 1978/79 to 2009/2010. TE scores were calculated using DEA methods (1, 2), and the model was estimated using the R software (3). The influence of factors affecting technical efficiency was analysed using a Tobit regression model of DEA-derived scores (4). Such factors include inputs (including number of fishers, time spent fishing in days and hours, dummy variables for fishing zones and disease outbreak, and a time trend. The data used for this analysis was obtained from the catch and effort unit, Fisheries Victoria, Department of Environment and Primary Industries. The data included information on fishing zones, diver days, diver hours, catch, value of catch, number of fishers and year.

Illustrative frontiers from the data

(a) Fishers (b) Days fished (c) Hours fished
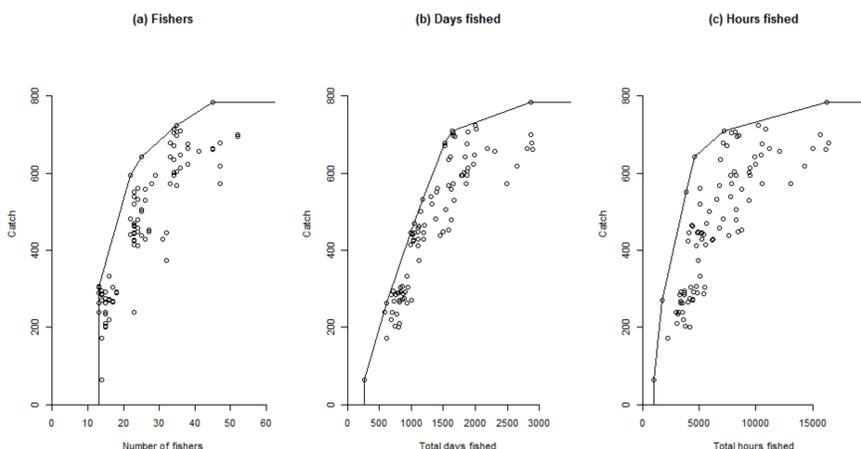
Results

Descriptive statistics

	Central Zone	Eastern Zone	Western Zone
Diver days	1,976	1,304	740
Diver hours	9,873	6,490	3,534
Catch (tonnes)	640	486	245
Value of catch (A$'000)	14,794	10,855	5,496
Number of fishers	38	24	15
Biomass ('000 tonnes)	1.72	1.65	1.95

- Catch is much higher in the central zone than in the eastern or western zones
- There were also more fishers operating longer diving days and hours in the central zone than the eastern and western zones.
- A declining trend in catch is noted in the western and central zones. This declining trend has resulted in a decrease in the TACC.
- Catch in the eastern zone has remained relatively stable, although it declined slightly in 2008/09.

Victorian Abalone Fishery catch by zones, 1978/79-2008/09
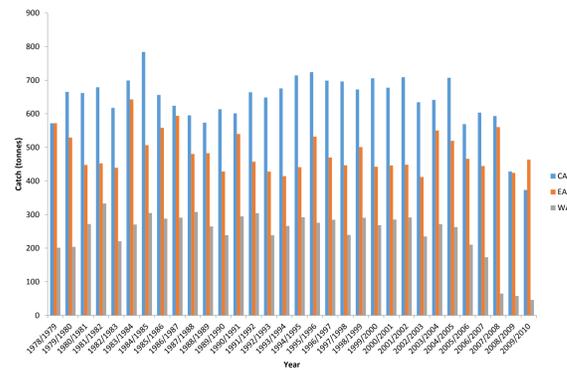
Results from DEA model

- A Tobit regression model was used to determine which factors influence efficiency, using a log-linear form of the model.
- The coefficient of input is positively signed but not significant.
- The dummy variable representing the year 2006 is significant and negatively related to efficiency, suggesting possible negative impact of disease outbreaks.
- Variables representing fishing zones are positively related to efficiency but only significant for the western zone.
- The time variable is significant and positively related to efficiency, suggesting technical change over time.
- Interaction terms between fishing zone and time are negatively related to efficiency.

Parameters	Coeff.	Std. error	Sig
Intercept	0.087	0.171	
Input	0.087	0.122	
Dummy98	0.219	0.201	
Dummy06	-0.209	0.057	***
Factor (Zone) EA	0.123	0.165	
Factor (Zone) WA	0.449	0.166	**
Time	0.037	0.009	***
Dummy06: Factor(Zone) EA	0.276	0.098	***
Dummy06: Factor(Zone) WA	0.313	0.121	*
Factor (Zone) EA: Time	-0.008	0.010	
Factor (Zone) WA: Time	-0.030	0.010	**
logSigma	-1.224	0.093	***

Results

Technical efficiency by zone and year
- Results show an increase in technical efficiency across the fishing zones
- A decline in capacity utilisation across the three fishing zones over time
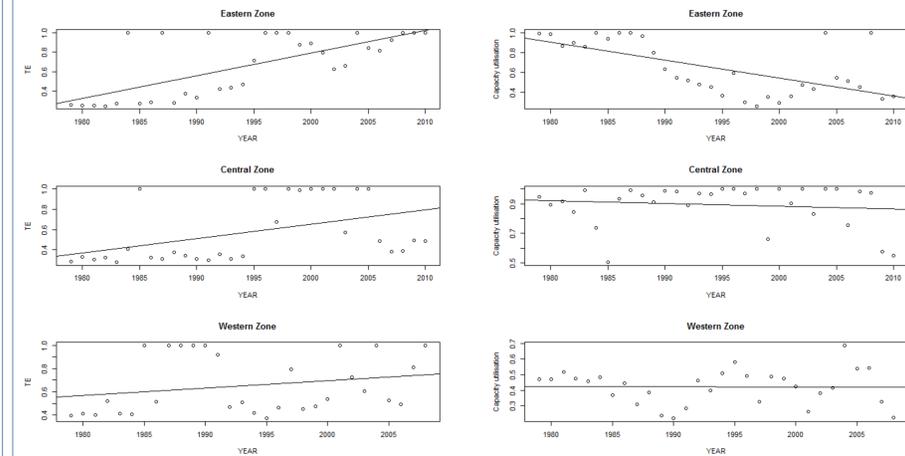
Conclusion

- This study is the first to examine technical efficiency, capacity utilisation and impacts of a viral disease outbreaks in the Victorian Abalone fishery in Australia.
- Results show an increase in technical efficiency over time, with a decline in capacity utilisation across the three fishing zones
- AVG disease outbreak had a negative impact on efficiency

References

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Acknowledgements