

Production efficiency and capacity utilisation of Queensland's Sydney rock oyster (SRO) industry

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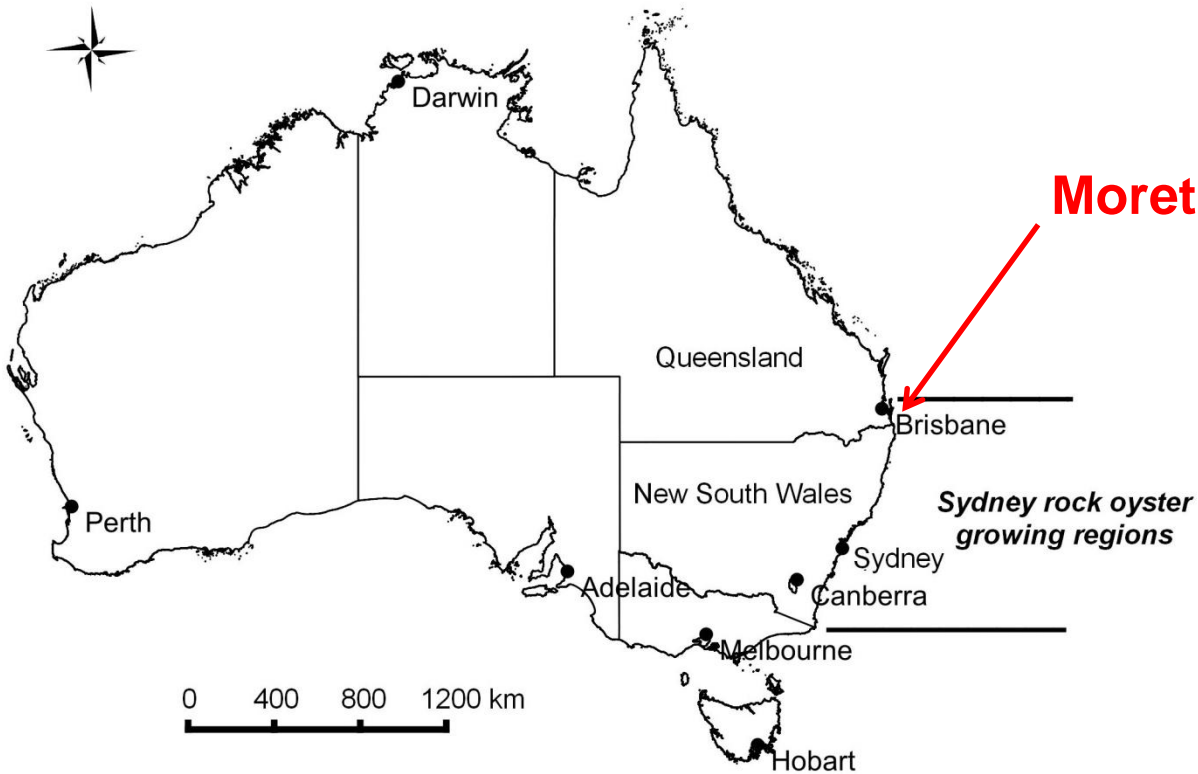
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IIFET 2014



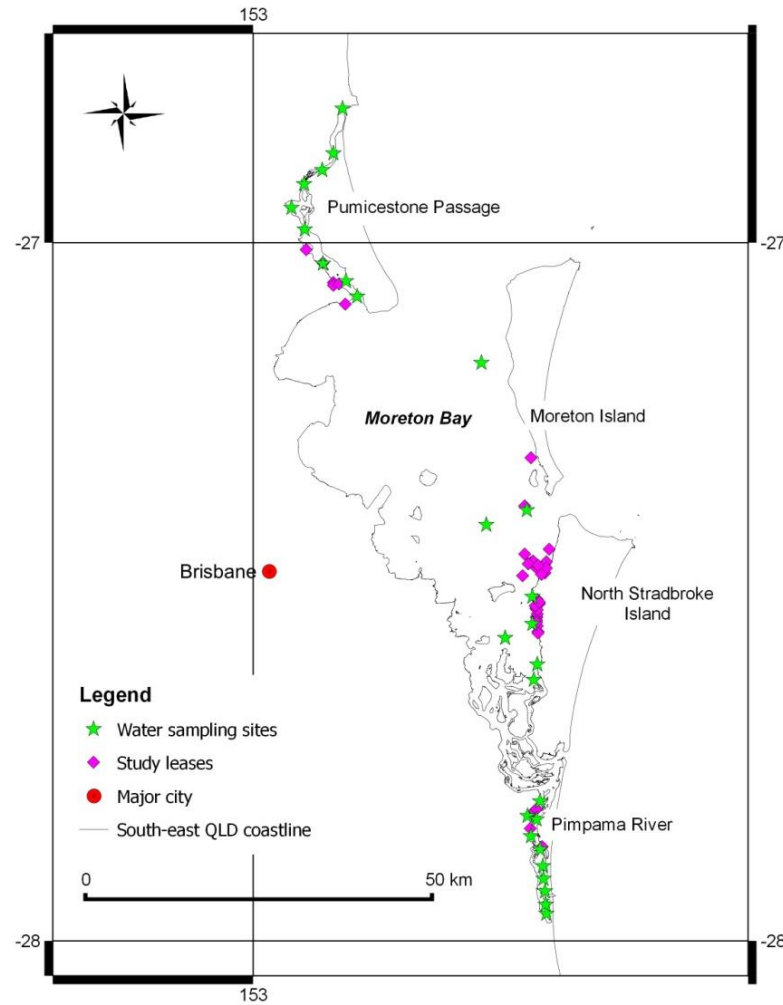
Sydney rock oyster industry



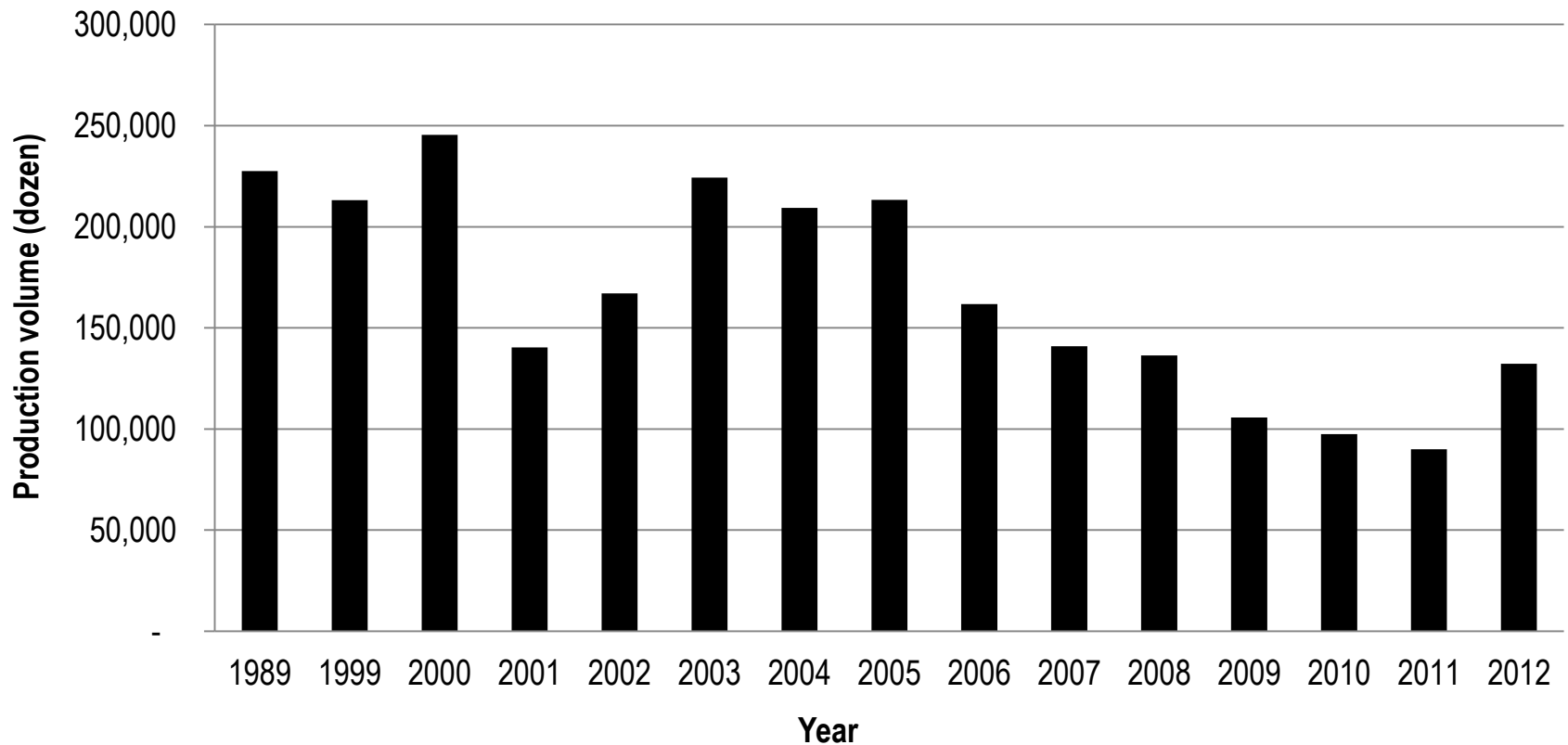
Moreton Bay (Queensland)



Moreton Bay (Queensland)



Production volume



Research questions

- What is the level of technical efficiency (TE) and capacity utilisation (CU)?
- What is the impact of oyster grower's characteristics and environmental conditions on TE & CU?

Definitions

- Technical efficiency (TE): Ability to obtain maximum output from given inputs
- Capacity utilisation (CU): Ratio of actual output to potential (capacity) output.

Methods

- 1st stage: Data Envelopment Analysis (DEA) to derive TE and CU scores
- 2nd stage: Estimate inference of oyster farmers characteristics and environmental conditions on derived TE and CU scores (OLS)

Production Data (1st Stage)

- Annual production volume & value (4 grades of oysters) per lease
- Labour input per lease
- Lease size (hectares)
- N=125 observations (covering period 2000-2012)

Demographic Data (2nd Stage)



Farm survey data (2012)

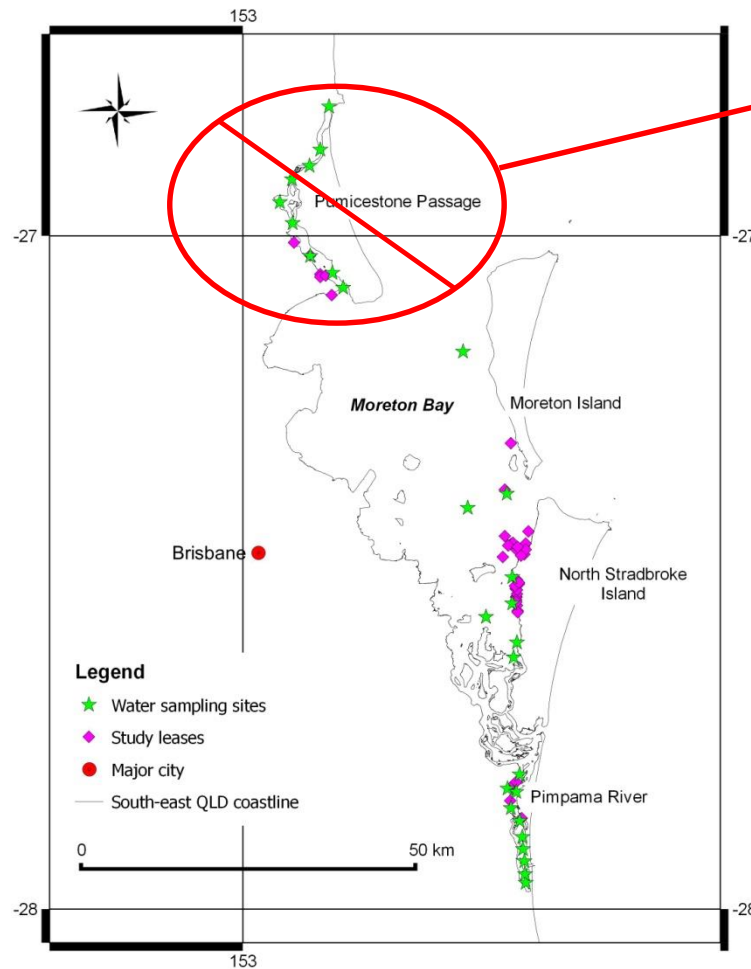
- Male: 83%
 - Age: 57 years (median)
 - Experience: 14 years (ave.)
 - 1st Generation: 83%
 - Tertiary degree: 26%
-
- Farmers with off-farm income: 73%
 - Proportion of income from oyster farming: 14%

Environmental Data (2nd Stage)

- Monthly records (2000-2012) from Healthy Waterways Ltd.
- Variables: salinity, temperature, dissolved oxygen, light, turbidity, nitrogen, phosphorus, chlorophyll, pH
- Derived annual averages



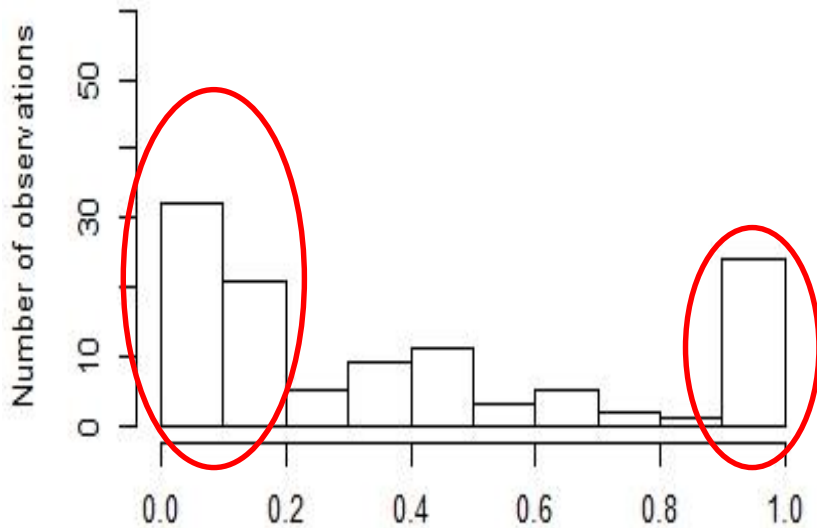
Production & water sampling sites



Excluded: no demographic data

Results: DEA (1st stage)

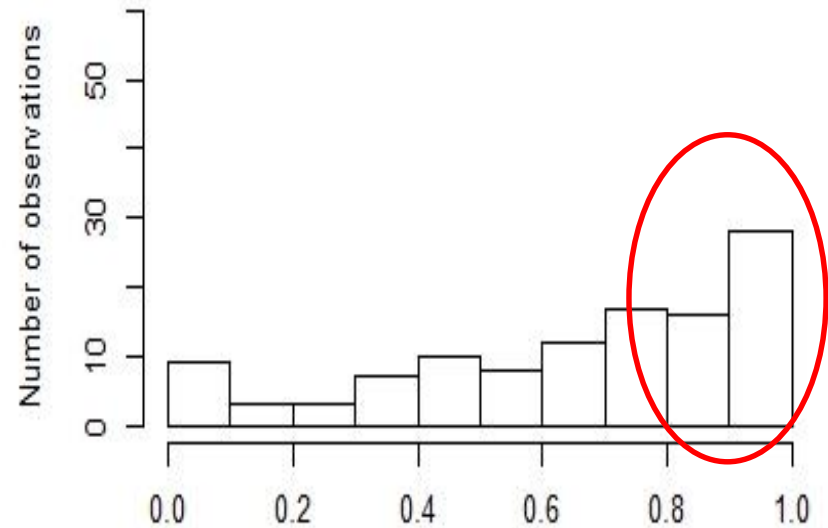
a) Technical efficiency



Technical efficiency scores

Median score: 0.29
Mean score: 0.40

b) Unbiased capacity utilisation



Unbiased capacity utilisation scores

Median score: 0.75
Mean score: 0.66

Results: TE (2nd Stage)

Coefficients	Estimate	Std. Error	p-value	VIF
(Intercept)	-14.467	8.402	0.088	
Male	0.020	0.153	0.894	2.79
Age	-0.020	0.004	0.000	3.62
Experience	0.013	0.004	0.002	2.02
Tertiary education	-0.195	0.102	0.058	2.26
Generation 1 <	-0.185	0.088	0.039	1.59
Salinity	0.017	0.047	0.728	3.41
Temperature	0.109	0.086	0.211	1.78
Diss. Oxygen	-0.002	0.024	0.923	3.97
Light	-0.144	0.053	0.008	11.26
Turbidity	0.194	0.067	0.005	27.55
Nitrogen	4.122	2.050	0.047	8.42
Phosphorus	-76.796	30.719	0.014	18.02
Chlorophyll	-0.560	0.209	0.009	14.79
pH	1.751	0.981	0.078	4.68
Eastern Banks	-0.407	0.389	0.297	10.29
Eastern Bay	0.170	0.261	0.515	19.96

Caution!

Adjusted R-square: 0.380, p-value: 0.000

Results: CU (2nd Stage)

Coefficients	Estimate	Std. Error	p-value	VIF
(Intercept)	4.368	7.078	0.539	
Male	0.458	0.129	0.001	2.79
Age	0.002	0.003	0.481	3.62
Experience	-0.001	0.003	0.819	2.02
Tertiary education	-0.075	0.086	0.384	2.26
Generation 1 <	0.143	0.074	0.057	1.59
Salinity	-0.015	0.040	0.717	3.41
Temperature	-0.001	0.073	0.992	1.78
Diss. Oxygen	-0.018	0.020	0.381	3.97
Light	0.043	0.045	0.338	11.26
Turbidity	-0.016	0.057	0.777	27.55
Nitrogen	0.150	1.727	0.931	8.42
Phosphorus	-14.330	25.880	0.581	18.02
Chlorophyll	0.009	0.176	0.961	14.79
pH	-0.212	0.827	0.799	4.68
Eastern Banks	0.540	0.327	0.102	10.29
Eastern Bay	-0.382	0.220	0.085	19.96

Caution!

Adjusted R-square: 0.311, p-value: 0.000

Conclusion

- Low level of technical efficiency driven by demographics & environmental conditions
 - Negative tertiary educational effect (hobbyists with little interest in efficient production, lifestyle industry)
- High level of capacity utilisation driven by male gender, knowledge about oyster growing, spatial location
- Policy focus on increasing technical efficiency
 - Incentive: Setting production targets to increase productivity
 - But: Risk of forcing out too many farmers out of the industry

Acknowledgements

- Fisheries Research Development Cooperation (FRDC), Queensland University of Technology (QUT) for financial support
- Commonwealth Scientific and Industrial Research Organisation (CSIRO) for in-kind support
- Max Wingfield, Michael Heidenreich (QLD DAFF), John Dexter (QLD DAFF) for providing access to data
- Ana Rubio Zuazo (University of Sydney) for remarks