

Maximum economic yield of the western rock lobster fishery of Western Australia after moving from effort to quota control

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ABSTRACT

The western rock lobster (*Panulirus cygnus*) fishery is Australia's most valuable single-species fishery, worth AUD\$200–\$400 million annually. Stock assessment for this fishery utilises the puerulus settlement to predict recruitment to the fishery 3–4 years later. This predictive ability has been particularly useful recently, due to an unprecedented period of low settlement between 2006/07 and 2012/13. Pre-emptive management action (~70% effort reduction) was taken to provide greater protection to the breeding stock which also moved the fishery to the maximum economic yield (MEY) level of effort for the projected recruitment. In 2010/11, the fishery moved from an effort-controlled to a quota-controlled fishery, which led to changes in fishing practices resulting in reductions in fishing costs and increases in lobster prices of about US\$16/kg. This provided a unique opportunity to compare an MEY assessment under effort and quota controls. The MEY assessment under quota controls for a 5-year period indicated that annual harvest rates of 37–47% of legal biomass will achieve catches of 5780–7370 t. in 2014. This MEY target harvest range, which complements existing sustainability reference points based on egg production, is robust to a range of costs, prices and profit discount rates. This catch range enables industry/managers to take into account marketing implications and social issues (e.g. employment) in quota setting and therefore could be considered a socio-economic target. The MEY level of fishing has increased egg production to well above threshold levels that were based on maximum sustainable yield, providing the fishery with increased resilience when faced with environmental perturbations. This enables consideration for relaxing some existing biological controls, e.g. setose (mature) females, females above a maximum size, and lobsters 76–77 mm carapace length. The relaxation of these controls is estimated to increase profits by about AUD\$15 million annually due to higher catch rates and reduced fishing effort while maintaining egg production well above threshold levels.

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1. Introduction

The western rock lobster *Panulirus cygnus* is exploited by commercial and recreational fishers along the lower west coast of Western Australia (Fig. 1). The commercial fishery is Australia's most valuable single-species fishery, worth \$200–\$400 million annually with catches historically averaging about 11,000 t, up to the mid-2000s, prior to recent management changes introduced as a result of a downturn in recruitment [1]. The fishery was one of the first to be made limited entry, with the number of licences restricted since 1963. Prior to the 2010/11 season, the fishery was managed using input controls to restrict fishing effort, but it has

since become a catch quota-controlled fishery with individual transferable quotas (ITQ). The fishery was also the first fishery in the world to achieve Marine Stewardship Certification in 2000 and has since been re-certified another two times.

As a result of economic pressures from increasing costs, lower lobster prices and predicted low recruitments into the fishery in the mid-2000s, an assessment was undertaken on the level of fishing effort that would maximise economic yield (MEY), where economic yield was defined as the net present value of fishery profits over the following 6 years [1]. This showed that the effort level required to achieve MEY for the effort-controlled fishery was about 50–70% less than the 2007/08 level.

A feature of the stock assessment and management of the western rock lobster fishery for over 30 years has been catch predictions based on the level of puerulus settlement (post-larval settling stage) recorded 3–4 years earlier [2,3,4]. Over the seven years (2006/07 to 2012/13), puerulus settlement has been below

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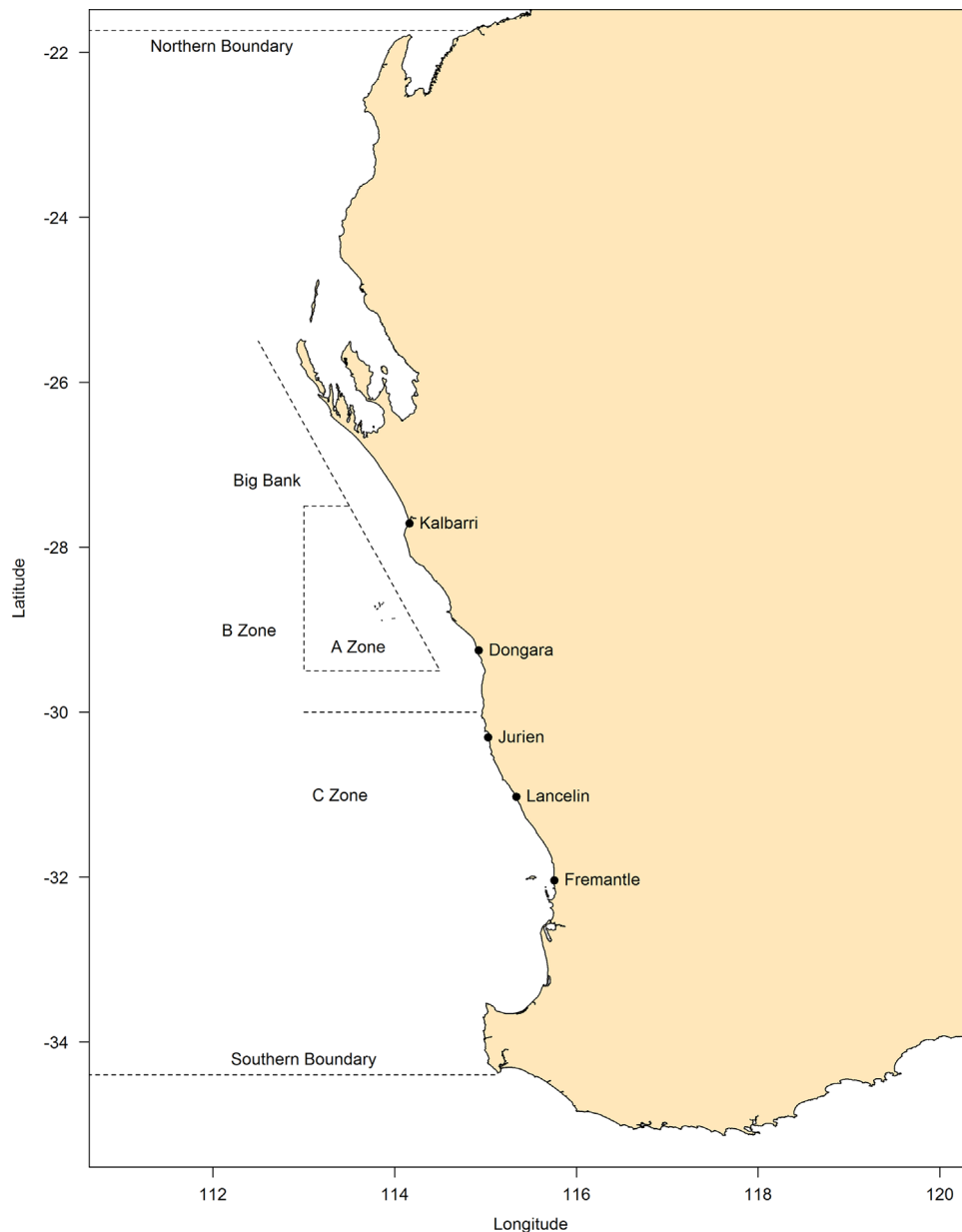


Fig. 1. The boundaries of the western rock lobster fishery in Western Australia with the three management zones ((A)–(C)), with the Big Bank region being part of Zone B.

average, with the settlements in 2008/09 and 2009/10 being the lowest recorded since monitoring began over 40 years ago. As a result of this extended period of low recruitment, pre-emptive management action was taken for the 2008/09 and 2009/10 fishing seasons (44 and 73% reductions in nominal fishing effort, respectively, relative to the 2007/08 level) to reduce catch levels in the fishery and thereby provide increased protection to the spawning stock, as well as ensuring a carryover of legal lobsters into the future years of lower recruitment. While the management changes were undertaken to ensure that stock conservation objectives could still be met despite the forecast downturn in recruitment, the effort reductions were also similar to those required to achieve MEY [1]. Consequently, fishery profits were estimated to have been \$13 and \$49 million higher for the effort-controlled years of 2008/09 and 2009/10, respectively, than they would have been if effort remained at 2007/08 levels [1]. For the first year of quota-controls in 2010/11, fishery profit was estimated to have been more than \$60 million higher than that expected under continued 2007/08 effort levels.

The move of the fishery from an input-control fishery to an output-control fishery using ITQs commenced in the 2010/11 season and has also led to changes in fishing patterns and marketing strategies. These changes included an increased fishing season from 7.5 to 12-months and a more even temporal spread of catch. These changes in cost structures of fishing operations and lobster prices would all influence the MEY assessment.

The purpose of this study was to undertake the MEY assessment under ITQ management, and compare it to that undertaken previously under effort controls by Reid et al. [1]. This assessment provides information for the development of a target reference range and control rules based on an MEY assessment that may be an appropriate measure for an economic objective for the management harvest strategy [5]. This conservative target complements the current harvest strategy adopted for this fishery, which is focused on egg production being maintained above a threshold and limit reference level.

Reducing fishing effort to a level associated with MEY since 2008/09 has resulted in an increase in egg production which is

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