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Fishing power increases continue in Queensland's east coast trawl fishery, Australia

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Abstract

The Queensland east coast trawl fishery is by far the largest prawn and scallop otter trawl fleet in Australia in terms of number of vessels, with 504 vessels licensed to fish for species including tiger prawns, endeavour prawns, red spot king prawns, eastern king prawns and saucer scallops by the end of 2004. The vessel fleet has gradually upgraded characteristics such as engine power and use of propeller nozzles, quad nets, global positioning systems (GPS) and computer mapping software. These changes, together with the ever-changing profile of the fleet, were analysed by linear mixed models to quantify annual efficiency increases of an average vessel at catching prawns or scallops. The analyses included vessel characteristics (treated as fixed effects) and vessel identifier codes (treated as random effects). For the period from 1989 to 2004 the models estimated overall fishing power increases of 6% in the northern tiger, 6% in the northern endeavour, 12% in the southern tiger, 18% in the red spot king, 46% in the eastern king prawn and 15% in the saucer scallop sector. The results illustrate the importance of ongoing monitoring of vessel and fleet characteristics and the need to use this information to standardise catch rate indices used in stock assessment and management.

Keywords: Fishing power; Linear mixed models; Prawns; Scallops; Otter trawling

1. Introduction

Harvest landings from the Queensland east coast otter trawl fishery (ECOTF) are in the order of 10–13 kilo-tonnes annually and worth approximately $100–150 million (AUD) at the wharf. With 504 vessels licensed at the end of 2004, the ECOTF is by far the largest prawn trawl fleet in Australia in terms of the number of vessels. The fishery is complex in nature targeting several species of prawns (mainly *Penaeus* spp., *Melicertus* spp. and *Metapenaeus* spp.) and one main species of scallop (*Amusium balloti*). The ECOTF is characterised by identifiable sectors that are largely based on target species and geographic regions (Fig. 1).

Vessel characteristics change through the adoption of new and better technologies and fishing gear, and individual license holders are free to target any sector they choose. Consequently, interpretation of the catch and effort statistics, and the use of these statistics for monitoring the status of the fishery and reviewing the suitability of management arrangements are more difficult.

Catch and effort statistics are used as the basis of stock assessments and management in many Australian fisheries (O'Neill and Leigh, 2006). Predictions based on raw data can be biased due to changes in the efficiency of fishing effort through time and between fishing operations or sectors. There is, therefore, a need to standardise catch and effort data to reduce biases and variability. Standardisation, accounting for factors affecting both relative abundance and fishing efficiency, results in time series of catch and effort data that are more representative of trends in population abundance.

Several studies have focussed on standardisation of catch–effort data (Bishop et al., 2000, 2004; Hall and Penn, 1979; O'Neill et al., 2003; Robins et al., 1998; Salthaug and Godø, 2001). Generalised linear regression models (GLM) have been used to estimate changes in relative fishing power and to standardise average catches in the Queensland trawl fishery (O'Neill et al., 2003). They have also been used to quantify the effects of global positioning system (GPS) on average catches in Australia's northern prawn fishery (Robins et al., 1998). Bishop et al. (2000) further developed the analysis of Robins et al. (1998)

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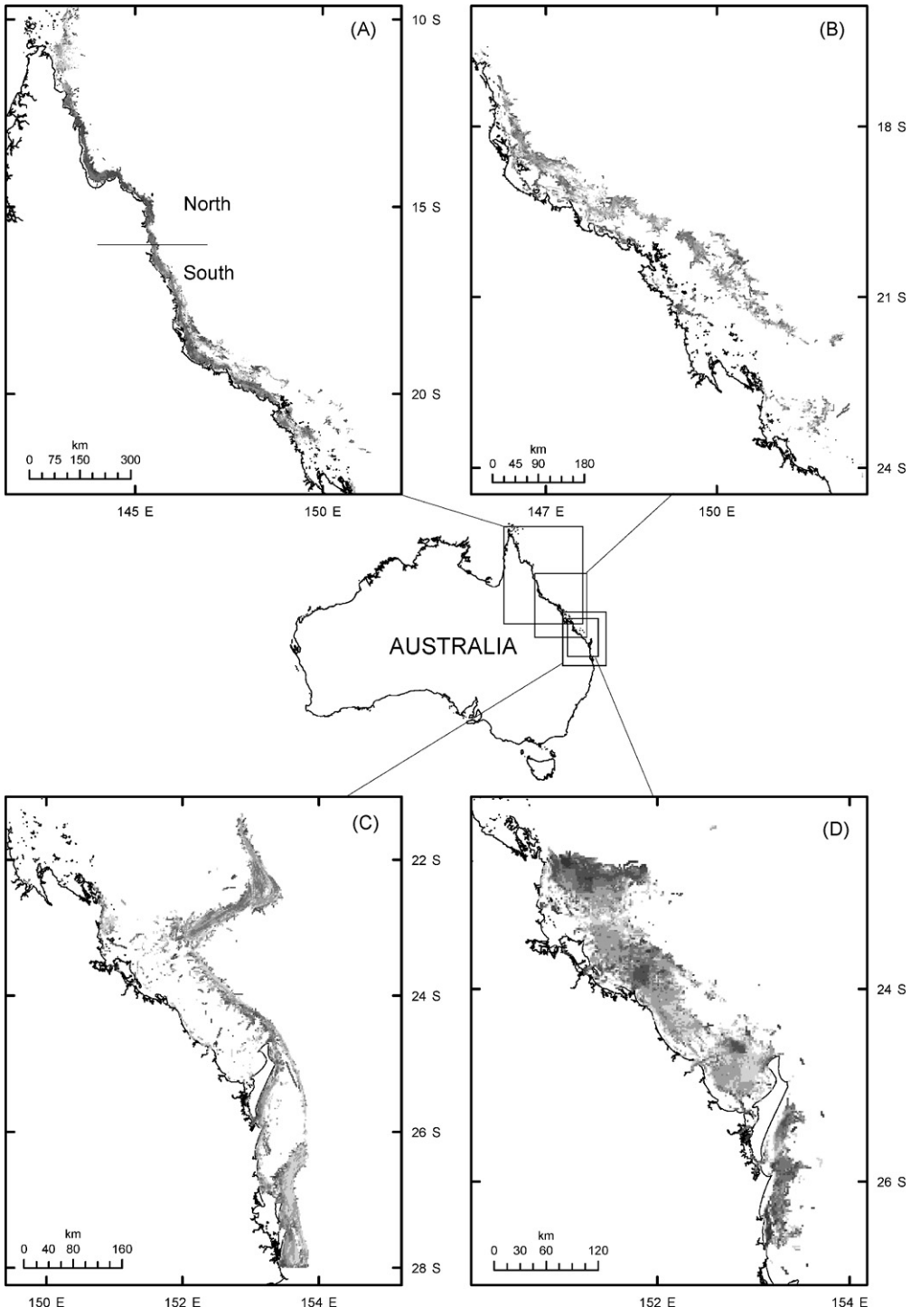

Fig. 1. Spatial distribution of normalised (log transformed) catch rates for: (A) tiger and endeavour prawn, (B) red spot king prawn, (C) eastern king prawn and (D) saucer scallop; the darker shades indicate high catching areas. The horizontal line in (A) at 16° S distinguishes the northern and southern tiger/endeavour prawn trawl sectors.

by using generalised estimating equations (GEE) to account for spatial and temporal correlations in the data. A linear mixed model (LMM) for catches from Australia's northern prawn fishery 'produced consistent results when compared with . . . other random vessel models' (Bishop et al., 2004).

In recent years, the Queensland and Australian governments have addressed Queensland's trawl fishing power increases by reducing the total number of nights that vessels are allowed to fish, through the use of penalties for vessel upgrades and surrender provisions on licence and effort trading (Kerrigan et al., 2004). 'Fishing power' is the term used to describe the efficiency of an average vessel at catching prawns or scallops. The concept of reducing fishing time (measured in nights) according to potential fishing power increases was implemented by fishery