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A comparison of the relative efficiency of ring, fyke, fence nets and beam trawling for estimating key estuarine fishery populations

Adam Butcher[a,*], David Mayer[b], Darren Smallwood[a], Mathew Johnston[a]

[a] *Department of Primary Industries and Fisheries, Southern Fisheries Centre, P.O. Box 76, Deception Bay, Qld 4508, Australia*
[b] *Department of Primary Industries and Fisheries, Animal Research institute, Locked MB4, Moorooka, Qld 4105, Australia*

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Abstract

We compared the relative capture efficiency of four commonly-used gear types; ring, fence, fyke nets and beam trawls, for estimating the abundance of sand whiting, *Sillago ciliata*, and dusky flathead, *Platycephalus fuscus*, in a southeast Queensland estuary. Our overall estimates of relative efficiency were based on an intensive time-replicated Latin-square experiment with all four gear types, combined with sampling at three sites, using different paired gear combinations, between January 1996 and December 1998. We found that ring and fyke nets were most effective (95%) in capturing a representative size-range of *S. ciliata* and *P. fuscus*, compared to fence nets (80 and 60%, respectively) and beam trawls (35 and 6%, respectively). However, to obtain an overall estimate of population abundances of either species, all four gear types were necessary to sample the range of habitat types found in the estuary.

Keywords: Gear efficiency; Gear comparison; Fish densities; *Platycephalus fuscus*; *Sillago ciliata*; Estuaries; Catch efficiency

1. Introduction

Sillago ciliata, a schooling benthic feeder and *Platycephalus fuscus*, a cryptic ambush predator are two of the top five catches of Queensland anglers (Williams, 1997). They were the target species of a pilot estuarine stock enhancement program conducted in the Maroochy River estuary between 1995 and 1998 (Butcher et al., 2000). The aim of this program was to assess whether the natural population size could be augmented by stock enhancement, following several major fish kills in the estuary. To achieve this, it was necessary to estimate the population size before, during, and after the stock enhancement program to quantify success of the stocking operation (Howell, 1998). This has rarely been undertaken previously (Hilborn, 1998), but was one of the objectives of a pilot estuarine stock enhancement program in the Maroochy River. The Maroochy estuary has a diverse range of habitat types (Anderson, 1993) and required several different types of gear to

* Corresponding author. Tel.: +61 7 3817 9583; fax: +61 7 3817 9500.
E-mail address: adam.butcher@dpi.qld.gov.au (A. Butcher).

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sample these effectively. The gear types included fyke, fence and ring nets, and a beam trawl. They sampled different amounts of surface area and different substrates. Thus to use the catch data from all gear types required a gear standardisation trial to assess the relative capture efficiency.

An absolute index of gear efficiency can be defined as the number caught divided by the number available to capture (Hilborn and Walters, 1992). In practice this is difficult to estimate because of the vagaries of fish behaviour, gear deployment and habitat complexity (Parsley et al., 1989; Pierce et al., 1990; Allen et al., 1992; Pepin and Shears, 1997; Salthaug, 2002). A relative index is more commonly used, either catch per unit area (Whitlaw et al., 1991; Van Den Avyle et al., 1995; Meekan et al., 2001) or as a proportional (%) efficiency (Jacobs and Swink, 1982; Parsley et al., 1989; Rogers and Lockwood, 1989; Pierce et al., 1990; Allen et al., 1992; Long and Wang, 1994; Van Den Avyle et al., 1995; Pepin and Shears, 1997; Bayley and Herendeen, 2000; Salthaug, 2002). These latter authors all reported on the deployment of multiple gear types over a similar area. They were based on the assumption that species abundance did not vary significantly between adjacent sites, an assumption that was questioned by Parsley et al. (1989), Allen et al. (1992) and Salthaug (2002). These authors observed that a patchy (schooling) distribution can significantly influence gear efficiency estimates and required a larger sample size to assess multiple gear efficiencies. Allen et al. (1992) recorded a relationship between catchability and temperature (season), but closer investigation of their results reveals that this relationship was probably size-related with an overlying seasonal influence on the prevailing size-range. Their results show that larger fish had a greater chance of escaping, thus highlighting the limitations of pull nets for assessing the abundance of mobile species. Jacobsen and Kushlan (1987) also reported a significant relationship between gear efficiency and fish-size, noting that many enclosure traps under-sample larger sized fish. This work reports on the relative efficiency of four gear types when used to sample different habitats within an estuary in south-eastern Queensland, Australia.

2. Methods

2.1. Study site

The Maroochy River, located 120 km north of Brisbane (Fig. 1), has a small estuary some 26 km long, which Anderson (1993) classified as moderately dis-

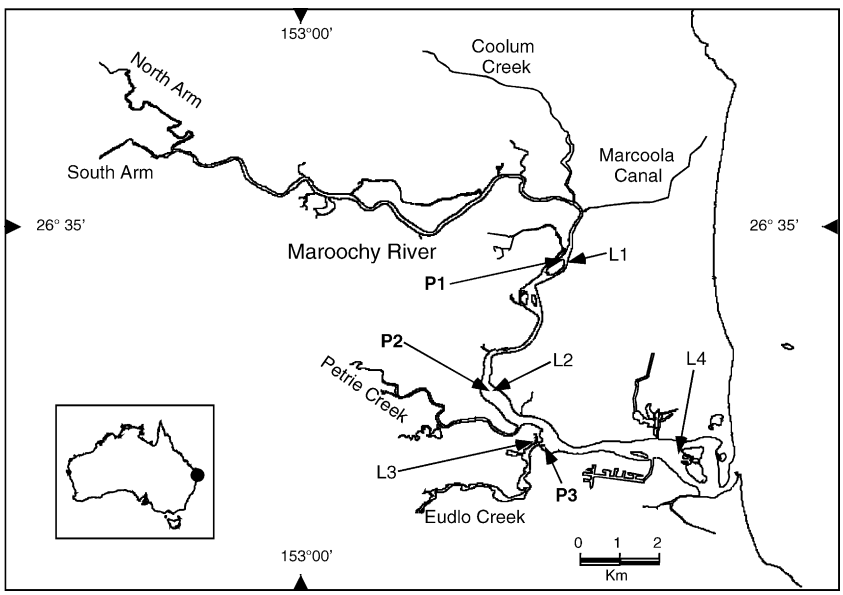

Fig. 1. Map of Maroochy River, southeast Queensland with survey site locations marked as; (P1) first paired sites, (P2) second paired sites, (P3) third paired sites, (L1–L4) location of four Latin-square experiment sites. Data supplied by Auslig©.