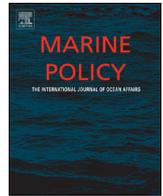




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Micro-economic drivers of profitability in an ITQ-managed fishery: An analysis of the Queensland Coral Reef Fin-Fish Fishery



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ABSTRACT

An economic survey of the commercial operators currently active in the Queensland Coral Reef Fin-Fish Fishery has been carried out, as part of a research project aimed at evaluating alternative management options for this fishery. This paper presents the background analysis used as a basis to develop the sampling design for this survey. The background analysis focuses on activity patterns of the fleet based on effort and catch information, as well as patterns of quota ownership. Based on this information, a fishing business profile describing the micro-economic structure of fishing operations is developed. This profile, in conjunction with the qualitative information gained in undertaking the economic surveys, allows preliminary understanding of the key drivers of profitability in the CRFFF, and possible impacts of external factors on fishing operations.

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1. Introduction

Decision-support tools used to assist in the evaluation of alternative fisheries management strategies increasingly seek to include the dynamic response of fishing operators to changes in their economic, ecological and/or regulatory circumstances [1,2]. This is because consideration of such responses may be critical in assessing the likely ecological, economic and social consequences of alternative management options [3–6], as well as of externally driven shocks such as climatic events [7]. In the fisheries modeling literature, as in the broader domain of fisheries research and policy analysis, the operators involved in commercial fishing are often referred to as “Fishermen” or “Fishers”, with limited to no further specification. This is particularly true in the fisheries economics literature, as illustrated by Gordon’s seminal work on developing a bio-economic theory of fisheries production dynamics [8], and the large body of research that developed on this basis. Since this research is concerned with the description of economic decisions made by

commercial enterprises harvesting marine living resources, there has been a tendency to identify these enterprises with individual people involved in the business of fishing. To some extent, this may be justified by the fact that a large proportion of the world’s commercial fishing activities are carried out by businesses that are held and operated by a single person, who owns and operates a single fishing vessel—the classic “owner-operator” fisher. However, there are also many cases in which the structure of commercial fishing businesses may be more complex, with multiple and varied individuals involved in the ownership and operation of fishing assets. When this is the case, commercial entities cannot be identified with particular individuals. In addition, such identification may be misleading as to the nature of the incentives and economic risks which businesses face, as these will depend on their business structure. This is particularly an issue if the aim of the research or policy analysis is to understand, and possibly influence, the incentives to which commercial fishing operations respond.

This paper presents an analysis of this issue using the Coral Reef Fin-Fish Fishery (CRFFF) on the Great Barrier Reef as a case study. The Effects of Line Fishing Simulator (ELFSim) was developed to examine potential management strategies for the CRFFF [9,10]. ELFSim simulates the populations of coral trout (CT) and

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red-throat emperor (RTE) on almost 4000 individual reefs. The model captures the spatial complexity of fish larval movement on the ocean currents, and the size, age and sex structure of the species across the region. In addition, ELFSim also simulates the fishing activity of commercial fishing operations across the region, as well as the charter and recreational components of the fishery. The platform contains an explicit representation of the behavior of commercial fishing operators, represented as individual, profit-maximizing agents. This includes fishing effort, its spatial and temporal distribution, as well as catch quota trading. This component of the model was developed and calibrated using economic data from the 1990s. At the time, the fishery was experiencing a transition from the landing of mostly dead fish, to the landing of both live and dead fish, the former attracting much higher prices. In mid 2004 the fishery also transitioned from a regulatory system based on input controls, to a mixed system that includes total allowable commercial catch limits and individual transferable quotas (ITQs), input restrictions, and increased marine reserves [11].

These changes led to the need for and a fishing industry request to update the economic description of the fishery to be included in the simulation platform. This paper presents the approach taken to collect this information and the background analysis of the industry that was developed in the process. This involved identifying types of fishing businesses with similar characteristics actively involved in the fishery in the 2010–11 financial year, as well as a preliminary analysis of the structure of quota ownership in the CRFFF. This background analysis, as well as a preliminary understanding of the economics of the fishery derived from discussions with stakeholders in the process of defining the survey approach, allowed an economic profile of the businesses involved in the fishery to be determined. This profile, along with qualitative information obtained in the course of developing it, provides insights into the diversity of businesses that currently operate in the fishery, and how this may affect key drivers of profitability in the fishery at the micro-economic level.

2. The commercial fishery

The Queensland Coral Reef Fin-Fish Fishery consists of a commercial component, a recreational component and a charter component, with a small amount of take by Indigenous fishers [12]. The commercial fleet, which is the focus of the analysis presented in this paper, targets a diversity of coral-reef associated fish using hand-held lines with baited hooks (> 155 species). The main species by order of decreasing value include several species of coral trout (*Plectropomus* and *Variola spp.*, CT), of which *P. leopardus* is predominantly landed as live fish and exported to Asia, as well as red-throat emperor (*Lethrinus miniatus*, RTE) and a wide range of other reef-associated fish species (OS) including other cods (mainly Serranidae), other emperors (Lethrinidae) and tropical snappers (mainly Lutjanidae), landed as dead whole fish or processed as fillets, and sold on the domestic market. The commercial fishery spans a broad latitudinal range along the Great Barrier Reef; from Cape York (10°41'S) in the north, to Bundaberg (24°30'S) in the south.

The commercial fishery consists of a wide diversity of operations, from single small vessels fishing short (12 to 48 h) trips, to larger operations using a mother vessel and a varying number of tender boats, undertaking trips of up to 2.5 weeks. In addition, fishing businesses display varying strategies regarding their targeted fishing effort and catch composition. Some focus solely on CRFFF species, in particular the landing of live CT, while others target a broader range of species, outside of the CRFFF, using hook and line as well as other fishing apparatus (e.g. nets, pots, trawl).

The commercial fishery is managed primarily via a range of input and output controls detailed in the 2003 Coral Reef Fin-Fish Management Plan [13]. These controls include:

1. technical regulations regarding maximum vessel length (20 m), number of lines per fisher and number of hooks on lines (no more than 3 fishing lines per fisher at a time, and no more than six hooks or lures attached to the lines) and minimum and maximum sizes of fish;
2. limited entry since 1984, through the issue of commercial fishing licences, which authorise the use of a primary boat (and identified tenders), to fish within the fisheries endorsed by fishery symbols on the licence. There are currently 369 licences authorised to operate in the CRFFF, of which approximately two thirds were recorded to be active in recent years [14]. Symbol endorsements on the licences determine the regions in which a licence holder is entitled to fish, as well as the species which can be caught (the symbol "RQ" allowing catch of CRFFF species), the fishing techniques, and the maximum number of tenders which can be used in the fishing operation;
3. commercial Total Allowable Catch (TAC) Limits. TAC limits were established in 2004 based on historical catch records. The available catch entitlements are: CT~1 288 t, RTE~616 t, and OS~956 t;
4. allocation of the commercial TAC via individual transferable quota units (ITQs). The TACs were allocated as line units to individual licence holders in 2004 on the basis of 1 unit=1 kg (whole weight) of allowable landings of a particular species group. These entitlements are valid only if its owner also holds an RQ symbol that is in force for that particular year. A number of rules also apply to landings including designated landing points and prior notice of landing. Additional regulations also apply to the filleting of fish prior to landing;
5. tradability of both input and output entitlements. Licences can be permanently sold or temporarily leased; fishery symbols can be transferred between licences; and individual line units can also be sold or leased between RQ symbols; and
6. seasonal spawning closures (currently two 5-day closures in October and November).

In addition, the fleet predominantly operates in the area covered by *Great Barrier Reef Marine Park (GBRMP) Zoning Plan 2003*. Approximately 33% of the Great Barrier Reef Marine Park comprises no-take marine reserves and the fishery is required to operate outside of these reserve areas.

In 2010–11, total landings by the fishery amounted to approximately 1600 t and estimated total gross returns of approximately \$44 million¹. This was composed of 763 t of live CT (49% of total RQ landings) and 115 t of dead CT, live CT generating the greatest share (81%) of total gross returns from the fishery (\$36 million, see Fig. 1) due to the much higher first sale price of this product category (\$47/kg on average). With lower average sale prices (around \$10/kg for RTE and \$7/kg for OS), landings of these species which represented approximately 43% of total landings led to an estimated gross return of approximately \$5.6 million, or less than 13% of the total returns from the fishery (Fig. 1).

The fishery has undergone significant changes since the introduction of the *Fisheries (Coral Reef Fin-Fish) Management Plan 2003* and its associated management, and the *Great Barrier Reef Marine Park Zoning Plan 2003* (Zoning Plan). ~136 t of CT, ~75 t of RTE and ~109 t of OS quota and 45 associated RQ symbols were bought out in a structural adjustment package associated with the

¹ Based on estimated annual average prices of the different product forms landed by the fishery.

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