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Editorial

Fisheries economics: cutting a broad swath in the field of scientific inquiry

The study of fisheries is the common theme running through the six papers in this special issue. For many years, this has been of interest to academics, government legislators and regulators alike. If we cast our sights back almost one hundred years, Warming's (1911) seminal article investigated the issue of resource rents from the exploitation of fisheries. Moving forward forty years Gordon (1954) and Scott (1955) set in place static and dynamic frameworks, respectively, for better understanding the motivations that underlay behavioural choices of fishers under conditions of both open access and sole ownership. Their papers highlighted the potential usefulness of integrating two fields of study: fisheries biology and economic optimization. Bio-economic modeling became the workhorse of the 1970s–1980s. Clark (1983) laid out the formal circumstances under which overexploitation, rent dissipation, and the potential for species extinction might arise while Clark and Munro (1975) pushed the boundaries even further by examining the linkage between fish stock dynamics and capital theory. On the management side, Moloney and Pearse (1979) proposed that fisheries managers adopt the use of individual transferable quotas (ITQs) as a way of discouraging the race-for-fish mentality that had developed with the introduction of limited entry, itself designed to deal with the excesses of open access. Squires's (1987) use of duality theory promoted a better understanding the micro-econometric foundations of fishing behaviour and spawned a large and expanding empirical literature that produced estimates of the value of rent dissipation in suboptimally managed fisheries (Dupont 1990) and laid the foundations for measuring capacity utilization and excess capacity (Dupont *et al*. 2002). More computing power was aligned with dynamic optimization models (Bjørndal 1988) and allowed researchers to examine behaviour of not just the representative fisher but also to incorporate both heterogeneity and spatial considerations into the analysis (Sanchirico and Wilen 1999; Smith 2000).

The six papers in this issue all further our understanding of the economics of the fishery and they reveal the breadth of scientific inquiry that we have come to expect from this literature. Increasingly, the study of the interrelationships among marine species, their habitats, and their human exploiters draws upon not just economic and biological models, but is also informed by literature from fields as diverse as the study of legal/regulatory systems and psychological models underlying risk-taking in uncertain environments. The

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papers in this issue range from conceptual models to case studies of governance and to the estimation of all of the components needed to optimize a bio-economic model. The fisheries examined come from such diverse countries as: Australia, New Zealand, the United States, and Canada. What these papers have in common is adoption of best past practices that are modified with current tools and techniques to push the study of fisheries economics into a new century. In so doing, these papers aim to provide results that are either more general and/or results that further delineate the circumstances under which various outcomes are expected to occur.

The first paper by Grafton, Kompas, Chu, and Che provides a brief review of optimization models used in the past to determine the target level of overall fishery catch in a single species fishery. A number of fisheries have recently considered using the dynamic counterpart of maximum economic yield for determining the annual target level of overall fisheries harvest but have held back over concerns of extinction predicted by models where the discount rate is higher than the intrinsic growth rate of the fishery. The goal of their paper is to examine the circumstances under which the dynamic counterpart of maximum economic yield is predicted to be larger than the maximum sustainable yield, even with slow growing species and high discount rates. They find that there is a role for other factors such as catchability coefficients, cost-price parameters, and harvest function parameters leading to stock effects that may mitigate extinction. These economic factors are the signals to which individual fishers respond and which can be forecast, leading to better predictions of future target levels. This leads to an optimistic prediction of a possible win-win situation in cases where the current biomass is less than the dynamic maximum economic yield – as is case for many of the world's commercially fished species. Management could impose higher biomass targets leading to not only increased economic profits through the stock effect but also ecological gains arising from a larger stock of fish.

In the second paper by Kompas, Che, Dichmont, Punt, Gooday, Bishop, and Deng, we see an empirical example of the adoption of a dynamic maximum economic yield target for the North Australian prawn fishery. The paper illustrates how fisheries economists have taken conceptual bio-economic models and estimated the key parameters using a variety of empirical techniques. The end result is a dynamic optimization model whose results can provide sound scientific advice to fisheries managers in need of data that they can use for real world fisheries. The results from the paper – that there is a substantial stock effect – suggest that stock rebuilding can lead to the win-win situation of higher profitability and ecological improvements arising from less stress on the ecosystem from overfishing. This work also points to the importance of having good forecasts that can be used for simulation and management purposes. While there is a large body of very detailed data available that allows fisheries economists to incorporate heterogeneity in fish stocks through recruitment and mortality, the paper shows the need to investigate further heterogeneity with respect to the fishers themselves. This requires a

greater emphasis on better and more frequent data collection than is currently employed in most countries.

While Townsend's paper continues a specific focus on fisheries in the South Pacific, it contains valuable lessons for fisheries managers everywhere, particularly those looking to introduce or expand the use of ITQs. He reviews the benefits and costs associated with ITQs – in particular, they are widely viewed in the literature as the only way forward if fisheries managers wish to harness the motivations of fishers and align them with the public interest. Once ITQs are in place, regulators often find themselves looking to cut management costs further. They look naturally to the devolution of governance to the fishers themselves. Townsend's look at the New Zealand Quota Management System (QMS) examines how different institutions affect the transactions costs of decision-making over resource use. This case study warns of the pitfalls – including those caused by legislative hurdles – that may be faced when designing institutions to manage fisheries and illustrates the means by which government can reduce transactions costs to the players. This paper and the first one also remind us of the important role that Tony Scott (1955, 2008) has played in fisheries economics over more than 50 years. His insistence that, in order to manage, we need to have a better understand of the context in which fishers operate – specifically, that of property rights – shows a remarkable prescience.

The fourth paper, by Costello and Kaffine, takes us further down the path that investigates the role of property rights in fisheries and, with a study based upon California kelp, moves the analysis up to the Northern Hemisphere. Using a numerical bio-economic model, the authors incorporate a spatial dimension in their investigation of the impact of Marine Protected Areas (MPAs) where privatization has already taken place through the adoption of a Territorial User Rights Fishery (TURF). While TURFs provide incentives for private interests to coincide with public interests, externalities may still arise in the form of spillovers because of the heterogeneity of productivity in the TURFs. The paper shows the importance of adopting a game theoretic framework for better understanding fisher–owner motivations interactions and finds that MPAs may be an effective complement to spatial property rights–based fisheries and lead to both higher fishery profits and greater abundance, if there is incomplete coordination among TURF owners. This finding is similar to that of the first two papers; namely, the optimistic view that certain regulatory changes may result in a win-win situation for fisheries. However, like the third paper, this paper implies that transactions costs of coordination may be too high and, therefore, there may still be a role for strategic government intervention that can allow for further gains.

The last two papers in the issue turn the spotlight onto different ways of measuring the productivity and capacity utilization of the individual fishing unit with the goal being to use the results for the purposes of evaluating alternative management schemes. As Morrison Paul, Felthoven, and Torres point

out, there is increasing reliance by many countries upon the measurement of economic performance as a means of determining regulatory success. They begin the discussion by providing an overview of techniques used in estimating the production structure/performance of fish harvesting. Parametric models (e.g., estimation of average production/distance and/or transformation functions and stochastic frontier functions), as well as nonparametric programming approaches (e.g., Data Envelopment Analysis (DEA)), are discussed. The key role played by duality theory in the development of empirical work in this area is emphasized. In addition, the authors stress the need for the analyst to be cognizant of whether the underlying behavioural assumptions of the empirical models are consistent with the actual incentives faced by the decision-makers under different regulatory schemes. They end their article with a call for better data at the level of the micro fishing unit, as well as the need for researchers to present not only point estimates of the key performance measures, but also confidence intervals. They provide managers with much needed information about the precision of estimates.

Squires, Jeon, Kirkley, and Grafton present a much needed empirical analysis of the extent to which a change in management schemes can alter fishing performance. Using an unique data set from three different regimes employed to manage the British Columbia (Canada) halibut fishery (pre-ITQ, introduction of ITQ, and post-ITQ), they illustrate the means by which ITQ may lead to improvements in performance at the level of the individual fishing unit. To account for potential inefficiencies and heterogeneity of vessels, they first employ a DEA approach. The resultant measures of capacity output and capacity utilization per vessel are then regressed in a second-stage analysis to examine the effects of the three different management regimes. Their empirical results confirm theoretical predictions that ITQs are more likely than limited-entry regimes to reduce excess capacity and increase capacity utilization. However, a key finding is the role of full transferability of property rights as a vehicle through which increasing capacity utilization may be achieved. This echoes the lessons from Townsend's case study of the New Zealand QMS: transactions costs need to be considered when governments design fisheries management schemes. At the end of the day, the most important role for a government in pursuit of win-win outcomes may be the mechanisms by which it can lower transactions costs and, in so doing, allow private interests in the fishery to become aligned with public interests.

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DIANE P. DUPONT
Guest Editor,
Special Issue on Fisheries Economics

ADDENDUM

The editors at AJARE, the guest editor and all the contributors of this special issue mourn the passing of Cathy Morrison-Paul. A great lady, a top-notch economist and someone with a big heart. She will be missed.