

Fisheries Analysis: A Marine Dimension for Regional Science

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On the first day of January 1977, Canada, by unilateral declaration, assumed jurisdiction over fish stocks in a zone extending 200 nautical miles from its coast. Most other countries with significant marine exposure took similar action that year or soon thereafter. As a result, in 1977 the 200-mile fishing limit became an accepted norm of conventional international law (Copes 1981).

The imposition of 200-mile limits has brought most of the world's fish stocks under the authority of individual states, which are now confronted with the need to extend their terrestrial administration and resource management to vast new marine territories. This development invites efforts to extend land-based regional science analysis to national marine domains. Here the fishery constitutes the immediately most important activity to be researched and managed. A distinct subdiscipline of fisheries economics has developed in recent decades, but so far it has not devoted much attention to location-specific phenomena. A blending of analytical paradigms used in regional and fisheries economics research suggests interesting possibilities in cross-over applications. This research note proposes some research areas to be explored in this context and provides sample references to relevant work already undertaken.

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The Regional-Fisheries Interface

It is the region-specific character of the fishing industry that provides the readily apparent link between regional and fisheries research concerns. Fishing communities and processing facilities are naturally located to ensure good access to available fish stocks. Resource adjacency is particularly important for the small-boat inshore fisheries, which provide the bulk of employment in the fishing industry. The problems and concerns of the fishery often put their stamp on the regional economy in which they are present. Conversely, the fortunes of the fishing industry are much influenced by the infrastructure, service base, and local market access that other economic activities characteristic of the region may provide.

Because the fishery tends to be a "problem" industry, it is an important object of regional economic assistance. Certainly in the case of Atlantic Canada, it is an industry that is characterized by income problems, that is highly politicized, and that has an influence on the affairs of society and state far in excess of what its contribution to the economy would suggest. One only has to read Canadian newspapers with their accounts of recurring crises in the country's Atlantic coast fisheries, most recently in relation to the depletion of the so-called northern cod stock (Harris 1990). One can also note the cries of protest, together with the nervous and placatory reactions of federal and provincial governments, accompanied inevitably by another round of emergency subsidies. In many other countries as well, the fishery is a problem industry—to a lesser or greater extent. The Organization for Economic Cooperation and Development (OECD) has documented a common pattern of heavy subsidies to support the fisheries of industrialized nations (OECD 1970) and has drawn attention to the perilous condition of the fishing industry in developing countries (OECD 1976).

The history of the fishing industry is strongly interwoven with regional development issues. A striking illustration relevant to this country is given by Innis's classic study of the cod fisheries (Innis 1940). In contemporary studies pertaining to regional development in Canada's coastal provinces, the fisheries sector invariably receives frequent mention (for example, Savoie 1986). Conversely, studies of particular fisheries commonly emphasize the regional development context (see Gardner 1984). In no other Canadian province has the fishing industry had so great an impact on regional economic policy as in Newfoundland. Indeed, federal and provincial economic development efforts in the 1960s and early 1970s in that province were framed largely around an attempt at fisheries redevelopment in conjunction with resettlement of fishing communities (Copes 1972; Copes and Steed 1975).

The importance of the link between the chronic economic problems of Atlantic Canada and the chronic problems of its fishing industry is unmistakable. Numerous government (and other) studies attest to this. An excellent example is the report of the Kirby Task Force on Atlantic Fisheries (Kirby 1982). The often forceful recommendations of such studies notwithstanding, severe problems in Canada's Atlantic fisheries have remained. Elsewhere I have pointed to the failure of regional policy for Atlantic Canada to address seriously the question of fisheries rationalization as a key factor (see, for example, Copes 1983). The fishery is regularly used—or abused—as the employer of last resort in the face of government failure to cope with regional unemployment (Copes 1990). Excessive subsidy-induced labour and capital inputs into the fishery have depressed average incomes in the industry, diminished its net contribution to the national economy, and contributed to fishing pressures that are stressing fish stocks.

Canada's Pacific coast is not devoid of regionally based fisheries problems, of which the Pearse Report bears ample evidence (Pearse 1982). Higher opportunity incomes on that coast, however, generally have prevented most fishing incomes from falling to the lower levels characteristic of much of the inshore fishery on the east coast. Salmon interception problems with the United States, the impact of the General Agreement on Tariffs and Trade (GATT) and "free trade" on the fish processing industry, and the controversy over native Indian access rights to fish stocks have kept fisheries problems in front of the public there as well. That these problems are considered important from a regional economic perspective is borne out by the policy objectives of the Pearse Report, which has as one of its goals economic development and growth in British Columbia's fishing communities (Pearse 1982:5).

Blending Analytical Paradigms

If the hallmark of regional analysis is one of spatial relations, that of fisheries analysis has to do with what has been called the "common property" characteristic of the fishery resource. Actually, I prefer the term *common use* resource, as the innate problems of the fishery occur in situations representing a wide variety of property relationships. From a general analytical perspective, the most interesting feature of fisheries economics is the presence of massive externalities in the exploitation of fishery resources—so much so that in fisheries economic theory, externalities are the rule and their absence the exception. In other words, fisheries economic theory is a theory of market failure, and much of the research in fisheries economics is aimed at

determining resource management measures that will remove, offset, or circumvent the effect of external diseconomies.

The fishery seems to offer the most prominent example of an industry dominated by externalities. The now extensively developed analytics of fisheries economics undoubtedly has much to offer to research on problems related to other instances of common resource use. Given that resource problems are an important ingredient in regional research, it appears likely that the analytical tools of fisheries economics will have potential uses of relevance to regional science analysis. Some efforts in this direction are already being made. In transportation research, for example, Brander et al. (1989) have applied to deregulated airline markets an analysis based on an extension of the fisheries open access commons model by Copes (1984).

On the interface of regional and fisheries research, there probably are many more opportunities to apply the analytical tools of regional science to fisheries questions than is conversely the case. There are, naturally, many occasions for the use of standard regional science methodology in research on fisheries-based communities. This journal, for example, featured an article in which income and employment multipliers were explored for a fisheries-based coastal region in British Columbia (Davis 1980).

Location theory—that special analytical contribution of regional science—could have some very interesting applications in fisheries analysis. Because of the migratory movements of fish, harvesting operations lend themselves to the application of interception strategies. In part this involves individual fishers “leapfrogging” one another to be first in line along a path of migrating fish. This will add to fishing cost per unit of catch by increasing average distance travelled and reducing average vessel fishing time. In a different context, the deployment of mobile gear may be used to intercept fish otherwise destined for capture by stationary gear, though the latter may represent a much more efficient harvesting device.

Building on Hotelling's seminal (1929) paper in which competitors jockey for position in market space, location theory has devised theoretical constructs that should be useful in modelling fisheries interception phenomena. Interestingly, potential action paths in two-dimensional ocean space are for the most part unconstrained, unlike the case in a terrestrial plane, where the preexisting location of fixed route facilities coerces and confines choice of location. One may foresee further challenges to modelling ingenuity in tracing three-dimensional fishing strategies, in which hooks and nets are deployed at varying water depths to target fish concentrations of varying composition and density.

Several models in the regional science literature no doubt are suitable for direct application to fisheries situations—for example, in the modelling of (human and non-human) population dispersal (Puu 1989). Analysis in the special area of recreational fisheries has relied on location-related modelling for many years through wide application of the travel cost method of establishing recreational values (Clawson 1959). Further elaborations of this model have included a recently published regional recreation demand model for spatially competing water uses (Ward 1989).

A number of initiatives in the modelling of spatial relations in the fishery have emerged directly in the fisheries literature. For example, in Clark (1976:325-333) a diffusion model is developed for an inshore-offshore fishery interaction, in which the spatial distribution and movement of fish are taken into account. Choice of fishing location has been modelled by Eales and Wilen (1986) and by Hilborn and Walters (1987). A comprehensive spatial allocation model for the New England fisheries has been developed by Emerson and Anderson (1989).

Attracted by the unique problems of common use resource exploitation, economists were first among social scientists to develop a distinct interest in fisheries analysis. More recently, evidence of chronic problems in the socio-economic conditions of fishing communities has attracted many sociologists and anthropologists to the fisheries field. In some instances, their research endeavours have emphasized distinct regional impacts (for example, Jentoft and Mikalsen 1987; Poetschke 1984; Warriner and Guppy 1984) or space-related analysis (for example, Andersen and Stiles 1973; Martin 1979).

A New Marine Dimension for Regional Science

Regional science so far has been largely land-bound, analyzing relations in terrestrial space. This was more understandable in the days when all of the oceans beyond narrow territorial limits were outside the jurisdiction of national law and not subject to the same regime as that pertaining to land-based economic activity. But, as noted earlier, the status of the oceans has changed drastically since 1977. Whereas previously most marine fishing activity had been conducted on the uncontrolled and uncontrollable high seas, probably more than 90 percent of the world's marine fish catch is now taken within nationally administered zones. Vast fishing areas have been enclosed by coastal states and are now subject—actually or potentially—to their territorially based systems of regulation and management.

There is a challenge for regional scientists now to apply their analysis to patterns of fishing activity in the extended zones of national marine jurisdiction, for the establishment of national authority has allowed the introduction of regimes of regulation and management that are area-patterned, both within and among national zones. No doubt, application of the analytical techniques of regional science to fishing operations will require modification and adaptation of existing theory, for even with the enclosure of national zones, the fisheries resource has remained largely fugitive in nature. Yet with the spatial discipline that may now be exerted over the fishing operations themselves, there is an enhanced opportunity for control of many of the negative externalities from which fisheries have suffered.

Regional science should have many insights to offer in determining the optimal gear composition of fleets, as well as the optimal spatial and temporal pattern of harvesting operations, processing facilities, and infrastructural developments in relation to the distribution of fish stocks. The application of regional science analysis to fishing operations offers the opportunity for regional science to develop a new marine dimension, helping to make the discipline more truly global in its application.

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