

Limited Entry Licensing: A Retrospective Assessment

JAMES E. WILEN

Department of Agricultural Economics
University of California, Davis

Abstract *This article takes a retrospective look at experience with limited entry licensing, with particular attention to events of the past decade since the Powell River Conference of 1978. The perspective is set by reviewing some of the issues raised early on in these programs' histories. This is followed with a synthesis of some of the important trends and characteristics of limited entry license programs. Finally, some speculative thought is offered regarding future directions for limited entry license programs and their roles in fisheries management.*

Introduction

A decade ago fisheries management was at an important crossroad. Throughout the world, many of the most important fisheries had been drastically overharvested by the large fleets of domestic and foreign vessels that fished the waters adjacent to coastal nations. Fishing incomes were generally low and fisheries managers were frustrated by their inability to control effort and harvests. Beginning in 1976, the institutional structure for marine resources management was suddenly and radically altered as coastal nations claimed jurisdiction out to 200 miles. This single institutional reform opened up a whole new range of management options and set in motion forces for major change in fisheries management.

It was in this setting that a small conference was convened in 1978, primarily to assess some new programs and to speculate over fisheries management options into the next decade. The Powell River Conference had an agenda focused on what were then some recent and revolutionary experiments in fisheries management, namely, limited entry licensing and buyback programs (see Proceedings in the *Journal of Fisheries Research Board of Canada* 1979). There was a sense of seriousness lent to the debates, as if the outcomes of the discussions might actually determine which of several paths fisheries management might take over the immediate future. By the close of the conference, however, there was little general agreement over several critical issues, and participants looked anxiously to the next decade to see how these new programs would unfold.

Limited Entry Licensing—Early Assessments

At the time that the Powell River Conference was convened in 1978, there were only a handful of limited entry experiments to assess, including: Rock Lobster and Prawn Fisheries in Australia (initiated 1968); salmon programs in British Columbia (initiated 1968), in Alaska (initiated in 1974), and in Washington (initiated 1974); and the roe

herring program in British Columbia (initiated in 1974). One of the first important points that surfaced during the discussion of events leading up to limited entry programs was that the objectives of various programs were generally different. Whereas in all cases the principal impetus for change was impending crisis, what constituted "crisis" was different to different people. In particular, whereas economists saw "too many boats chasing too few fish" as an *economic* problem, biologists saw exactly the same phenomenon as a *biological* threat to species protection. In nearly all of these early cases, fisheries managers rather than economists were instrumental in pushing for limited entry, not to arrest rent dissipation, but to maintain control over harvest in the face of increasing power. This was most surely the case in Alaska and Washington, and in the Australian fisheries.¹

Significantly, it was only in the British Columbia salmon fishery that the prime motive was initially one of addressing the *economic* consequences of overcapacity. The events that led up to the implementation of licensing in this case are instructive. As early as the 1940s, the province's major fisheries union urged license limitation as a method of ensuring "a decent livelihood" for British Columbian fishermen and shoreworkers (Morehouse 1972). This kernel of political support was cultivated by provincial politicians at various times, and in 1956 a commission was drawn up in which a limited entry plan was devised and circulated. This Sinclair Report clearly had economic rationalization as a mandate,² but diverse opposition to the specifics of the plan stalemated adoption until 1968. In that year two events crystallized to force adoption. The first was the Liberal party victory in national parliamentary elections and the second was the election of Jack Davis to the position of Minister of Fisheries. Davis was a Westerner thoroughly familiar with the salmon fishery and also an economist well versed in the concepts associated with economic rationalization. These sympathies, together with the rather special ability to issue Orders in Council, allowed the program to be initiated quickly and despite the objections of the industry.

Given the uniqueness of the British Columbian program, it should not be surprising that there was considerable excitement and anticipation over what was unfolding by 1978. By that date there were a few other programs in existence, but it was British Columbia's that was most clearly an economic experiment. The picture that emerged in this case and rapidly in all of the others was quite similar. The most obvious lesson was that simple limited entry licensing alone was not very effective in freezing either financial capital or physical fishing capacity in these fisheries. In one analysis of British Columbia's salmon fleet value, it was found that although growth in real fleet value (exclusive of license values) was slowed, it was still significant after adoption of limited entry (Pearse and Wilen 1979).

With respect to fishing capacity, the British Columbia experience also immediately revealed a rapid erosion of simple effort controls as fishermen found ways to circumvent regulations by expanding the "free" dimensions of effort. In the British Columbia experience, the result was a series of regulation changes as managers "chased" fishing effort through several phases, including:

1. Initial limits in *numbers* of vessels; changed in 1970 (after 76 vessels of 186 tons were replaced with new vessels of 596 tons capacity).
2. Limits of *tonnage* of vessels; allowed ton-for-ton replacement and prohibited splitting larger licenses into more than one smaller license.
3. Limits on *length* of vessels; applicable to smaller vessels (less than 15 tons) for which there were no registered tonnages. The effectiveness of length limits was

skirted by new hull designs. After 1977 replacement vessels with "pyramided" licenses (i.e., one vessel replacing two or more) could not be longer than 50 feet in length.

4. Limits on *gear* types; prohibited converting gillnet or troll vessels into seines from 1977 forward.
5. Limits on *combining licenses*, specifically ending the practice of pyramiding licenses (combining two or more small vessels into one large one).

Perhaps the most compelling question to arise out of this first evidence on limited entry licensing was: can limited entry programs *ever* be successful in freezing capacity expansion and generating sustainable rents? This question generated the most heated and interesting debates at Powell River for obvious reasons. If, as some argued, such programs could effectively bind up capacity expansion, then it would be a relatively easy policy to implement across the many fisheries that had suddenly come under single nation jurisdiction in 1976. On the other hand, if an endless process of "effort chasing" were in store, then even more radical institutional restructuring would be necessary in order to achieve efficiency in fisheries.³

The debate over this issue separated into discussions over the correct *paradigm* and over the correct interpretation of the *empirical evidence*, scant as it was. It quickly became apparent that analysis was hampered by the absence of any theories of the regulated fishery with which to predict what ought to unfold in a limited entry fishery. Part of the problem was that H. S. Gordon's legacy was not rich enough to address some of the issues emerging out of the British Columbian and other programs (Gordon 1954). Gordon was among the first economists to analyze fisheries as common property resources. His important prediction was that effort would be drawn into common property fisheries until the value of *average* (rather than marginal) product of effort was equal to marginal opportunity cost. At this point, potential rents would be completely wasted (dissipated) through the use of excessive inputs. Unfortunately, whereas Gordon's paradigm gave a straightforward prediction when there was only one input, it was not clear what the multi-input analogue should be. This was clearly important because limited entry programs could only hold one or a few inputs fixed. Without a theory of the regulated fishery (in a multiple input setting), economists had little on which to base predictions regarding the extent and nature of regulated rent dissipation (Wilén 1979).

The bulk of the discussion was devoted to interpreting what the evidence from the few (relatively new) limited entry programs was revealing. In each of the programs, licenses had apparently taken on some values and this was interpreted by some as evidence of rent generation. This interpretation was not accepted by all, however. First of all, there were important measurement problems associated with the fact that several of the programs disallowed trading of licenses, whereas others disallowed trade in licenses exclusive of the vessels they were attached to. Second, where data on license values could be pieced together, the markets appeared to exhibit somewhat anomalous behavior, perhaps attributable to very immature markets. For example, licenses in all programs immediately assumed values even though some fisheries were extremely overcapitalized and near bankruptcy. In Washington State, licenses took on values even when entry was not fully closed. In Alaska, license values increased steadily without any further policy measures, whereas in British Columbia, salmon seine license values appeared also to reflect herring rents (since many vessels fished for both). To some analysts, it was unclear how much of the value of licenses was attributable to real as opposed to expected rents in very youthful stages of various markets' development.

A more important focus of debate was over whether the erosion of effort control was an inevitable consequence of limited entry and whether, in the longer run, limited entry would be able to *sustain* rents. On one side of the argument were those who held to the view that fishing technology is extremely flexible and that the (internal and external) incentives for continued dissipation could not be contained. On the other side were those who viewed fishing technology as essentially fixed proportions (i.e., a "platform on which to hang gear"). If this were true, once a few key dimensions (length, width, tonnage, etc.) were constrained, there would be few additional ways to waste rents.

Lastly, there were differing interpretations on the kinds of investments that were taking place in the handful of limited entry fisheries. Some of these were felt to be "comfort and safety" investments that signalled a more proprietary position ensured by licensing programs. As a general summary view, it was felt by most discussants that many of these issues were empirical questions, the answers to which would be revealed with further experience. It was also noted that limited entry programs had not really been "pushed" to test their rent generating potential; nearly all simply froze entry and only British Columbia attempted a (quickly aborted) buyback program. Powell River Conference participants thus looked anxiously at the future to reveal just how effective limited entry policies might become and what their limitations might be.

License Limitation—A Retrospective Assessment

What new evidence has been provided by the accumulation of 10 more years of experience with limited entry? Although it is hazardous to generalize, several observations seem pertinent to the issues raised at Powell River. To set the stage it is important to note that fisheries have generally undergone at least some recovery from conditions of the early 1970s. This has been largely a result of increased ability to control harvests off coastal waters formerly targeted, at least in part, by foreign vessels. In addition, real fish prices have risen as tastes have shifted toward health-conscious diets and as trade patterns have realigned due to the extension of jurisdiction. Thus, by and large, there have been more fish available and stronger markets over the past decade.

Under these conditions of general profitability, it is likely that substantial rents have been generated in most limited entry fisheries. Partial evidence of this is in the prices attained for limited entry licenses. British Columbian salmon seine licenses have fluctuated over values as low as \$500 per registered ton of vessel to values as high as \$8,000 per ton over this past decade. British Columbian roe herring licenses currently sell for over \$500,000 for seine licenses and \$80,000 for gillnet licenses. Norwegian purse seine licenses are quoted upwards of \$1,000,000 for a 6,000 hectoliter vessel (Hannesson 1986). In Alaska, prices for permits vary by gear and by region, but representative values include: \$175,000 for a drift gillnet in the Aleutian Peninsula; \$250,000 for a purse seine license for the same area; \$325,000 for a Bristol Bay gillnet, etc. (Schelle and Muse 1986). Whereas it may be questioned whether the markets for these limited entry permits are "perfect," in the sense of correctly anticipating all future events, there is little doubt that rents have been generated in most of these fisheries and persistently reflected in license values. This has occurred even in programs with very limited controls on capital (e.g., in Alaska the permits are on individuals) and at input levels close to initial open access conditions.

On the other hand, it is also clear that the fundamental incentives to employ extra measures to compete are latent, strong, quickly triggered, and basically unaffected by

Table 1
Mobility of Roe Herring Gillnet Fleet, 1977-1979

Area	1977	1978	1979
Queen Charlotte Is.			
No. vessels	45	80	340
Catch (tons)	1,650	3,051	2,571
North Coast			
No. vessels	150	200	300
Catch (tons)	1,632	2,800	1,363
Central Coast			
No. vessels	170	550	No
Catch (tons)	7,363	10,083	openings
Strait of Georgia			
No. vessels	325	320	450
Catch (tons)	8,050	7,877	5,500
West Coast Vancouver Is.			
No. vessels	450	235	387
Catch (tons)	13,520	14,650	9,981

Source: Macgillivray (1986).

limited entry. Fishermen are quick to adopt any measures possible to gain a small, short-lived edge, even when it is understood that when everyone adopts in the face of fixed total harvests, costs simply rise. The hypothesis that much of the early vessel improvements were for "comfort and safety" appears to be incorrect. When vessels are made more seaworthy, it is less for safety and more to beat fellow fishermen to "outside" fisheries and/or to enable fishing under adverse weather conditions. Similarly, practices such as installing multiple units of electronic gear are not for redundancy to increase safety but for rapid maneuvering under navigation during the frenzy of an opening.⁴

It is also clear that economists' early focus on over *capitalization* in the fisheries economics literature drew attention away from other means of dissipating rents. Fishermen engage in a whole spectrum of decisions in a competitive environment with each other, and just as there is no incentive to configure their vessels optimally, neither is there reason to believe that these other decisions are efficient. One particularly important "sink" for rent dissipation is in excess mobility and movement. During the buildup of roe herring profits in the late 1970s, the fishery was transformed from one where the fleet was spread over relatively longer openings in several areas to one where a significant fraction of the fleet converged on each opening. As Table 1 shows, the number of vessels participating in each area's fishery grew in a staggering fashion even though total allowable catch dropped in most cases. The reason for this frenzied movement was that prices and profits rose to such an extent⁵ that near Klondike conditions occurred. At the height of this management nightmare, gillnetters were being helicoptered from one opening to another and capacity was so large on some grounds that openings were reduced to 15 minutes.

Other fisheries reveal similar examples of rent dissipation by congestion and interference on the grounds in day-to-day activities. For example, in the pink shrimp fishery off the Pacific Coast, fishermen "search" for fishable concentrations over many known

shrimp beds up and down the coast (Eales and Wilen 1986). When concentrations are heavy, fishermen quickly converge and repeatedly drag over the beds in a frenzied manner. These activities cause the shrimp to disperse, thus driving catching costs up until rents are dissipated. The important point in these two examples is that short-run fishing, moving, and searching activities can be just as important as long-run capital configuration decisions in dissipating potential rents. Economists have paid little attention to these dimensions of the problem.

These observations shed some light on the issue of the correct paradigm for regulated fisheries. Most significant fisheries today fall under single nation or bilateral treaty jurisdiction and are, in principle, biologically *controllable* via traditional methods, such as closed seasons, closed areas, and gear restrictions. If we accept the assumption that harvests can be held to some level by fisheries managers, then fisheries are, from the perspective of each individual fisherman, essentially a game involving division of a fixed pie. Fishermen compete with each other over individual shares of the pie and regulators "compete" against the industry to ensure that the fishery is not overharvested (Wilen 1985, 1986). Under these circumstances, cost minimization over unregulated inputs is an inappropriate hypothesis with which to predict either how much rent will be generated or what fishing technology will look like over time.

The lengthy history we have of regulated fisheries shows these two behavioral processes at work in all fisheries. On the one side, fishermen are continually engaged in the process of gaining an *edge* on their counterparts, either with long-term vessel configuration changes and/or with short-term actions (ranging a spectrum including mobility and movement, information gathering, sharing, bluffing, etc.). On the other side, regulators are continually stifling any increases in aggregate fishing capacity with changes in season length, area closures, and gear restrictions. It is important to note that this process is dynamic, interactive, and evolutionary, and is thus difficult to predict. To predict the long term with this paradigm, we need to hypothesize something about regulators' behavior, and the best that can be said is that they seem to choose policies that minimize deviations from some targeted aggregate harvest levels. A look at the specific mechanisms in several fisheries reveals that managers generally find it easiest to shorten seasons, and hence season length restrictions dominate policy instruments chosen. Mitigating against this, however, is the fact that shorter seasons require much more monitoring and control, and hence become increasingly risky. Thus periodically regulators will invoke other instruments (generally tighter terminal gear restrictions) to reduce fishing effectiveness and (perhaps) enable the relaxing of season length restrictions.

What does this general paradigm tell us about what we should expect to happen in limited entry fisheries over time? The last decade's experience reveals a wealth of case study materials, which, at first glance, seems hard to synthesize. On the one hand, it is clear that fisheries have been successfully *controlled* where managers have been willing to employ the instruments of their disposal with enough vigor to combat increasing effort. On the other hand, these traditional means of regulating fisheries have done nothing to alter the *incentives* among fishermen to compete for shares of the fixed resource.

In fisheries where these incentives have been allowed to operate unbridled, the universal results has been tighter and tighter biological controls and rising costs. Perhaps the most instructive example of this tendency is in the Pacific Halibut fishery, a high-valued, open access fishery that is currently on a razor's edge of control. What was once prosecuted over a 9 month period is now completed in hours in a mass frenzy of activity. Over the past several years the length of openings has hovered around 5 days, with an

enormous waste of potential rents. At one of this year's 24-hour openings in Alaska, there were reports that 50% of the catch was delivered after never being on ice, 30% was not even gutted, etc. The important lesson to arise out of this case (and others) is that this *process* (if not the degree of current waste) is an *inevitable* result of the incentives and interactions inherent in regulated fisheries. Conditions in the Pacific halibut fishery are not anomalous but, in some sense, characteristic of the "Grand Equilibrium" toward which all traditionally regulated fisheries open access will gravitate as real fish prices rise. That others have not reached such extreme conditions yet is due only to their relatively lower rents at this stage of their history.

To return to the critical issue raised 10 years ago, can limited entry programs bind up these opportunities to compete so that rents can emerge and be sustained? As the Powl River debates correctly predicted, an important determinant of the potential long-run success of limited entry programs is the substitutability of inputs in fishing technology. If technology is close to fixed proportions, it is reasonable to expect that constraining one (or a few) critical dimensions will indeed bind up choices. On the other hand, if technology is very flexible, then constraints placed on one dimension of effort will be circumvented by changes in others. In hindsight it is probably safe to say that the fishing *process* allows more substitution than was anticipated. This is the case for several reasons including: (1) the boatbuilding industry has responded to constrained inputs by innovating around them (induced innovation), and (2) there are numerous short- and intermediate-term decisions that are also subject to the same incentives (e.g., mobility, searching). Mitigating against these, however, is the fixity induced by the terminal *gear* restrictions that are also in place in most modern fisheries. This important connection was also overlooked 10 years ago; namely, that substitution possibilities on the *vessel* are linked to and limited by terminal *gear* characteristics. When regulations bind up net depth, length, and other gear characteristics, there are in many cases few further competitive options to pursue.

In some sense, then, we have come full circle in this review. In 1976 many of the world's important fisheries were in poor condition financially and biologically. The more valuable fisheries that were controllable were severely restricted with short seasons and often tight constraints on terminal gear. In this setting, more often than not the principal support for limited entry came from fisheries managers who saw it as a means of eliminating a significant avenue (entry) for fishing capacity increases. In the fisheries where limited entry was adopted, these low-level equilibrium open access conditions set the initial stage, which was then followed (after limiting entry) by relatively prosperous times. During the past 10 years we have thus had good test conditions for limited entry policies.

Where limited entry programs have *not* been introduced, the results have been more of the same process witnessed prior to 1976; namely, strong competition between fishermen and "racing" to catch fish, redundant and inefficient investment, and increasingly severe biological controls (e.g. the Halibut fishery). Where limited entry *has* been introduced, the results have been some rents emerging in license values; substantial in some fisheries. There has also been "slippage" in all fisheries as fishermen have found means to expand capacity and as regulators have had to "chase" effort.

The degree to which rents have been generated and have been sustained appears to depend in a complicated way on initial and later economic conditions, fishing technology, and cumulative regulatory decisions. In fisheries where the terminal gear has been mandated to remain "primitive" (e.g., lobster and crab traps, salmon troll gear), the principal "sinks" for rents have been somewhat limited, mainly in increased mobility and seaworthiness and a push toward outside or previously inaccessible stocks. With seine and gillnet

gear, the extent of vessel reconfigurations has been dictated by the stringency of the terminal gear regulations. Other investments (in electronics, etc.) have taken place as well as increases in mobility. To an important degree, then, some of the rents we see appearing in license values may be mostly a function of the type of terminal gear restrictions in place rather than input substitutability of vessel inputs per se. Thus the biologically determined regulations in place at the beginning of limited entry programs and the subsequent sequence of follow-up changes may be the real determinants of patterns of rent generation across regulated fisheries.

The irony in all of this is that rent creation and maintenance in today's limited entry fisheries is still very unsystematic. It is not a result of cost saving and efficiency creating actions on the part of fishermen but rather (still) a by-product of the struggle to increase shares by fishermen and the desire to stifle potential effort by regulators. It is still the case that the focus of economists' concerns (overcapitalization or excess financial capital) is decoupled from the focus of fisheries managers' concerns (excess physical fishing capacity). Finally, the regulatory structure still reacts to the workings of perverse incentives, and these reactions determine rents as a side effect as opposed to using incentives to create rents as a primary objective.

Limited Entry—The Next Generation of Refinement

If a central lesson emerges out of the past decade or two of limited entry experience, it is that such programs have failed to tackle the basic incentives problem, more or less as economists predicted. Conventional limited entry programs, although they may generate rents indirectly, do nothing to encourage efficiency and cost saving. Moreover, such programs do not, in themselves, eliminate excess inputs. Instead, once initiated, such programs take on a (somewhat unpredictable) life of their own; namely, a pattern of action and reaction by fishermen and regulators. The only political hope for buyback or other effort elimination programs under these scenarios is for the limited entry program to box itself into a corner as severe as what generated the program in the first place.

The primary way to break this pattern and help fishermen out of this race, or "investment treadmill," is to attack the cause rather than the symptoms of the problem with management programs that change incentives. Individual Transferable Quotas (ITQs) have been suggested as one way of doing this. ITQs are not the only way to restructure incentives, however. The other primary avenue is to reduce the numbers playing the competitive "game" to an extent that makes coordinated group action a preferable strategy from each individual's standpoint. This, in turn, may be possible in some fisheries by initiating a straightforward modification of limited entry licensing; namely, area licensing. Under this policy option, limiting numbers of participants via a traditional licensing program would be only a first step to eliminate entry pressure from outside the fishery. Once numbers are frozen, the fishery could be subdivided into smaller individual fisheries, each containing a fraction of the individual fleet and total quota. Moving to this second stage should in principle make everyone better off on average since average catch can be maintained and excess movement costs reduced.

The applicability and benefits to be gained from area licensing depend upon the fishery, but the potential is very high in fisheries such as herring and salmon where spawning occurs across widely dispersed areas. It is conceivable, in fact, to move these fisheries very close to "privatization," where small groups of fishermen effectively own rights to fish in certain spawning areas and very controlled fisheries take place only at river mouths (for returning salmon) or specific spawning beds (for returning herring). In salmon fisheries, in particular, this would reverse the process that has evolved out of the

race to catch fish, namely, the push toward "outside" fishing over mixed stocks, which makes tailoring escapement to individual runs nearly impossible.

The principal barrier to a limited entry/area licensing program is the uncertainty it engenders among fishermen. In the same sense that the freedom to costlessly enter an open access fishery is viewed as important to fishermen, so is the freedom to move from area to area viewed as important. The reason that fishermen need to move from area to area, however, is partly a result of the regulation structure that has evolved. In the current system in several fisheries, many fishermen move over many areas and fish in highly frenzied openings for short periods of time. As the British Columbian herring fishery revealed, as prices rise, this movement can become very frantic and may increase the variability and uncertainty associated with each fisherman's catch. An area licensing scheme would effectively slow this whole process down, by having each fisherman concentrate on fewer areas, under less frantic conditions with fewer competitors, and over longer periods in each area. Since the same amount (or even larger) total catch would be available, average catch per vessel would not be changed. The costs of fishing and management difficulties would be drastically reduced, however.

The main example of an important fishery where area licensing has been initiated is British Columbia's roe herring fishery. As has been documented amply elsewhere, this fishery has gone through a classic pattern of overcapitalization, limited entry, and gradual erosion of management control (Fraser 1980; Macgillivray 1986; Wilen 1981). In 1981 managers were faced with the dilemma of managing a high capacity fleet in the face of a decline in potential sustainable harvest. Conditions over the previous few seasons were bordering on management nightmares; in many cases frantic movement of vessels occurred between openings so that large fractions of the fleet were showing up at each staggered opening. In several instances this necessitated extremely short openings (one set or 15 minutes) and in others the fishery had to remain closed because of the TAC/capacity mismatch.

After consultations with industry groups prior to the 1981 season, herring managers adopted an area licensing scheme, splitting up the British Columbian fishery into three areas. Fishermen were allowed to fish in only one area, thereby reducing the overcapacity problem on each of the grounds by up to two-thirds. Since 1981 the area selection process has changed somewhat, but the basic procedure involves aggregate quotas being announced in each area prior to the season and fishermen jockeying around their first choice selections prior to a preannounced date. Fishermen may hold licenses to fish more than one area with a single vessel and, as Table 2 shows, there has been a move toward this.

By nearly all standards this program is very successful. Management pressure is eased due to the reduction in capacity in each area. In addition, a surprising number of fishermen view the system as an improvement. Response to a repeated questionnaire including "do you think that area licensing should continue?" revealed that by 1983, 86 percent of the gillnetters and 78 percent of the seiners answered yes.

The interesting conceptual feature of area licensing is that it nudges incentives in the right direction by changing the *numbers* playing the (rent dissipation) game. In the initial experiments with limited entry, it was hoped that over time fishery-wide buyback programs might be instituted in order to reduce excess inputs. The past decade has shown that to be difficult, particularly when there are large numbers of fishermen initially involved. The same ends can be achieved with area licensing, however, and perhaps much easier, for by reducing numbers in each area, it becomes easier to gain consensus in each area-specific group over further efficiency-enhancing policies. Ultimately, at

Table 2
Multiple License Use in the British Columbian Herring Fishery

	1982		1985	
	Seine	Gillnet	Seine	Gillnet
Total licenses	252	1,319	252	1,328
Vessels with 1 license	216	1,087	99	602
Vessels with 2 licenses	18	116	75	339
Vessels with 3 licenses	0	0	1	16
Total vessels participating	234	1,203	175	957

Source: Macgillivray (1986).

some point as numbers are reduced, it becomes obvious to each group that controlled and coordinated harvesting is superior to a frenzied race to individually maximize shares of the (area) quota. At that point the fishery will convert to essentially an optimally managed "privatized" fishery, with excess inputs retired and fishing operating on a pooled-decision profit maximizing basis. It is conceivable, in fact, that each group could share in the stock assessment and harvest target for "their" area since it would be in their interest to operate with the long term in mind.

Whereas much of this is speculative at present, there is scattered evidence that area licensing is a very viable alternative in some fisheries, perhaps preferable to other measures such as ITQs, in fact. The British Columbian roe herring case has been successful as have a few cases implemented in newly developed fisheries off Australia and New Zealand where initial numbers were relatively small. It is not clear, however, whether the critical threshold, which begins to induce cooperative behavior in an area group, is small (5-10) or moderately large (50-75). There is much anecdotal evidence even in traditional limited entry fisheries that fishermen will revert to cooperative behavior when numbers are small enough and the gains are clearly evident. In the British Columbian herring fishery, for example, seine fishermen have agreed to "pool" in several instances where the capacity exceeded the stock's ability to withstand even one whole-fleet opening. Similarly, in Alaska's roe herring fishery this year, a group of about 40 vessels decided to consolidate and prosecute a particularly difficult opening with a pool of 10 vessels. These examples demonstrate that when numbers are small enough, both the benefits from and the possibilities for group profit maximizing behavior become more evident to participants.

Area licensing schemes are thus variants of limited entry programs that deserve more consideration, perhaps as a natural extension of existing programs. As experience with standard limited entry programs has shown, it is virtually impossible to fight the basic incentives inherent in a regulated fishery where large numbers of participants compete with flexible technology for a share of a valuable pie. The last 10 years has demonstrated, in fact, that rents can be sustained mainly where the fishing technology is relatively primitive and/or where terminal gear restrictions bind up the substitution possibilities. The attractive feature of area licensing is that it alters the basic incentives guiding fishermen and thereby changes the decision-making process. By reducing the size of the group within which each fisherman competes, the prospects for more orderly

and coordinated behavior become greater. If numbers in each group could be reduced enough, in fact, a fishery could more or less automatically convert into several "privatized" fisheries in which costs and management problems are substantially reduced.

Notes

1. Other goals were important as well. In Alaska, there was some hope that limited entry would restrict entry by non-Alaskans. In Washington, limited entry was a reaction to the management crisis induced by the Boldt decision, which gave native Americans half of the targeted salmon catch. In the British Columbian roe herring fishery, there was concern that management difficulties might accelerate (as they had in salmon), and limited entry was intended to forestall this.

2. The Terms of Reference stated "(r)educed to its simplest form, the problem to be resolved was this: how can salmon and halibut fisheries as currently administered provide a decent standard of living for all those engaged in the industry?" (see Sinclair 1962, p. 306).

3. The answer to this question was of more than idle academic curiosity since several of its discussants had been involved with bruising struggles to get even simple changes made in fisheries policy in the 1950s and 1960s. To many of these discussants, fishermen were thought to be particularly intransigent and the prospects for promoting restructuring any more complicated than simple limited entry were looked on with considerable skepticism.

4. Many salmon seine vessels have two loran (radar navigation) units (at \$20,000 each) installed; one on the bridge and one in the wheelhouse. The reason given by fishermen for this expensive redundancy is that a few seconds missed during a frantic opening could result in a lost net set; hence having units close by in different parts of the boat is worth the investment. When all fishermen do this, of course, there is no gain; costs simply rise for everyone.

5. Roe herring prices increased from around \$500 per ton in 1974 to over \$3,500 per ton in 1979.

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