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LOCAL PERMIT OWNERSHIP IN ALASKA SALMON FISHERIES

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Abstract

Changes in ownership of limited entry permits by “local” residents of the region where a fishery occurs may have significant economic and social implications for fishery-dependent regions. This paper examines changes in local permit ownership in Alaska salmon fisheries, for which a long-term decline in rural local permit ownership is an important policy concern. Theoretically, permit market allocate permits over time to the individuals who are willing to pay the most for them. Any factors that differentially affect what local and non-local residents are willing to pay for permits may affect the equilibrium share of permits held by local residents. For remote rural fisheries in particular, these may include differences between local and non-local residents with respect to access to and costs of financing permits and boats, costs of travel to the fishery, opportunity costs of participation in the fishery, and many other factors. As a fishery increases in profitability, differences between local and non-local residents in access to financing matter more while differences in costs of travel and opportunity costs matter less in the relative ranking of what local and non-local residents are willing to pay for permits. This tends to increase the share of non-local residents among buyers willing to pay the market price for permits, reducing the equilibrium share of permits held by local residents. This leads to a conflict between two important policy goals: increasing fishery profitability and maintaining rural local permit ownership. Consistent with predictions of this theory, the local share of permit ownership in Alaska salmon fisheries is negatively related to permit prices (an indicator of fishery profitability).

Keywords:

Alaska salmon
Limited entry
Permits
Transfers
Local ownership
Local participation

1. Introduction

Changes in ownership of limited entry permits by “local” residents of the region where a fishery occurs may have significant economic and social implications for regions in which the local fishery represents an important or dominant economic activity.¹ A decline in local permit ownership may lead to a decline in local fish landings, fish processing, spending of fishing income, hiring of fishing crew, entry of young people into the fishery—and more broadly in the economic and social viability of fishing communities [1, 2, 3, 4]. Thus in designing limited entry programs (and other rights-based management systems) it is important to consider what the effects may be on local ownership of permits (or other access rights) over time.

This paper examines local ownership of limited entry permits in Alaska salmon fisheries. When limited entry management was adopted for Alaska’s twenty-six salmon fisheries in 1975, the share of permits initially allocated to local residents varied widely between fisheries (Figure 1). Since that time, the number of locally-owned permits has declined significantly in many but not all of these fisheries.

[PLACE FIGURE 1 APPROXIMATELY HERE]

Local permit loss, particularly for rural fishery-dependent regions, has long been a concern in Alaska. Expressing early concerns about the transfer of salmon limited entry permits from rural Alaska following the implementation of limited entry, Langdon [5] concluded that “. . . the outflow of permits that has occurred and that potentially can occur must be regarded as a significant threat to the rural Alaskan economic base and the well-being of rural Alaskans.” According to the Commercial Fisheries Entry Commission (CFEC), which administers the limited entry program, “many people remain concerned that permit transfers might result in undesirable consequences with regard to the distribution of permits. There is a concern that permits will leave the state, or that permits will disappear from isolated fishing communities which are local to a limited fishery, thereby eroding the economic base.” [6]

The primary goal of this paper is to propose a theory which may be used to explain changes in local permit ownership and for empirical and policy analysis of local permit ownership. The paper also presents a brief empirical analysis which shows that data for Alaska salmon fisheries are consistent with three broad predictions of the theory.

The paper uses the terms “local” to refer to residents of communities adjacent to Alaska salmon fisheries and “non-local” to refer to all other individuals. However, the same theory, modeling approaches, and policy questions may be applied to any geographic groupings of holders of fishery access rights. For example, “local” could apply to Alaskans and “non-local” could apply to residents of other states.

¹ For convenience, this paper refers to limited entry permits as having “owners” and being “owned.” Legally, Alaska salmon limited entry permits, like many types of fishery access rights, are not property which is “owned” but rather privileges which are “held” by individuals and which can be revoked.

1.1 Alaska salmon fisheries and the limited entry program

Alaska salmon fisheries account for about 40 percent of world wild salmon harvests [7], with annual harvests averaging 737 million pounds (334 thousand metric tons) with an average ex-vessel value of \$326 million dollars for the period 2004-2008 [8]. Each of the twenty-six fisheries is defined in terms of a geographic area and type of fishing gear. Limited entry was implemented for most fisheries in 1975. Permits were initially issued for free to individuals based on “(1) the degree of economic dependence upon the fishery, including . . . the percentage of income derived from the fishery, reliance on alternative occupations, availability of alternative occupations, investment in vessels and gear; and (2) extent of past participation in the fishery, including . . . the number of years of participation in the fishery, and the consistency of participation during each year” [9]. The purpose and effect of this initial allocation system was to ensure that significant numbers of rural local residents received permits in regions of Alaska with limited other economic opportunities.

Several important features of Alaska limited entry permits distinguish them from other types of fishery access rights in ways which may affect the dynamics of local permit ownership. Permits may only be owned by individuals. Permit holders must be on board vessels while they are fishing. Permits may not be leased. Unlike individual quota, permits convey a right to participate in a fishery, but not to a guaranteed share of the catch. Also unlike individual quota, permits cannot be consolidated: an individual may only one permit in a fishery and may fish only one unit of gear.²

A total of 11,047 transferable limited entry permits were initially allocated, beginning in 1975. Between 1975 and 2008 a total of 30,992 permit transfers occurred, including 9,812 transfers of permits from initial issues, or 89% of the initially allocated permits [6].

As illustrated for selected fisheries in Table 1, there is wide variation among Alaska salmon fisheries in the mix of species harvested, catch volume, ex-vessel prices, total earnings, numbers of permit holders, average earnings of permit holders, and permit prices. In many fisheries, many of the permits have not been fished in recent years.

There is wide variation in the share of permits which were initially allocated to residents of communities “local” to each fishery (as classified by CFEC), how the share of permits held by local residents had changed by 2008, and the extent to which the change in the local share of permits was due to net transfers from locals to non-locals, net migration of permit holders out of the region, and other causes (Table 1).

Total earnings in Alaska salmon fisheries exhibit wide variation from year to year and over longer periods of time, reflecting changes in both catches and prices. In general, total earnings rose dramatically from 1975 to the late 1980s, then fell dramatically until 2002, and have since recovered modestly to levels well below earlier peak values [8]. Average permit prices are strongly correlated with total earnings.

² Since the mid-2000’s, exceptions have been adopted for a few fisheries, such as rules in some set-net fisheries allowing individuals to own multiple permits and fish multiple set-net sites.

Table 1
Comparisons of selected Alaska salmon fisheries.

		Fishery area and gear type					
		Bristol Bay Drift Gillnet	Kodiak purse seine	South-east drift gillnet	Alaska Peninsula drift gillnet	Chignik purse seine	Kuskokwim gillnet
Selected fishery data (averages, 2004-2008) [8]	Total harvests (million lbs)	142.7	84.2	31.0	18.0	10.1	3.7
	Total earnings (\$ million)	86.2	20.6	16.5	11.1	5.7	1.4
	Total permits issued*	1861	375	477	162	96	766
	Total permits fished	1454	135	371	124	57	463
	Average earnings per permit fished (\$000)	59.2	153.7	44.4	89.3	107.7	3.0
	Average permit price (\$000)	66.5	17.6	40.1	64.2	142.2	6.4
Local permit share [6]	% initially issued to local residents	38%	62%	66%	61%	32%	100%
	% held by local residents in 2008	21%	52%	75%	25%	42%	85%
	Change from initial issues to 2008	-17%	-10%	9%	-36%	10%	-15%
Causes of change in local share [6]	Change attributable to net transfers	-11%	20%	11%	-33%	2%	2%
	Change attributable to net migration	-4%	-21%	2%	-1%	9%	-7%
	Change attributable to other causes**	-2%	-8%	-3%	-3%	-1%	-10%

*Includes both permanent and interim permits. **Includes foreclosures, forfeits, administrative and criminal revocations, and reinstatements.

Within fisheries, there is wide variation among permit holders in average earnings, reflecting differences in vessels, fishing experience and skill, and how aggressively and for how long they fish. For example, in the Bristol Bay fishery, the highest-earning permit holders (those accounting for the first 25% of total gross earnings) typically average gross earnings three to four times as high as the lowest-earning permit holders (those accounting for the last 25% of total gross earnings) [10].

In many but not all Alaska salmon fisheries, there are clear differences between local and non-local permit holders with respect to vessel characteristics, average earnings, income from other fishing and non-fishing activities, and other indicators. For example, in the Bristol Bay drift gillnet fishery in 2003, average vessel horsepower was 287 for local residents, 350 for other Alaskans, and 373 for residents of other states. Average revenue per permit fished was \$21,794 for local residents, \$25,626 for other Alaskans, and \$29,426 for residents of other states [11].

1.2 Earlier analysis of local permit ownership

Most of the extensive literature on markets for fishery access rights has focused on prices of entry permits and fishing quota, potential barriers to entry, and consolidation of access rights. The author has found little theoretical or empirical analysis focused specifically on interregional net transfers of fishery access rights other than for Alaska salmon permits and halibut IFQ.³

Concerns about rural Alaska permit losses arose soon after the implementation of limited entry, and were the focus of several studies in the early 1980s which described trends in permit transfers, examined causes of transfers, and discussed potential strategies to stem rural permit losses [5, 14, 15, 16, 17, 18, 19]. Langdon [5] noted significant declines in rural local permit ownership in some fisheries, particularly “. . . where there was initially a fairly balanced mix of nonresident, Alaskan rural and Alaskan urban fishermen. . . .” He suggested that if rural residents have lower average net earnings than other groups, they will be more willing to sell permits than other groups. Rural residents might have lower average net earnings than other groups due to differences in equipment and mobility. Lower rural incomes might also contribute to higher discount rates resulting in a greater willingness to sell for any given permit price. Similarly, Focht and Schelle [19] noted that the initial allocation of limited entry permits may have favored more “marginal” rural fishermen who would earn lower returns and consequently be more likely to sell permits.

Langdon [5] also suggested a number of reasons for which rural residents might be less able to buy permits, particularly the ability of rural residents to meet requirements necessary to gain access to financing for permit purchases. Non-economic factors such as identity, life-style, recreation, and food preferences might also influence willingness to buy permits among different groups. Other factors which might differentially affect demand for permits among different groups include distance to the fisheries, profitability of the fisheries, and knowledge about the fisheries. Summarizing, Langdon argued that “systematic disadvantage” of rural residents with respect to a variety of factors, and in particular lack of access to capital, were the likely causes of net permit transfers from rural Alaska to date, and that without significant improvements in capital access for rural residents, permit outflow would continue in the future.

Karpoff [14, 15, 16, 17] and Huppert et al [20] developed formal models of limited entry permit markets. In Karpoff’s model, for any individual (both permit holders and non-permit holders), the “demand-price” for a permit may be expressed as the expected present value of future net earnings from the permit. In any given time period, aggregate demand and supply curves for permits may be derived from different individuals’ demand-prices. “. . . Whether a person is a potential seller or buyer of a permit depends on whether he currently holds a permit or not. . . Ignoring discontinuities, the observed market price thus corresponds to the demand price of the marginal permit holder.” Karpoff used this modeling framework to examine the effects of a low-

³ Numerous studies briefly discuss changes in the geographic distribution of fishery and related policy issues. For example, Eythórsson [12] summarized causes of declining quota holdings of fisheries-dependent communities in Iceland, and Campbell [13] presented data on changes in the holdings of Australian southern bluefin tuna quota by state. However, the author has not found studies which have specifically focused on explaining changes in the geographic distribution of fishery access rights over time.

interest loan program limited entry permits and to examine evidence for non-pecuniary benefits of fishing. However, he did not examine net transfers between residents of different regions.

Carothers et al [3] found that net transfers of halibut individual fishing quota (IFQ) occurred from small remote Alaska communities during the first five years of the Alaska halibut IFQ program (1995-99), and that that residents of predominantly Native communities were more likely to sell than buy quota. They noted that “to the extent that [quota sellers] are disproportionately located in small communities or indigenous communities, social and economic impacts (including negative multiplier effects) will be differentially concentrated. So the consequence of solving one collective action problem (too many participants in a fishery) creates another (disproportionate quota loss form small or indigenous communities.” However, they did not suggest a theory to explain *why* small communities had lost quota or how quota ownership might change in the future.

Since the early 1980s the CFEC has produced detailed annual reports on changes in the geographic distribution of permits. However, surprisingly little research has been reported since the early 1980s about the *causes* of changes in permit distribution, how permit distribution is likely to change in the future, how permit distribution might be affected by government policies or other factors, and what might be done to slow or reverse rural permit losses. The following section proposes a theory which may be used to address these questions.

2. An economic theory of local permit ownership

Assume that (as in Alaska salmon fisheries) permits represent a right to participate in a competitive fishery, that individuals may hold only one permit; that permits may not be leased, and that all transfers are by sale. Each year, each individual in the world has a *valuation* of a permit (Karpoff’s “demand-price”). A permit-holder’s valuation is defined as the lowest price for which the individual would be willing to sell a permit. A non-permit holder’s valuation is defined as the highest price which the individual would be willing to pay for a permit.

Economic theory suggests that an individual’s valuation would be a positive function of the profits the individual would expect to earn from fishing and a negative function of the rate at which the individual discount future fishing profits. Included in “profits” is the value the individual attributes to any non-market benefits derived from participation in the fishery. Costs deducted from profits include not only monetary costs incurred but also “opportunity costs” of foregone income that the individual could have earned from alternative work.

Individuals’ permit valuations may differ due to differences in factors such as where they live, how good they are at fishing, how much they could earn in other jobs, and their access to capital for purchasing a permit and/or boat. For this analysis, only those individuals matter for whom valuations are or might become positive.

If there are a limited number of permits, and permits may be bought and sold, then *transfers*—permit sales—will occur from permit holders to non-permit holders with higher valuations. If all valuations remained constant—if no individuals’ permit valuations ever changed—this process would continue until an *equilibrium* allocation was reached in which permits are held by the

individuals with the highest valuations. In equilibrium, no non-permit holder's valuation would exceed any permit holder's valuation.

Suppose that permits are initially allocated by a non-market based initial allocation rule: they are not sold to the highest bidders. (As discussed above, this was the case with Alaska salmon limited entry permits, for which allocation criteria included factors such as the percentage of income derived from the fishery, reliance on alternative occupations, and availability of alternative occupations.) Suppose also that there are no transactions costs to buying or selling a permit. If all valuations remained constant, transfers would occur from some initial permit recipients to non-initial permit recipients until an equilibrium allocation is reached. These transfers may be characterized as *adjustments to the initial allocation*.

Following adjustments to the initial allocation, any further transfers will occur only as *adjustments to changes in valuations*. Valuations of individual permit holders and non-permit holders may change over time in different ways, for a wide variety of reasons. For example, individuals' expected profits from fishing may change due to changes in resource conditions, prices, and costs. Individuals' opportunity costs of fishing may increase or decrease due to changes in other fisheries or alternative employment opportunities. Younger people's valuations may increase over time as they gain education, crewing experience, and financial capital—increasing the net benefits that they would expect to derive from ownership of a permit. Older people's valuations may decline over time as they age and find fishing more difficult. As individual valuations change, transfers as adjustments to changes in valuation will continue to occur over time from permit holders whose relative valuations have decreased and/or to non-permit holders whose relative valuations have increased.

If permit markets were fully competitive and adjusted instantaneously—so that permits were always sold immediately any time any non permit-holder's valuation exceeded any permit holder's valuation—then a large number of transfers would occur immediately after implementation of the program (as adjustments to the initial allocation) and smaller numbers of transfers would occur in subsequent years (as adjustments to changes in valuation). However, if markets are not fully competitive and do not fully adjust each year, permit transfers that occur as adjustments to the initial allocation or to changes in valuations may be spread out over several periods. The permit market may never fully adjust to equilibrium as individual valuations continue to change over time. This does not change the fundamental insights of the model, but complicates empirical modeling of annual permit transfers.

In summary, permit markets allocate permits to the individuals with the highest valuations. Transfers between individuals occur partly to adjust to non-market based initial allocations, and continue over time as individuals' relative valuations change over time.

2.1 Implications of transactions costs

The above discussion assumed that there are no transactions costs of buying or selling permits. What are the implications of relaxing this assumption? The higher the transactions costs of selling or buying permits, the lower the net price received by permit sellers (after deducting transactions costs), and/or the higher the net price paid by permit buyers (after adding transaction

costs). Transfers would only occur when the buyer's valuation exceeded the seller's valuation by more than the transaction cost—resulting in fewer transfers. In the extreme, if transactions costs are sufficiently high, no transfers will occur. Transactions costs do not change the fundamental insights of the model, but complicate empirical modeling of permit markets and transfers. However, for simplicity, the following discussion assumes that permit markets fully adjust each year and that transfer costs are zero.

2.2 The local permit share and net transfers between local and non-local residents

The preceding discussion has focused on which individuals hold permits and on the causes of transfers between individuals. The same theoretical approach may be used to understand the share of permits held by local residents and the causes of net transfers between local and non-local residents.

The equilibrium share of permits held by local residents depends on the *relative valuation rankings* of local residents relative to non-local residents. If a fishery has M permits, the locally owned share will be equal to the local share of the M individuals with the highest permit valuations. In equilibrium, the marginal permit holders' valuations will be equalized for local and non-local residents at the permit price.

Net transfers between local and non-local residents will occur partly to adjust to non-market based initial allocations. If transferable access rights are initially allocated by a non-market method for the purpose of maintaining local participation and ownership, over time transfers will occur and permit ownership will adjust to a market-driven allocation. Put differently, if local residents would not have bought permits if they had had to buy them, over time they are likely to sell them if they have the option to do so.

This simple but critically important point appears to have received little attention in the design of the Alaska salmon limited entry program. As noted by Langdon [21], "Alaska designers were cognizant of some local social and economic factors and sought to avoid serious economic hardship to fishermen and damage to Native Alaskan communities when initially awarding permits. There is, however, no evidence that policy makers gave any thought to the potential dynamics of market transferability of permits or the likely patterns of resulting permit distribution."

Following adjustments to the initial equilibrium, net transfers between local and non-local residents will continue over time as local and non-local residents' relative valuation rankings change over time. Particularly important are any factors which change valuations differently for local residents than for non-local residents, so that relative valuation rankings change. For example, if all individuals' valuations double, this will not change the equilibrium allocation between local and non-local residents. But if local residents' valuations double while non-local residents' valuations triple, their relative valuation rankings will change, resulting in some net transfers from local to non-local residents, and a decline in the local resident share.

The following discussion focuses on a variety of factors which may affect relative valuation rankings of local and non-local residents, and/or change relative valuation rankings over time,

and thus affect or change the equilibrium local permit share, leading to net transfers between local and non-local residents.

2.2 Effects of local population on local permit share

For any given distributions of permit valuation within the local and non-local populations, the larger the local population, the larger the number of local residents will be among the individuals with the highest permit valuations, and the larger the local permit share. If the relative distribution of permit valuation is identical, then the equilibrium local permit share will be equal to the local share of the total population. Consider, for example, the two groups “left-handed people” and “right-handed people. If both groups have the same relative permit-valuation distributions, in equilibrium the left-handed share of permit-holders will equal the left-handed share of the total population. If a larger share of permits is initially allocated to left-handed people, over time market forces will cause this share to decline.

All else equal, if the local and non-local population grow at different rates over time, this will tend to change the equilibrium local share of permits. For example, if the local population is stable but the non-local population grows, over time the local share of permits will tend to decline.

2.4 Effects of differences in discount rates on local permit share

Economic theory suggests that an individual’s permit valuation will be a negative function of the rate at which he discounts future fishing profits. How an individual discounts future profits depends on how he would use the funds from the sale of a permit (for permit holders) or how he would fund the purchase of a permit (for non-permit holders). If there are systematic differences between local and non-local residents in how they would use funds from the sale of a permit, how they would fund the purchase of permits, the interest rates they would pay on permit loans, the amount they could borrow, the rates of return they would expect on alternative investments, or their rates of time preference, this could affect their relative permit valuation rankings and the equilibrium local share of permits.

There are a number of reasons for which residents of remote rural regions may have relatively higher discount rates than residents of other regions:

- They may face greater needs for cash for current consumption
- They may have less personal wealth that they could invest in purchases of permits and boats.
- They may have less collateral for loans to purchase permits and boats.
- They may have less access to financing from family or friends.
- They may have less access to and banks or other potential lenders to finance permits and boats.
- They may have less knowledge of government programs intended to assist individuals in financing permits and boats, or they may face higher costs in accessing these programs.

If residents of remote rural regions face higher discount rates for these kinds of reasons, it will tend to reduce their relative permit valuations in comparison with non-local residents and hence the equilibrium local share of permits.

2.5 Effects of differences in fixed costs on local permit share

“Fixed costs” of fishing—costs independent of the volume harvested—may differ for local and non-local residents. Non-local residents generally face higher costs of travel to a fishery. Local and non-local residents may also face different opportunity costs: income that could be earned in other fisheries or non-fishing employment. Thus in general, differences in relative fixed costs between local and non-local residents are likely to be greater, the more remote and poor the region of the fishery. All else equal, to the extent that non-local residents face higher fixed costs, this will tend to reduce their relative valuation rankings, increasing the local share of permit ownership. Put differently, all else equal, the relatively more that non-local residents can earn in other kinds of fishing or non-fishing activities, and the relatively higher their costs of travel to a fishery, the less they are likely to be willing to pay (or accept) for a fishing permit compared to a local resident.

2.6 Effects of fishery profitability on local permit share

In general, an increase in the profitability of a fishery is likely to reduce the local permit share if (a) non-local residents have lower discount rates or (b) non-local residents face higher fixed costs. If non-local residents have lower discount rates, an increase in fishery profitability will result in greater absolute increases in their permit valuations, increasing their relative valuation rankings in comparison with local residents. Put differently, the higher the price of a permit, the greater the relative constraint limited personal wealth and collateral may represent for local residents.

Similarly, if non-local residents face higher fixed costs, then in general an increase in fishing revenues (for example due to an increase in ex-vessel prices) will cause their profits to increase relatively more than for local-residents, increasing their relative valuation rankings in comparison with local residents.

2.7 Effects of differences in other factors on local permit share

A wide variety of other factors may also affect relative permit valuation rankings of local and non-local residents and the equilibrium local permit share. Examples include:

- Experience in and knowledge of the local fishery. Local residents may have relatively more experience in and knowledge of conditions in the local fishery, giving them relatively greater interest in the fishery and/or a relative advantage in competing for the available fish. In particular, relatively more local young people may gain experience and knowledge by working as crew for local permit holders. Note that this may contribute to dynamic effects of net permit transfers over time: changes in the local permit share may affect the extent of experience and knowledge of the fishery among future potential local permit buyers.

- Differences in synergies with other activities. Local and non-local residents may differ in the extent to which participation in the local fishery would complement or conflict with other activities, including other commercial fisheries, non-fishing employment, and non-commercial “subsistence” fishing activities.
- Tax effects. Local and non-local residents may differ in the tax implications of their fishing profits or losses from participation in the local fishery. For example, if non-local residents earn relatively more income from other sources, they may pay a higher tax rate on fishing income—but also benefit more from the opportunity to write off potential fishing losses.
- Cultural differences. Cultural differences may contribute to differences between local and non-local residents in their fishing objectives and how they fish. For example, local residents’ objectives might be relatively more oriented towards meeting a target income goal, while non-local residents’ objectives might be relatively more oriented towards maximizing profits. This might lead to relatively more aggressive fishing and greater profits for non-local residents, and in turn relatively greater higher permit valuations.

2.8 Net migration of permit holders

A permit holder’s relative preference for living in the region “local” to the fishery or another “non-local” region may be influenced by a wide variety of factors including not only the relative potential net income from participation in the fishery but also relative opportunities to earn non-fishing income, relative costs of living, relative quality of public services such as schools, and many other non-market factors affecting the relative quality of life such as proximity of family and friends, opportunities for subsistence activities (fishing, hunting and gathering), community size, and climate. Permit migration may occur in response to changes in any fishing or non-fishing related factors which shift the permit holder’s relative preference between regions sufficiently to cause the permit holder to choose to migrate, but which also leave the permit holder’s permit valuation after migration sufficiently high that he does not sell the permit.

A wide variety of non-fishing related causes could cause net migration of permit holders, such a relative decline in local opportunities to earn non-fishing income (for permit holders or other family members), a relative increase in the local cost of living, or a relative decline in the quality of local public services such as education.

Changes in the fishery could also cause migration of permit holders. However, the implications of changes in the fishery for migration are not obvious, and depend upon both non-fishing related factors as well as how permit holders fishing costs and revenues would be affected by migration. For example, if the fishery becomes more profitable it may make it easier for a permit holder to live in the local region, but also may make it easier for a permit holder to fish the permit while living outside the region. The relative significance of these two effects is not obvious and depends upon a variety of region-specific fishery and non-fishery related factors. More generally, any theory of permit migration must be incorporated within a broader theory of inter-regional migration.

3. Testing the theory for Alaska salmon fisheries

Is the theory presented above helpful in explaining local permit ownership in Alaska salmon fisheries? As discussed below, data for Alaska salmon fisheries are consistent with three broad predictions of the theory.

A first prediction is that in equilibrium, following adjustments to the initial allocation, the share of permits held by local residents should be negatively related to permit prices (an indicator of fishery profitability), positively related to the size of the local population, and positively related to differences in fixed costs between non-local and local residents.

This prediction is consistent with the ordinary least squares regression results summarized in Table 2, Regression 1. All three explanatory variables were highly significant with the expected signs. Figure 2 shows a clear inverse relationship between the average permit prices for Alaska salmon fisheries in 2008 and the share of permits held by local residents.

Table 2
Ordinary Least Squares regression results for Alaska salmon fisheries*

Regression	Variables		Estimated coefficient	Standard error	t - statistic	P- Value
Regression #1 N = 26 R ² = .717	Dependent	Local share of permits in 2008 [6]				
	Independent	Intercept	.684	.0696	9.83	0.00
		Permit price in 2008 (\$) [8]	-3.65	1.10	-3.33	0.00
		Local population in 2000 (a)	.000000639	.000000277	2.31	0.03
		Dummy variable for remote AYK region (b)	.197	.080	2.46	0.02
Regression #2 N = 72 R ² = .192	Dependent	Net transfers from local residents to non-local residents during period as % of total initially allocated permits [6]				
	Independent	Intercept	-.016	.010	-1.58	.118
		Change in real permit price during period as % of 1979 price (c) [8]	-.0369	.0090	-4.08	.0001
Regression #3 N = 15 R ² = .378	Dependent	Ratio of average gross earnings: local to non-local Alaskan (c) [23]				
	Independent	Intercept	.467	.237	1.97	.070
		Local share of permits in 2005 [6]	1.11	.395	2.81	.015

* Data for Regressions 1 and 3 are cross-sectional data for 26 and 15 salmon fisheries, respectively. Data for Regression 2 are cross-sectional time-series data for 24 salmon fisheries during three time periods: 1979-1989 (a period of generally increasing permit prices); 1989-2002 (a period of generally decreasing permit prices); and 2002-2008 (a period of generally increasing permit prices). Regression 2 excludes the Chignik Purse Seine fishery (S01L) and Statewide Hand Troll fishery (S05B) due to missing permit price data. Regression 3 excludes fisheries for which average earnings data were not available for both local and non-local permit holders.

(a) United States 2000 Census data.

(b) Equals 1 if the fishery is one of the six Arctic-Yukon-Kuskokwim (AYK) fisheries in the remote, high-cost northwestern and interior regions of Alaska. No data series are easily available for all Alaska salmon fisheries which provide a reliable indicator of differences in fixed costs of fishery participation between local and non-local residents, which may include both transportation costs and opportunity costs. For the AYK region, it was clear that both transportation costs and opportunity costs would be significantly lower for local residents.

(c) Data on average gross earnings by residency category are not published for most salmon fisheries. Ratios of un-weighted averages, for local and non-local communities, of average gross earnings of permit holders living in the community, as reported by CFEC [23]. For each fishery only those communities were included for which CFEC reported average earnings in 2005 (only those communities with at least four participating permit holders).

[PLACE FIGURE 2 APPROXIMATELY HERE]

A second prediction of the theory is that the rate of net permit transfers to local residents should be negatively related to changes in permit prices: when permit prices are rising, there should be net transfers from local residents to non-local residents; and when permit prices are falling, there should be net transfers from non-local residents to local residents.

This prediction is consistent with the ordinary least squares regression results summarized in Table 2, Regression 2 and illustrated in Figure 3. For twenty-four salmon fisheries, over three different time periods during which permit prices were in turn generally rising, generally falling, and generally rising, there was a statistically significant negative relationship between the percentage change in the real permit price and the net percentage of permits transferred to local residents.

[PLACE FIGURE 3 APPROXIMATELY HERE]

A third prediction of the theory is that the ratio of average earnings of local residents to non-local residents should be positively related to the share of permits held by local residents. All else equal, the greater the share of local residents among individuals with valuations equal to or exceeding the equilibrium price, the greater the expected average earnings of residents relative to the average earnings of non-residents.⁴ This prediction is consistent with the ordinary least squares regression results summarized in Table 2, Regressions 3, and illustrated in Figure 4.

[PLACE FIGURE 4 APPROXIMATELY HERE]

This brief analysis is not in any sense a full analysis of the factors affecting local permit ownership in Alaska salmon fisheries. Its purpose is only to suggest that the theory presented above represents a useful way of conceptualizing how different factors may affect local permit ownership and net transfers.

Given the richness of the data available for Alaska salmon fisheries, much more extensive empirical analysis of factors affecting local permit ownership is possible than that permitted by the space limitations of this paper. For example, time-series analyses for individual fisheries (or

⁴ This prediction depends on the assumption that differences in permit share between groups are not driven solely by the size of the groups' relative populations, but at least in part by differences between the groups in the distribution of relative permit valuations. For example, if the share of right-handed permit holders is higher than the share of left-handed permit holders, this does not imply that the average earnings of right-handed permit holders should be higher than the average earnings of left-handed permit holders.

time-series cross-sectional analyses across multiple fisheries) could shed insights into the dynamics of permit transfers and migration over time. Analysis of data for tens of thousands of individual permit holders over more than three decades could provide an even richer opportunity to examine the dynamics of transfers and migration over time.⁵

4. Discussion

Economic theory suggests that over time, markets will allocate transferable limited entry permits to the individuals who are willing and able to pay or forego the most money for them. Any factors that differentially affect the relative ranking of local and non-local residents with respect to what they are willing and able to pay or forego for permits will affect the long-term equilibrium share of permits held by local residents. These include but are not limited to differences in the relative sizes of the local and non-local populations, as well as differences between local and non-local residents with respect to wealth and access to and costs of capital, ownership of boats and gear, fishing skill, costs of travel to the fishery and opportunity costs of participation in the fishery.

In general, the more profitable a limited entry fishery, the greater the share of permits that will be owned by non-local residents. The effects of profitability on the non-local permit share will be amplified to the extent that non-local residents have greater access to or lower costs of capital, or face higher transportation or opportunity costs of participation in the fishery.

How permits are initially allocated determines the initial local permit share. However, over time, regardless of the initial allocation, market forces will drive the equilibrium distribution of permits among local and non-local residents. The greater the initial allocation differs from the market distribution, the greater the extent to which net transfers between local and non-local residents will occur as market adjustments to the initial allocation.

If local residents have less wealth, less access to capital and/or less capacity to profit from a fishery than non-local residents, fishery managers may face a policy tradeoff between the two potential goals of increasing the profitability of a fishery and maintaining or increasing the local permit share. The more managers succeed in increasing the profitability of the fishery, for example by increasing catches or prices or by lowering unit costs, the relatively more economically attractive the fishery will become to non-local residents, and the larger the share of permits likely to be bought by non-residents over time.

There may be no easy or cheap ways to reverse market-driven declines in local permit ownership, when all citizens—both local and non-local residents—enjoy federal and/or state constitutional guarantees of equal protection. Subsidizing capital costs of permits or boats for local residents is expensive, and there is no obvious way of ensuring that the subsidies go to the local residents who need them to purchase (or not sell) a permit or boat rather than individuals who would have been able to purchase (or not sell) a permit or boat without the loan. The more profitable the fishery, the higher the cost of subsidizing local permit ownership. Allowing

⁵ Publicly available data include the names, addresses and vessel characteristics of holders of all salmon permits over time. Confidential data include annual landings and earnings of all permit holders in both salmon fisheries and other fisheries.

community or regional organizations to buy and hold permits for sale or lease to local residents raises similar cost issues, as well as issues of governance of these organizations.

In summary, when fishery managers create tradable fishery access privileges, regardless of the initial allocation of those privileges, markets become powerful forces for the reallocation of privileges over time, both among individuals and among geographic regions.

Fishery management policies must be evaluated in comparison with actual alternatives, not theoretical ideal outcomes. For those Alaska regions which have experienced a decline in local ownership of salmon limited entry permits, local participation and benefits from the salmon fishery would not necessarily have been greater had limited entry not been implemented. Without entry limitation, non-resident participation in the fisheries would likely have continued to increase in the same fisheries for which it increased with limited entry—those which offered the greatest economic opportunity for non-residents. Although local residents could have continued to fish, they would have derived less benefit from doing so. Alternatively, limiting entry but with non-transferable permits would not have necessarily have guaranteed that local residents would have received permits when initial permit recipients exited the fishery. When constitutional or political constraints limit policy discrimination between local and non-local residents, there are no easy or obvious ways to ensure that local residents benefit from a fishery which is economically attractive to non-local residents.

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Figure 1

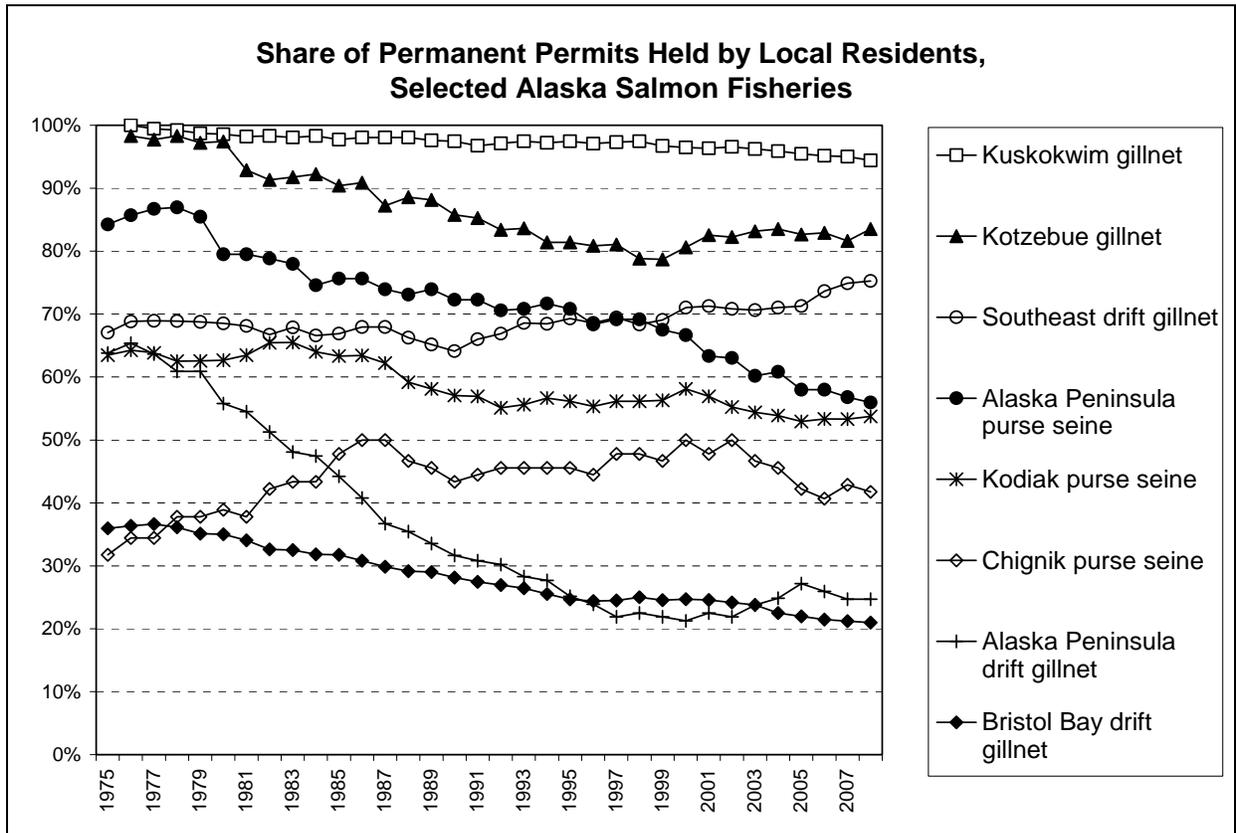


Fig. 1. The share of permits held by local residents in selected Alaska salmon fisheries [6]. The share initially allocated to local residents varied widely between Alaska salmon fisheries. The share of locally-owned permits has declined significantly in many but not all fisheries.

Figure 2

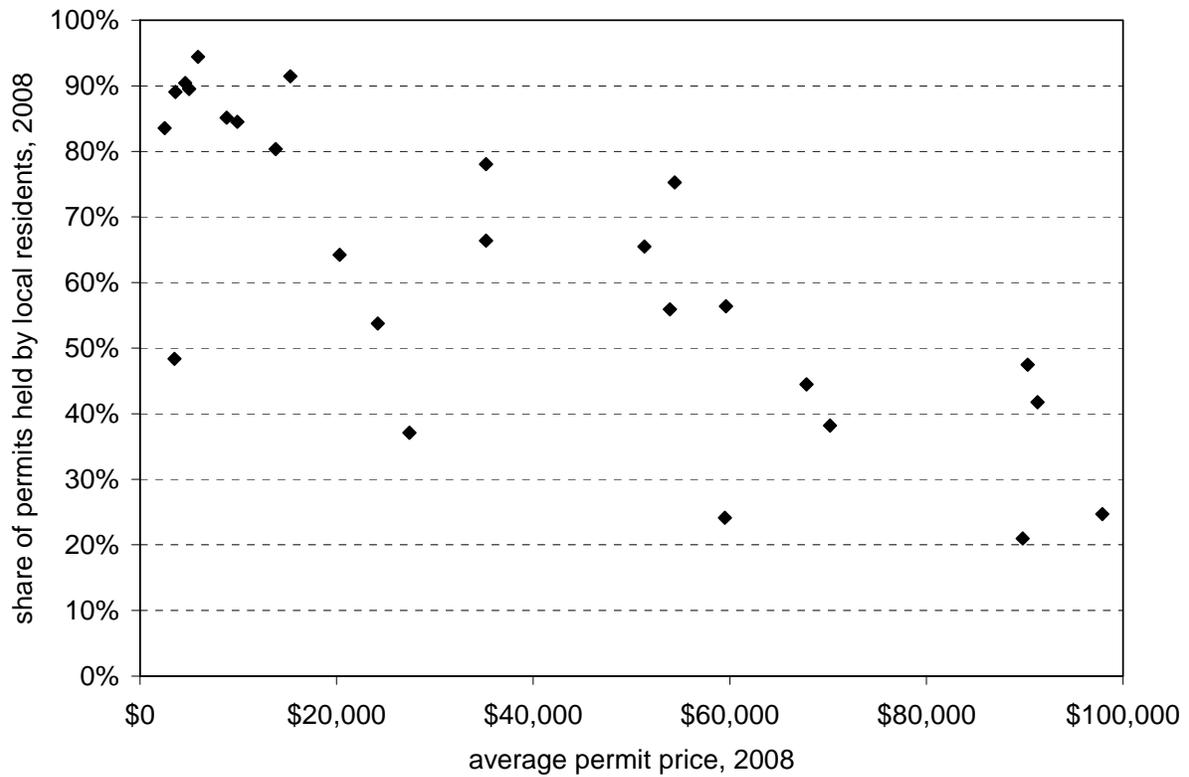


Fig. 2. The share of Alaska salmon permits held by local residents in 2008 plotted against the average permit price [6, 8]. Each observation corresponds to one of 26 limited entry salmon fisheries. There is a clear negative relationship between the local permit share and the average permit price.

Figure 3

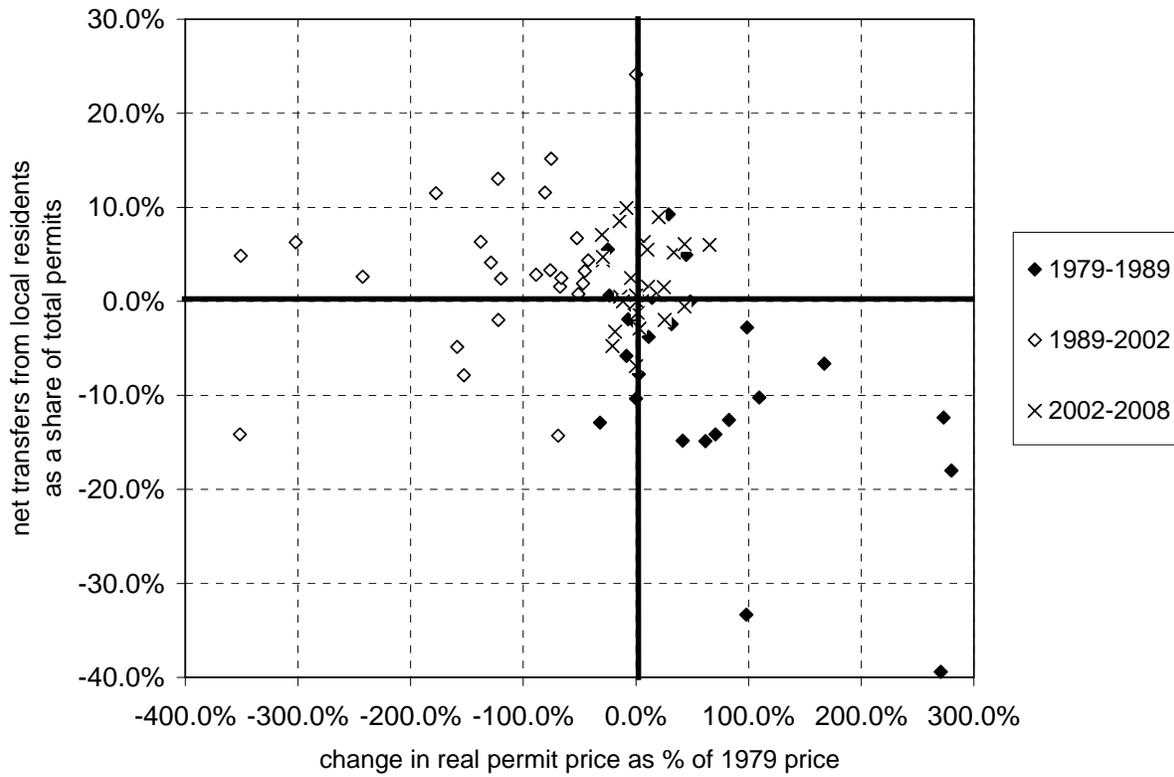


Fig. 3. Net transfers from local residents as a share of total permits, plotted against the change in the real permit price as a percentage of the 1979 price, for three different time periods [6, 8, 22]. Each observation corresponds to one of 26 limited entry salmon fisheries. There is a clear negative relationship between the local permit share and the average permit price. The real permit price was calculated using the Anchorage consumer price index.

Figure 4

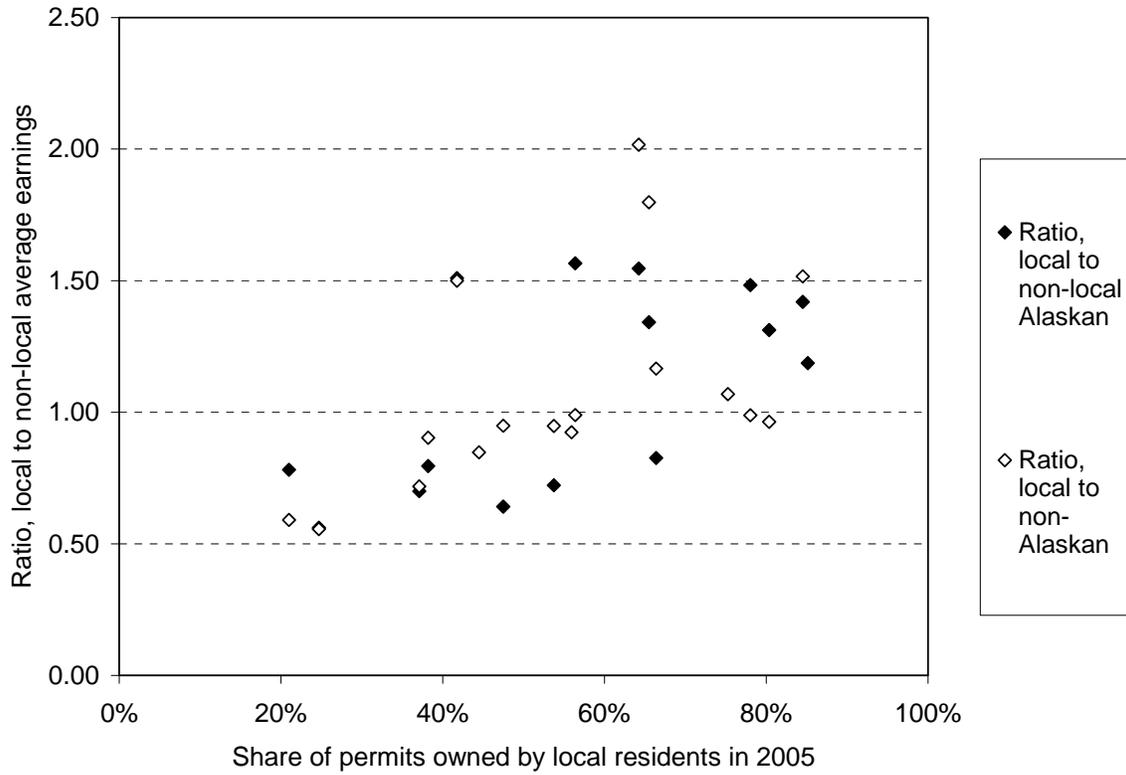


Fig. 4. Ratio of average earnings of local permit holders to average earnings of non-local permit holders, plotted against the share of permits owned by local residents in 2005 [6, 23]. Each observation corresponds to an Alaska salmon fishery for which average earnings data were available for both local and non-local permit holders. There is a positive relationship between the local permit share and ratio of earnings of local permit holders to non-local permit holders.