The Legacy of *United States v. Washington:*

Economic Effects of the Boldt and Rafeedie Decisions

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I. Introduction[1]

In 1974, after decades of courtroom battles, federal district court judge George Boldt issued a controversial and widely unexpected ruling in *U.S. v. Washington* that had major impacts on the distribution of revenue from Washington State's salmon fisheries. The ruling, commonly referred to as the Boldt Decision, decreed that based on treaties signed in the 1850s, certain Native American tribes had the legal right to catch up to 50 percent of the harvestable salmon entering Washington State's waters each year. The victory was substantial because tribal salmon catch was only 6 percent of the annual harvest for the 25 years prior to 1974, and because 50 percent of the commercial fishery's revenue at its peak in 1973 was approximately $130 million in 2014 dollars.[2] This amounted to $10,189 in revenue per capita for the members of the 14 original plaintiff tribes based on their 1973 populations.[3] For perspective, consider that per capita income for Boldt tribes was $9,204 based on the 1970 census.[4]

The Boldt Decision focused on salmon, which was the most economically important species in 1974, but said nothing regarding the allocation between treaty and non-treaty fishers of shellfish, which are more economically important today. In 1994, following two more decades of litigation, the Rafeedie Decision extended Judge Boldt's 50 percent allocation to Washington's shellfish harvest. Important commercial shellfish species include Dungeness

[1] Substantial components of the material in this chapter are drawn from more detailed and technical analyses of issues related to *U.S. v Washington* in Parker et al. (2012 and 2013).

[2] This is the ex-vessel revenue from salmon based on the prices paid to fishermen by processors and dealers. The retail revenue from the fishery was much higher. Real salmon revenues were greater in 1973 than in any other year between 1970 and 2009.

[3] Estimates of tribal members come from the *U.S. v. Washington* ruling and are corroborated by Bureau of Indian Affairs estimates in its 1973 *Estimates of Resident Indian Population and Labor Force Status* report. Six additional tribes later became claimants to the 50 percent share. The 1973 membership of the original 14 plaintiff tribes was 12,199, and the membership of the six additional tribes was 2,544. Note, of course, that after accounting for harvest costs, the net revenues to tribal fishers would be substantially less than the gross revenues in the text.

[4] This is the mean per capita income (in 2014 dollars) for the seven tribes for whom income data are reported in the 1970 census.

crabs, oysters, and clams. As can be seen in figures 1 and 2A, both the number of Washington salmon harvested and the real value of the harvest have fallen in recent decades. On the other hand, the real value of the Washington shellfish harvest has increased significantly, although tribal shellfish catch has not reached 50 percent of the total for several shellfish species (figure 2B). The growing revenues from shellfish have offset the falling revenue from salmon, and real tribal harvest revenues have remained roughly constant (see the dashed line labelled "All" in figure 2C).[5]

In this chapter, we examine the short- and long-run impacts of the Boldt and Rafeedie Decisions on tribal fishing revenues and reservation-level incomes. We conclude the effects were neither as rosy for the treaty tribes, nor as bleak for the non-Indian fishers as were anticipated by newspaper accounts at the time of the Boldt Decision. Those accounts forecast scenarios in which thousands of non-Indian fishers would be left penniless, and in which tribal fishers would garner significant income and wealth. Non-Indians were not left penniless because they were provided relief through limited entry license systems, and government funded buyback programs. On the other hand, many treaty (tribal) fishers did not garner significant wealth, in part because the court rulings failed to clearly define property rights that would have created effective limits on access to salmon and shellfish. The court rulings established no mechanism for allocating revenues across tribes, which encouraged economically wasteful inter-tribal competition for fish. Moreover, by defining tribal fishing areas very broadly, the rulings discouraged efficient traditional systems of tribal fishing used prior to the treaties, which involved salmon fishing with stationary gear near river mouths (see Barsh 1977). As a result, although the Boldt and Rafeedie Decisions provided tribal fishers with the rights to a substantial

[5] As can be seen in figure 2D, following a sharp reduction in salmon revenues for non-tribal fishers between 1972 and 1980, there was little trend in total salmon and shellfish revenues for the next three decades.

share of the potential wealth associated with Washington's salmon and shellfish resources, the value of those resources has been dissipated by competition resulting from poorly defined property rights.

II. The Washington Fishery Prior to Boldt and Rafeedie

A. Salmon Fishing[6]

Historically, the waters of the Pacific Northwest were prolific producers of salmon. Before non-Indians entered the fishery, the annual runs of Pacific salmon to what is now Washington State were in excess of 50 million fish in even numbered years and possibly as large as 100 million in odd numbered years.[7] Although early Spanish and Russian ships occasionally visited the coasts of the region, the journey of Lewis and Clark up the Missouri and down the Columbia river in 1805-06 was the beginning of the white man's migration to the far west. Though growth in the region was considerable through the Civil War period, commercial use of the fishery was nearly non-existent and the fishery remained in the domain of the Native Americans.

During this early period, Native Americans relied upon a system of clan and family-owned fishing sites near river mouths to husband salmon and live off their abundance (see Higgs 1982, Boxberger 1989). They primarily caught salmon with highly efficient stationary gear affixed to river banks and bottoms—for example, with fishing weirs—and managed populations by allowing some salmon escapement to facilitate spawning and reproduction. There is evidence

[6] Information in this section comes primarily from Higgs (1982), Crutchfield and Pontecorvo (1969), and Parker et al. (2012 and 2013).

[7] Pink salmon, the major source of canned salmon today, return to their native waters and are catchable primarily in odd numbered years.

of tribal investment in habitat, and no evidence of salmon depletion under this system. In fact, salmon were so abundant that they were often given away in elaborate potlatch ceremonies (see Johnsen 2006).

In 1855 the territorial Governor, Isaac Stevens, negotiated and signed six treaties with representatives from 14 Washington tribes and family groups.[8] Through these treaties the Natives gave up certain lands in return for money, but retained access to the fishery. Each of the treaties specified that "...the right of taking fish at usual and accustomed grounds and stations is further secured to said Indians in common with all of the citizens of the Territory..."[9]

Twenty years after the signing of the treaties, salmon fishing in Washington was second only to the timber industry in terms of employment and revenue generated. The rise of the fishing industry was due to the development of the canning process, which allowed salmon to be preserved and shipped long distances. The first cannery in the territory was constructed in 1866, and 10 years later there were over 70. It was during this period that the first fish traps began to dominate the industry. These traps were large stationary structures that were built by non-tribal fishers at or near the mouth of rivers. In 1913, 61 percent of the fish were caught by these devices, with the remainder harvested using purse-seines and gill nets (Higgs, p. 70). Purse seines are large nets, deployed by large boats, capable of intercepting migrating salmon before they reach fish traps on their way to spawn in rivers. Because of the traps, purse seines, and gill netters, salmon were intercepted before they reached tribal fishing grounds and the Native American catch became an inconsequential part of the fishery as early as 1900.

Like the tribal fish weirs, the stationary fish traps were highly efficient at catching

[8] See Treaty with the Makahs, 12 Stat 939; Treaty of Medicine Creek, 10 Stat 1132; Treaty of Olympia, 12 Stat 971; Treaty of Point Elliot, 12 Stat 927; Treaty of Point No Point, 12 Stat 933; and Treaty with Yakimas, 12 Stat 951.

[9] See, for example, Treaty of Point Elliot, Article 5.

salmon, but only if the state was willing to preclude marine fishing from purse seines and other boats. Fish traps eliminated the costs of searching for salmon, and as a result, the unit cost of trapping fish was significantly lower than that of mobile gear that required more labor inputs and marine fuel—cost savings were perhaps as high as 90 to 95 percent (Barsh 1977). In spite of their efficiency advantages, fish traps were banned from Washington waters in 1934.[10] That ban remains in effect to the present day.

In addition to the movement away from efficient stationary fishing methods, rent dissipation prior to 1974 also resulted from the lack of constraints on entry into the mobile fishery. At least as early as Crutchfield (1961), economists were espousing limits on entry to address the overcapitalization problem of "too many boats chasing too few fish." Their idea was to cap the number of vessels permitted to compete for a fishery-wide total allowable catch (TAC) and to issue licenses to a limited number of fishers. The licenses would be transferable, so that the right to enter could be sold to other fishers. The first limited entry programs were introduced with pioneering programs in Australia, British Columbia and Alaska, but they were not introduced in Washington State salmon fisheries until after the Boldt Decision, and these limits only apply to the non-tribal fishery.[11]

The long-run trend in Washington has been a decline in the size of annual salmon runs. After 1913, runs declined and only the development of a large hatchery system in the state has allowed the fishery to continue as a viable industry. Population growth, development, pollution, and timber harvesting have exacerbated the over-fishing problems by degrading and destroying

[10] See Higgs (1982) for a discussion of the political economy of this ban.

[11] Empirical evidence suggests that the early limited entry programs, where applied, generated noteworthy rents. Evidence that rents were generated under these programs is found in license prices, which have been positive and substantial in many limited entry fisheries (Wilen 1988). Positive license prices are an indication of positive rents because the market value of a license should reflect the expected present value of profits that a fisher can earn in a fishery.

fish spawning habitat. Many previously productive watersheds have had little or no viable wild runs of salmon for the past two or three decades.

From 1950 through 1973, total catch did not trend up or down, and the distribution of catch between non-Indians and tribal fishermen was relatively stable (see figure 1).[12] Most of the observed variation in the number of fish caught during this time span was due primarily to entry of pink salmon fishers in odd numbered years. On average tribal fishers caught about 6 percent of the commercial catch over this period.

B. Shellfish Harvesting

Commercial shellfish species in the Washington state fishery include Dungeness crab, Pacific oysters, clams (hard shell and Geoduck), and shrimp. The relative importance of salmon and shellfish in the Washington fishery has shifted dramatically in the last 50 years. Using the ratio of ex-vessel salmon to shellfish revenue as an indicator of this relative importance, the nominal salmon revenues for all districts in the Washington fishery were $5.64 million in 1960, while shellfish revenues were $3.35 million, for a ratio of 1.68. In 1970 and 1975 that ratio increased to 2.2 and 2.6, respectively. By 1995, however, the ratio had fallen to 0.12, with nominal salmon revenues of $10.29 million and shellfish revenues of $87.08 million. In 2009, nominal salmon revenues were $20.67 million and nominal shellfish revenues were $153.84 million, for a ratio of 0.13. [13]

Of the various shellfish species, historically crab and oysters have generated the greatest shares of ex-vessel revenues in the fishery, although in recent years geoduck revenues have

[12] Washington State Department of Fisheries, "1991 Fisheries Statistical Report," 1992.

[13] The revenue numbers for 1995 and before are obtained from the respective annual Fisheries Statistical Reports produced by the Washington Department of Fish and Wildlife. 1995 is the most recent annual report published by the WDFW. The 2009 revenue numbers are obtained from calculations using fish ticket data obtained from the WDFW.

spiked as prices paid by Chinese buyers have skyrocketed (Shamshak and King, 2015). The proportion of total shellfish revenue from crab ranged from a low of 0.27 to a high of 0.39 over 2005-2009. The proportion for oysters ranged from 0.20 to 0.25 over the same time period, while the proportion of revenue from geoduck ranged from 0.21 to 0.31. Note, however, that geoduck accounted for less than 10 percent of shellfish revenue until 1994, when this species began to become relatively more valuable, first exceeding 20 percent of total revenues in 1998. We note that some of the geoduck is harvested from privately owned tideland farms, while "wild stock" geoduck are harvested from public lands.

As with salmon, harvest of shellfish species by treaty fishers was generally quite small as the commercial fisheries for these species developed. Figure 2B indicates that prior to the Rafeedie Decision, through the 1970s and 1980s, harvest of shellfish by treaty fishers was a tiny proportion of total harvest. In the case of the coastal crab fishery, tribal participation was presumably limited—at least in part—by the fact that crabbing has typically been undertaken with large vessels, and fishers without such capital would not have fared well in the fishing race that was encouraged by the regulations of the day.[14] In the case of oysters and clams, tribal participation was limited because oysters and clams were farmed by non-Indians on privately owned tidelands. These issues were addressed in the Rafeedie Decision discussed below.

III. *U.S. v. Washington*

A. The Boldt Decision

Though Native Americans were always recognized as having some treaty-based access to the fishery, the extent of their rights had been an issue of litigation since the turn of the 20th

[14] The regulatory system governing crab was effectively "regulated open access" (Homans and Wilen 1998). In this system, the regulator sets a total allowable catch (TAC) but there are no limits on entry.

century.[15] In 1970, after a series of arrests by state officials of Indians fishing off their reservations, the U.S. government decided to pursue litigation that would clarify fishing rights. *U.S. v. Washington* was filed in Federal District Court by the U.S. Department of Justice on behalf of 14 Washington tribes with the objective of forcing the State of Washington to recognize the tribes as a group having rights distinct from those of other fishing groups. In February of 1974, after three-and-a-half years of litigation, Judge Boldt ruled that as signatories to the treaties, the tribes had reserved a fair share of the resource for themselves. This fair share, Judge Boldt determined, was equal to up to half of the harvestable fish.

Although these initial rulings became the cornerstone of the "Boldt Decisions," litigation continued. In 1978, the Washington State Supreme Court ordered the Department of Fisheries not to enforce the Boldt decision because it violated the equal protection provision of the U.S. Constitution. In response, the federal court took over management of the fishery from the state. In 1979, the U.S. Supreme Court denied the state's appeal on the central issue of a 50 percent share, but agreed that tribal catches for subsistence and ceremonial fish would be counted toward the tribal allocation (see the timeline in figure 3). Tribal catch first reached half of the fish harvested in 1980 and effectively stayed there after 1982 (see figure 1).

To promote a smoother transition, the federal court ordered the state to implement programs that would significantly reduce the harvest by non-treaty fishers. In addition to decreasing the seasons and allowable catches of the non-treaty fishers, the state instituted a license moratorium, began programs to compensate fishers for leaving the fishery, imposed smaller limits and shorter fishing seasons on sports fishermen, and stopped renewing licenses for commercial fishermen who did not fish every year. Though this process took time, the size of

[15] See, for example, United States v. Winans, 198 US 371, 1905; Duwamish, et al., Indians v. United States, 79 Ct.Cl. 530, 1935; State v. Moses, 70 Wash. 2d 282, 1967; and Sohappy v. Smith, 302 F. Supp, 899, 1969.

the non-Indian fleet was gradually reduced and the number of Native American fishermen grew. From 1975 to 1982, for example, our data indicate the number of tribal fishermen grew from 1,109 to 3,014.

The Boldt Decision did not establish a mechanism by which the treaty tribes would share their 50 percent allocation, but it did create a system of fishing territories based on historical fishing patterns. The U.S. District Court was given the difficult task of defining each tribe's usual and accustomed fishing area (U&A) and ultimately defined U&As for 20 modern Indian tribes having federally recognized reservations.

Most of the U&As have significant areas of overlap, with as many as eight tribes sharing portions of a single U&A. For example, U&As for the Lummi, Suquamish, Swinomish, Tulalip, Skokomish, and the three Klallam tribes (Lower Elwha, Port Gamble, and Jamestown) all overlap. But spatial overlap is only one dimension of the issue. In a temporal sense, because of the migration path of salmon, nearly all of the U&As overlap. As Wold (1989, p. 40) points out, "salmon from, for example, the Squaxin Island's U&A, pass through Makah, Lower Elwha, Jamestown, Port Gamble, Lummi, Skokomish, Swinomish, Suquamish, Tulalip, Muckleshoot, Puyallup, and Nisqually U&As on their way to the spawning grounds." The salmon migration offers a sequence of opportunities to catch fish, with the Makah having the first opportunity and the Squaxin Island having the terminal opportunity.

In 1974, the Northwest Indian Fisheries Commission (NWIFC) was established by the Indian tribes named in *U.S. v Washington* and became the regulatory agency for the treaty fishers. The Boldt decision effectively split the management of the fishery between the Washington Department of Fish (which later became the Washington Department of Fish and Wildlife, WDFW) and the NWIFC.

Roughly concurrent with the Boldt Decision, the Washington State legislature froze the number of available non-treaty commercial vessel licenses. Only those fishers who held licenses between January 1, 1970 and May 6, 1974 were eligible to renew their licenses. In 1977, amendments were added requiring at least one annual food fish landing per license. A federally funded vessel buyback program was also implemented in which selected non-treaty license holders were offered the average of two independent valuations for their vessel. The vessels purchased by the state were then auctioned off, with the stipulation that the buyer could not use the vessel to fish for salmon in the Washington fishery. The licenses held by the fishers who sold their vessels in the buyback program were effectively eliminated from the Washington fishery. Between 1981 and 2001, approximately 1,500 fishing vessels (and the associated licenses) were purchased from non-treaty fishers through four additional buyback programs (Muse 1999). The limited entry programs helped preserve rents for non-treaty fishers who remained, while the buyback programs offered financial compensation to those who exited.

B. The Rafeedie Decision

The Boldt Decision determined that treaty fishers had the right to catch 50 percent of the annual harvestable salmon but it said nothing about tribal shares of various shellfish species.[16] The Stevens treaties contain a relevant caveat for tribal rights to harvest shellfish that is referred to as the "shellfish proviso." This clause states that treaty fishers "shall not take shellfish from any beds staked or cultivated by citizens." For more than three decades following Judge Boldt's ruling there was ongoing legal wrangling regarding the appropriate interpretation of this proviso.

[16] Total revenues from species other than salmon and shellfish have been (and continue to be) considerable in the Washington fishery, although they declined slightly (in real terms) over the 1970–2010 period. Because the portion of these revenues going to treaty fishers has been small over that period, we limit our discussion to salmon and shellfish.

This extended litigation battle was fought because of (1) the particular characteristics of some shellfish species and (2) property rights to tidelands that were different in Washington than elsewhere in the United States.

Whereas crabs and shrimp reside in open waters and may move considerable distances, oysters and clams are stationary and live in tidelands. This difference among species suggests that (*ceteris paribus*) the costs of establishing private property rights are lower with oysters and clams than with crabs and shrimp. These cost differences are consistent with the observation that in Washington, whereas crab and shrimp fishing are governed by the rule of capture, nearly all the usable tidelands are privately owned by oyster farmers who have invested in the productivity of their lands.[17]

In 1989, 16 tribes were joined by the United States in filing a Request for Determination with the district court to interpret the Stevens Treaties' shellfish proviso and define their shellfishing rights.[18] Lining up to contest the tribes' claims were the Puget Sound Shellfish Growers, the Adkins group of private tidelands owners, and the United Property Owners of Washington (U.S., D.O.J. 1998). In 1994, Judge Rafeedie ruled that the tribes had the right to harvest 50 percent of naturally occurring shellfish and that the purpose of the proviso was to "exclude Indians from artificial, or planted shellfish beds; (the parties to the Treaties) neither contemplated or desired that the Indians would be excluded from natural shellfish beds."[19]

[17] Washington became a state in 1889. In 1995, the Bush and Callow Acts were passed. The first of these allowed oyster farmers to purchase tidelands they had been using to farm oysters, whereas the second allowed citizens to buy tidelands provided they raised oysters on the land. In other coastal states, clam and oyster farmers operate on lands leased from the states in which their operations are located.

[18] "Request for Determination" as sub proceeding 89-3 of *United States v. Washington*.

[19] *United States v. Washington* –"The Rafeedie Decision," W.D.Wash. 1994 – 873F. Supp. 1422, 1441.

In the following year, proceedings were held to determine how the Rafeedie Decision was to be implemented. The court sought to balance the tribes' treaty rights with the rights of the shellfish growers and property owners, noting that the latter "are, effectively, innocent purchasers who had no notice of the Tribes' Treaty fishing right when they acquired their property." Contentious issues related primarily to oyster and clam harvesting that had to be resolved included (but were not limited to) whether lands maintained by the State for recreation shellfishing were to be exempted from tribal harvest; the appropriate definition of a "natural shellfish bed;" the extent to which tribes would be allowed harvest from beds that had been cultivated by shellfish farmers; and the restrictions to be placed on whether, how, and when tribal fishers could harvest from private property.

Disputes regarding these issues were not resolved until 2008, at which point the tribes agreed to forego their treaty rights to annually harvest an estimated $2.1 million from commercial growers' operations. In return, a trust with $33 million in funds ($11 million from Washington state and $22 million from the federal government) was established for the tribes to use to enhance existing tidelands on reservations and on lands purchased or leased from private owners. Members of the Puget Sound Shellfish Growers Legal Defense Fund also agreed to provide $500,000 over a ten year period for enhancement of shellfish habitat on public tidelands to be identified by the state.

Judge Rafeedie also allocated 50 percent of the share of crab and shrimp, which reside in open waters and may move considerable distances. Because the crab fishery is economically important, both in Puget Sound and along the coast, the division of the crab catch was controversial. To soften the impacts on coastal non-Indian crabbers, the state limited entry by non-treaty fishers in 1995 and initiated buyback programs, immediately after Rafeedie (figure 3).

C. Revenue Impacts of *U.S. v. Washington*

The Boldt and Rafeedie Decisions were viewed by some as wealth transfers from non-treaty to treaty fishers. Here, we demonstrate why that view is at least partially correct by examining the impacts of the court decisions on fishing revenues. The first point to make regarding attempts to measure the impacts of the Boldt Decision on salmon fishers is that care must be taken not to confound the impacts of the decision with the state-wide decline in the salmon fishery that occurred for unrelated reasons. We accomplish this here by only comparing the pre-Boldt years to the post-Boldt years up to the point in time when the salmon fishery began its decline. In figure 1, the stock decline in the Washington salmon fishery can be seen in the series labelled "All." Whereas there had long been substantial year-to-year variation in the total number of salmon caught, it was only in the early 1990s that the number of fish harvested began to decline without recovering (except for a positive spike at the end of the series, in 2009). The plot in figure 2A indicates that real revenues fell below their 1970-1972 levels in 1991 and did not recover. Figure 1 also indicates that it took treaty fishers until 1980 to harvest their 50 percent share of salmon.

The decline in salmon revenue from 1987 to 2009 resulted from a decline in salmon populations but also from a decline in prices paid for wild salmon. [20] In 1987, the average price paid to fishermen per pound harvested was $3.48 for chinook; $1.99 for Chum; $0.98 for Pink; $3.19 for coho; and $3.09 for sockeye, all in 2014 dollars. By 2009, the average price had declined to $2.34 for chinook; $0.69 for chum; $0.25 for Pink; $1.14 for coho; and $1.74 for sockeye. Moreover, the distribution of salmon catch shifted from 25 percent pink salmon in

[20] This decline in wild salmon prices is probably attributable to a steady rise in farmed-raised salmon, particularly from the late 1980s until present (see Asche and Bjorndal 2011).

1987 to 75 percent pinks in 2009. This is important because pink salmon command the lowest price of the five species.

Based on the preceding observations, most of the revenue effects of the Boldt Decision were concentrated between 1981 and 1990. According to the fish ticket data that underlie figure 2, salmon revenue for treaty fishers averaged $6.67 million (in 2014 dollars) over 1970 and 1971, a baseline period before the Boldt Decision. This pre-Boldt revenue compares with the $50.6 million in average revenues earned by treaty fishers for the years 1981-1990. This suggests that the Boldt decision resulted in an annual increase in treaty fishers' revenues from salmon fishing of roughly $44 million per year.

From the data underlying figure 2A, the average revenue of non-treaty fishers for the years 1970-1971 was $103 million. By comparison, non-treaty salmon revenues averaged $59 million per year over 1981-1990. These comparisons imply that treaty fishers lost about $44 million (= $103 million - $59 million) in revenue per year because of Boldt. As might be expected given the terms of the Boldt Decision, the revenue gains to treaty fishers were roughly equal to the losses incurred by the non-treaty fishers.

Next, consider the revenue impacts of the Rafeedie Decision on treaty and non-treaty fishers. From figures 2B and 2C, it is clear that there was an increase in the revenues of treaty fishers following the 1994 Refeedie Decision. Moreover, it appears that the adjustment period was considerably shorter for shellfish than for salmon following the Boldt Decision, with treaty shellfish harvesting adjustments fully accomplished within three years of the decision. Also, in contrast to the salmon fishery, shellfish revenue comparisons for the pre- and post-Rafeedie periods are not confounded by a reduction in harvests and revenues from shellfish. From figure

4, it is clear that the revenue benefits were concentrated in the crab and geoduck fisheries, with the 2008 settlement primarily representing the compensation for naturally occurring oysters.

Accordingly, the impacts of the Rafeedie Decision on tribal revenues is best estimated by comparing average revenues over the years 1980-1990 with revenues from 1998 – 2009. Using the state of Washington's Dept. of Fish and Wildlife's fish ticket data, we estimate real annual shellfish revenues for the early time period to be $1.7 million per year, whereas estimated average annual revenues for the later period are $32.5 million per year. Based on these estimates, treaty shellfishers saw annual revenue gains of about $31 million from the Rafeedie Decision. The Rafeedie Decision resulted in only a partial transfer of revenue from non-treaty fishers, however, because the tribal share of total catch in the crab fisheries had not reached 50 percent by 2009. Although the treaty fishers have reached their share of the crab harvest in Puget Sound, they do not catch their share in the coastal crab fishery, likely because the capital costs of entry into the coastal fishery are high.

IV. Rents in Washington Fisheries after *U.S. v. Washington*

Although the Boldt and Rafeedie Decisions shifted significant fishery revenues to members of treaty tribes, we emphasize that gross revenues are a poor measure of benefits to a group of fishers, because harvest costs can be substantial. Moreover, these harvest costs depend critically on the regulatory regime that governs harvest. When the regulatory system encourages a competitive race to harvest, fishing costs rise and net economic gains fall. By contrast, when the regulatory system rewards restraint and coordination, fishing costs are lower and net economic gains are higher. In this section, we discuss the level of rents captured from fisheries

under different regimes and characterize the non-treaty and treaty salmon, oyster, crab, and geoduck fisheries within those regimes.

A. Rents under Different Regulatory Regimes

Table 1 summarizes the economic gains from fisheries under different regulatory regimes. Under regulated open access, anyone can use the fishery until the TAC is reached. Ownership is governed by the rule of capture. Aggregate economic gains from the fishery are low because entry continues until the fishery is congested and seasons are short, raising capital costs per unit of effort to a point where (assuming homogeneous fishers) profit for the fishery approaches zero (Homans and Wilen 1997). When there is heterogeneity among fishers in terms of skill or capital, there will be a small number of "highliners" who profit within this system, but most users will merely sustain (Johnson and Libecap 1982, Karpoff 1987). Examples of this regime include the Washington salmon fishery between 1934 and 1975, the Washington coastal crab fishery prior to 1995, the Washington oyster fishery prior to 1895, and the Canadian geoduck fishery prior to 1979.

Limited entry systems cap the number of vessels permitted to compete for a fishery-wide TAC and are now prevalent in U.S., Canadian, and European waters and govern non-treaty salmon and crab fisheries in Washington State. Because the licenses are transferable, the right to enter can be sold to other fishermen through private transactions. Relative to open access, limited entry suppresses the overcapitalization problem of "too many boats chasing too few fish."[21] The positive license prices observed in many limited entry fisheries indicate that rents are earned in those fisheries (Wilen 1988), including Washington's non-treaty salmon fishery in the late 1980s

[21] To be effective, the licensing requirement has to fix one input, for example one vessel per license (see Boyce 2004, Deacon et al 2011).

(see Parker et al. 2012). Some rents are competed away under limited entry, however, because the rule of capture is in effect. The rule of capture in a limited entry fishery encourages socially wasteful competition for fish on the "intensive margin," meaning that license holders have the incentive to engage in derby-style fishing until the TAC is reached (Grafton et al. 2000). This system is particularly wasteful in the context of salmon fishing. Because salmon migrate annually to rivers to spawn, efforts to intercept them further at sea—by leapfrogging other fishermen—raises aggregate costs without increasing the quantity or quality of catch (Deacon et al. 2013).

Table 1 summarizes two solutions to the salmon interception problem, regimes 3 and 4. Regime 3 grants individuals or small groups secure property rights to specific riverside fishing locations. For the rights to be meaningful, fishing in open seas must be prohibited by law or by technological or social constraints. An example of regime 3 is the Native American family and clan ownership of sites and stationary salmon weirs affixed to rivers during the mid-1800s (Boxberger 1989, Johnsen 2006). Another example is corporate ownership of fish traps in Washington and Alaskan waters during the early 1900s (Higgs 1982, Colt 1999). Like weirs, the stationary fish traps were efficient at catching salmon because the unit cost of trapping fish was lower than that of mobile gear, which required more labor inputs and marine fuel—cost savings were perhaps as high as 90 to 95 percent (Barsh 1977). While granting property rights to specific sites creates rents in salmon fisheries, this can be politically unpopular because benefits are concentrated.[22] For relatively immobile shellfish resources, however, private ownership of tidelands is tolerated. This is the dominant system in the Washington non-treaty oyster, clam, and geoduck fisheries.

[22] The stationary fishing sites lost economic value with the advent of gasoline powered purse seines after 1910, and when Washington and Alaskan politicians sided with individual fishermen over out-of-state corporations and banned the practice of fish traps (Higgs 1982, Colt 1999).

The second conceptual solution to the salmon interception problem is regime 4, in which fishers coordinating their effort as a single enterprise, sharing costs and revenues. Where such coordination has been attempted, such as the Chignik salmon cooperative in Alaska during 2003-2005, the rent gains have been significant (see Deacon et al. 2013). Under the cooperative system, fishermen do not have incentives to race or to intercept salmon out at sea. The cooperative system therefore potentially eliminates most of the capital used in a limited entry mobile fishery (e.g., purse seines, trollers, and gill net boats) thereby dramatically reducing costs.

Crabs are different because they are more mobile than oysters and clams, but less predictable than salmon in their mobility. For this reason, spatial property rights systems are generally not feasible for crab but some crab fisheries are now governed by individual tradable quotas (ITQs). Under this regime (#5 in table 1), incentives to race are minimal because quota holders have secure rights to a share of the total harvest (Grafton et al. 2000, Costello et al. 2008). ITQs can be politically contentious insofar as they lead to concentrated profits among a relatively small number of rights holders (Grainger and Parker 2013).

B. Rents in Washington's Treaty Fisheries

Where do the Washington treaty salmon, crab, and geoduck fisheries fall within the regulatory schematic outlined in table 1? We note above that the Boldt Decision did not define a means by which the treaty tribes would share the 50 percent allocation, but it did set up a system of fishing territories (usual and accustomed areas or U&As) based on historical fishing patterns. These U&As are broad zones that extend into marine waters and according to Barsh (1977), do not match the riverside locations where salmon were caught prior to the treaties. Moreover, the

U&As often overlap each other with multiple tribes sharing U&As.[23] Therefore, although the Boldt and Rafeedie Decisions could, in principle, have created a system of individual and group rights to fishing locations, in practice, the U&As are too coarse for the benefits of regime 3 to be realized.

Neither do the treaty fisheries fall cleanly within regime 4 in table 1. Boxberger (1989) notes the Boldt tribes could conceivably have coordinated their effort as a single fishing enterprise, sharing costs and revenues and reaping the benefits of regime 4. The Boldt Decision, however, made the prospects for inter-tribal coordination of fishing effort slim. By assigning usual and accustomed areas that gave some tribes superior access to migrating salmon, the decision significantly raised the transaction costs that tribes would have to overcome to achieve a widely acceptable coordinated solution.

Of the remaining possible regimes, a combination of regimes 1 and 2 in table 1 best characterizes the treaty fisheries affected by the Boldt and Rafeedie Decisions. On one hand, the treaty salmon, crab, and geoduck fisheries have features of regulated open access fisheries (regime 1) because there is not a fishery-wide limited license system in place. The incentive for tribal governments to limit fishery access to their members seems weak for two reasons. First, the overlapping U&As created by the Boldt Decision mean that limits on access by one tribe could result in more fish being caught by other tribes with overlapping U&As. Second, imposing limited entry takes political will because there are winners and losers in the transition from open access (Grainger and Parker 2013). While the transition to limited entry creates aggregate economic rents, the transition likely involves wealth transfers and may also create economic inequality.

[23] As Wold (1989) points out, the district court decisions did not distinguish between parts of overlapping U&As that should be controlled by a particular tribe and those that were open to others. Instead, the decisions demarcated areas in which tribes could fish without being subject to state regulations.

On the other hand, the treaty salmon, crab, and geoduck fisheries may, in some ways, be a *de facto* limited entry system (regime 2). This is because participation is limited to tribal members, and tribal membership is limited. According to a 2005 Bureau of Indian Affairs, Indian Labor Force Report, there were approximately 30,000 members of the Boldt and Rafeedie Tribes. The on-reservation American Indian population in 2010 for the Boldt tribes was approximately 20,000.[24] Assuming that the 18 to 65 year old population is most likely to fish implies there were approximately 19,000 treaty tribal members of "fishing age," with about 12,000 of these living on reservations during the mid- to late-2000s.

For context on whether or not tribal populations create a *de facto* limited entry system, consider that the optimal number of non-treaty commercial salmon licenses in 1991 was estimated by Muse (1999) to be 1,350, and that there were actually 1,671 salmon licenses in 1999, prior to the implementation of another buyback program in 2001-2002. During the years 2005-2009, salmon catch in the non-treaty commercial fishery was executed by an average of only 388 license holders per year according to fish ticket data. In Washington's non-treaty coastal commercial Dungeness crab fishery, there are currently 228 licenses. In the Puget Sound non-treaty fishery there are 248 licenses.[25] Comparing these numbers with tribal fishing age populations suggests that, at least in recent years, populations are great enough that there is not a *de facto* limited entry system in the treaty fishery as a whole. The situation may have been different in the 1970s and 1980s, however, when treaty fishing age populations were smaller and the salmon runs were larger.

[24] This population estimate is based on U.S. Census respondents who reported American Indian as a single race. The number is larger if we include respondents who checked American Indian along with other races.
[25] Washington Department of Fish and Wildlife, Fishing and Shellfishing, Commercial Dungeness Crab Fishery, http://wdfw.wa.gov/fishing/commercial/crab/

VI. Net Income Impacts of *U.S. v. Washington*

Because we do not have detailed data on the costs of fishing, we cannot directly compare changes in the profitability of the treaty and non-treaty fisheries over time. In lieu of direct comparisons, here we attempt to measure the extent to which growth in fishing revenue across the Boldt and Rafeedie tribes was translated into higher per capita income on each tribe's reservation.[26] We employ income data from the 1970, 1980, 1990, 2000, and 2010 U.S. census reports. The Census decadal reports are a comprehensive source of American Indian income data, with the caveat that in the 1970 census, data are reported for only seven of the Boldt treaty tribes. Data are reported for 15 Boldt treaty tribes in 1980, and for most of the Boldt and Rafeedie treaty tribes in 1990, 2000, and 2010.

For each decade, we estimate simple first-difference regressions of the form:

$$\Delta Income_r = \alpha + \eta(Initial\ Income)_r + \beta(\Delta Salmon\ Revenues)_r + \mu(\Delta Shellfish\ Revenues)_r + \lambda(Boldt \text{ or } Rafeedie\ Dummy)_r + \varepsilon_r,$$

where *r* indicates the reservation, with sample sizes varying from a low of 94 for the 1970 - 1980 decade, to a high of 158 for the 2000 to 2010 decade. The regressions control for the initial income level at the beginning of each decade to allow for the possibility of convergence or divergence in reservation level incomes (Barro and Salai-Martin 1992). The coefficients of primary interest are β, μ, and λ. The β and μ coefficients measure the relationship between decadal changes in income per capita and decadal changes in salmon and shellfish revenue at the tribal level. The λ coefficient measures the correlation between indicator variables for Boldt or Rafeedie treaty tribes and changes in income. Hence, λ measures the relationship between being a treaty tribe and changes in income, holding constant changes in each tribe's fishing revenues.

[26] We interpret the income information from the census data as corresponding (roughly) to Adjusted Gross Incomes reported on federal income tax forms, which includes a measure of tribal net income from fishing.

The coefficients β and μ measure any linear relationships between changes in fishing revenues and changes in incomes for the Boldt and Rafeedie tribes.

Table 2 reports the ordinary least squares (OLS) estimates in four specifications, one for each decade. We employ standard errors that are robust to heteroskedasticity (in parentheses), and that are clustered by U.S. state (in brackets) to allow for reservations within states to share a common error structure.[27] Clustering the standard errors allows for a more flexible error structure, but due to the limited number of states with reservations in the sample, the clustered standard errors are potentially biased.

Column 1 in table 2 presents regression estimates for the 1970 to 1980 decade. During this decade, total salmon revenue across all of the Boldt treaty tribes increased by $44 million, from an average of $6.67 million in the 1970-1971 season, to an average of $50.8 million in 1978-1979 (in 2014 $s). Some tribes, such as the Lummi, garnered a large portion of the $44 million increase in salmon revenue whereas other tribes garnered very little.[28] The coefficient of $\hat{\beta}$ =0.10 in column 1, which is statistically significant at the 0.10 level, suggests that an increase of $1 million in salmon revenue was associated with a $100 increase in per capita income. For perspective, the mean 1970 per capita income for the seven Boldt tribes in the 1970-1980 sample was $9,204 and their mean increase in salmon fishing revenues was $4.2 million. Hence, the average increase associated with salmon fishing was $4.2 x 100 = $420. This is a five percent increase, relative to average 1970 per capita incomes. We attribute this positive result to the observation that during this period, there was an abundance of salmon for tribal fishers entering

[27] In cases where the reservation spans multiple states, we locate the reservation in the state for which the majority of the reservation land lies.

[28] The WDFW fish ticket data do not report tribal affiliations until 1975. We estimate the 1970-1971 revenues by tribe by multiplying each tribe's proportion of the 1978-1979 season's revenue by the total treaty revenue in 1970-1971, which was $6.67 million.

the fishery because it took time for the tribal fishery to become sufficiently capitalized and for congestion externalities to take effect.[29]

Column 2 in table 2 reports estimates over the decade from 1980 to 1990. Over this decade, there is a negative relationship at the tribal level between growth in salmon revenues and growth in income per capita ($\hat{\beta}$=-0.32). This relationship is statistically significant if one relies on the clustered standard errors. The Boldt treaty indicator is positive ($\hat{\lambda}$=769) and statistically significant based on the clustered standard errors. These results suggest the Boldt treaty tribes received income benefits from being part of the salmon boom, due to economic spillover benefits from nearby fishing activity. In contrast to the 1970s, gains in fishing revenues during the 1980s required fishers to make costly physical and human capital investments in order to successfully race for fish in a congested fishery, and this helps explain the finding that increased salmon revenues did not generate income gains during the 1980s.

Column 3 reports estimates for the 1990 to 2000 decade. This was the decade in which the Washington salmon fishery collapsed, but the treaty tribes won the Rafeedie Decision and shellfish revenues continued to climb. This is also the decade during which casino gambling became an important revenue generator on some reservations.

In the column 3 regressions, we separate shellfish revenue growth from salmon revenue growth, and note that treaty shellfish revenue grew in aggregate from about $2.8 million at the beginning of the decade to $30 million in the 1998-1999 season. To control for gambling activity, we include a measure of the number of slot machines on reservations as of 1999 from Anderson and Parker (2008). We also control for the change in salmon revenues during the 1980s, to test for the possibility that capital investments in fishing during that decade had longer

[29] See Parker et al. (2013) for more discussion of this issue.

run effects on income growth. The key finding in column 3 is that although growth in shellfish revenue due to the Rafeedie Decision is positively associated with income growth ($\hat{\mu}$ =0.21), this effect is statistically insignificant. The coefficient on the Rafeedie indicator is negative ($\hat{\lambda}$ =-986) but is also statistically insignificant. Hence, the evidence in column 3 suggests the Rafeedie Decision did not in general raise the per capita incomes of the treaty tribes during the 1990s.

Column 4 reports estimates for the 2000 to 2010 decade. During this decade, aggregate treaty shellfish revenue grew from about $30 to $40 million, and the tribes received benefits from the 2008 oyster settlement described above. There was also continued growth in casino gaming on some reservations, which we control for by including the estimated number of slot machines added during 2000 to 2010 from Anderson and Parker (2015).

Turning to the column 4 findings, we draw attention to the negative coefficient on shellfish revenue coefficient ($\hat{\mu}$ =-0.66). This coefficient is statistically significant if one relies on the clustered standard errors, and it may suggest that efforts to increase shellfish revenue in 2000s required investments in racing capital that reduced income growth. The negative and statistically significant coefficient of -0.54 on "Δ in Salmon Revenue over 1980 to 1990" is also noteworthy. This finding indicates that tribes heavily invested in the race for salmon during the 1980s have experienced slower income growth in recent years. This finding merits more research, as it may suggest that concentrated efforts to catch fish during the 1980s crowded out other productive human and capital investments (e.g., going to college, learning non-fishing skills) that now earn a higher return in terms of income generation (see Parker et al. 2013).[30]

[30] The positive coefficient of 1.19 for $\hat{\beta}$ also merits more research, as it suggests that tribes focused on salmon during the 2000s increased their income. We hypothesize this may be because the Rafeedie Decision diverted fishing capital towards catching crab, thereby easing the race to catch salmon and lowering costs in that fishery.

V. Conclusions

Our analysis suggests the effects of the Boldt and Rafeedie Decisions were neither as rosy for the treaty tribes, nor as bleak for non-Indian fishers, as anticipated at the time of the decisions. To be sure, the revenue transfers were substantial. We estimate that the Boldt Decision resulted in a transfer to the treaty fishers of over $40 million in salmon revenue per year from (roughly) 1977 to 1990 and that the Rafeedie Decision resulted in similar transfers of over $30 million in shellfish revenue per year from 1997 to 2009. But, according to our analysis of decadal U.S. Census income data and salmon and shellfish revenues, these revenue transfers did not in general translate into higher per capita incomes on the reservations of treaty tribes.

The main exception is the decade of the 1970s, when increased treaty revenues from the salmon fishery was accompanied by significant reservation-level income growth. This decade was marked by rapid entry of tribal fishermen into the salmon fishery—from 1,109 in 1975 to 3,014 in 1982. There was an abundance of salmon for new entrants because the tribal fishery was not sufficiently capitalized to harvest 50 percent. This suggests that new entrants could harvest salmon without causing congestion and higher costs in the fishery.

In later periods—during the 1980s and beyond—the evidence is consistent with congestion and over-capitalization in the treaty fisheries raising the costs of harvesting such that rents from the court victories were at least partially competed away. We fail to find positive relationships between changes in a tribe's salmon fishing revenues and changes in per-capita income during the 1980s, when the salmon fishery was booming. We also fail to find positive relationships between changes in a tribe's shellfishing revenues and changes in per capita income during the 1990s and 2000s, after the Rafeedie Decision. The evidence also suggests that 2010 incomes of treaty tribes were still negatively affected by the demise of the salmon fishery; tribes

that were heavily invested in salmon fishing during the 1980s had slower income growth during the 2000s.

Although we cannot estimate the effects of the Boldt and Rafeedie Decisions on the income of non-treaty fishers, there are indications that those fishers were not left destitute. Many of the non-treaty salmon fishers who chose to exit the salmon and crab fisheries after the Boldt and Rafeedie Decisions were compensated by government funded buyback programs. The non-treaty fishers that remained in the salmon and crab fisheries were granted limited entry licenses, which are a secure asset that is salable in private markets. Thus, non-treaty fishers who stayed after the court decisions may have benefited from a better managed fishery, and those who exited were compensated.

What will be the legacy of the Boldt and Rafeedie Decisions moving forward, away from the 1970-2009 period that we study? Will the economic gains from the treaty and non-treaty fisheries exceed those of the past? There are reasons for optimism. The state's shellfish industry is healthy and there are indications that Washington salmon runs may be rebounding. The critical issue now is how the state and tribes will choose to manage the fisheries. Economic research demonstrates the value of property rights-based management regimes, but these regimes are contentious, and politicians are at times reluctant to implement them unless a fishery is on the verge of ecological and economic collapse (Libecap 2008). This is perhaps the silver lining of the salmon collapse in the two decades following 1990. This collapse may have bought time for tribal leaders to devise new ways of managing salmon for more profit, with the level of contention being mitigated by low salmon prices and stocks. Because of the demise in salmon, the timing may now be right for tribes to implement management regimes that outperform the rule-of-capture systems that have been employed in non-Indian fisheries in Washington State,

thereby allowing tribal fishers to capture a larger portion of the wealth associated with Washington's salmon and shellfish fisheries.

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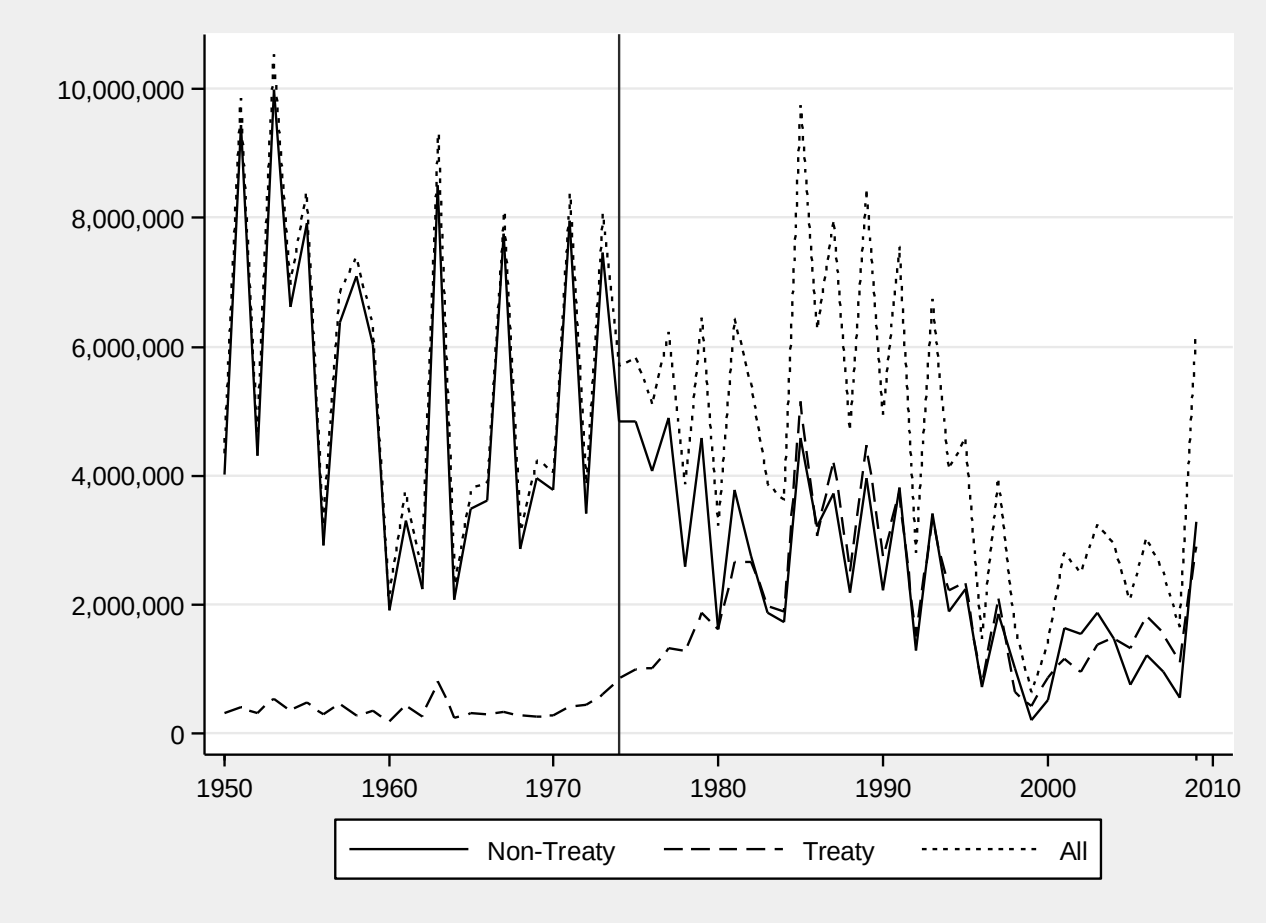
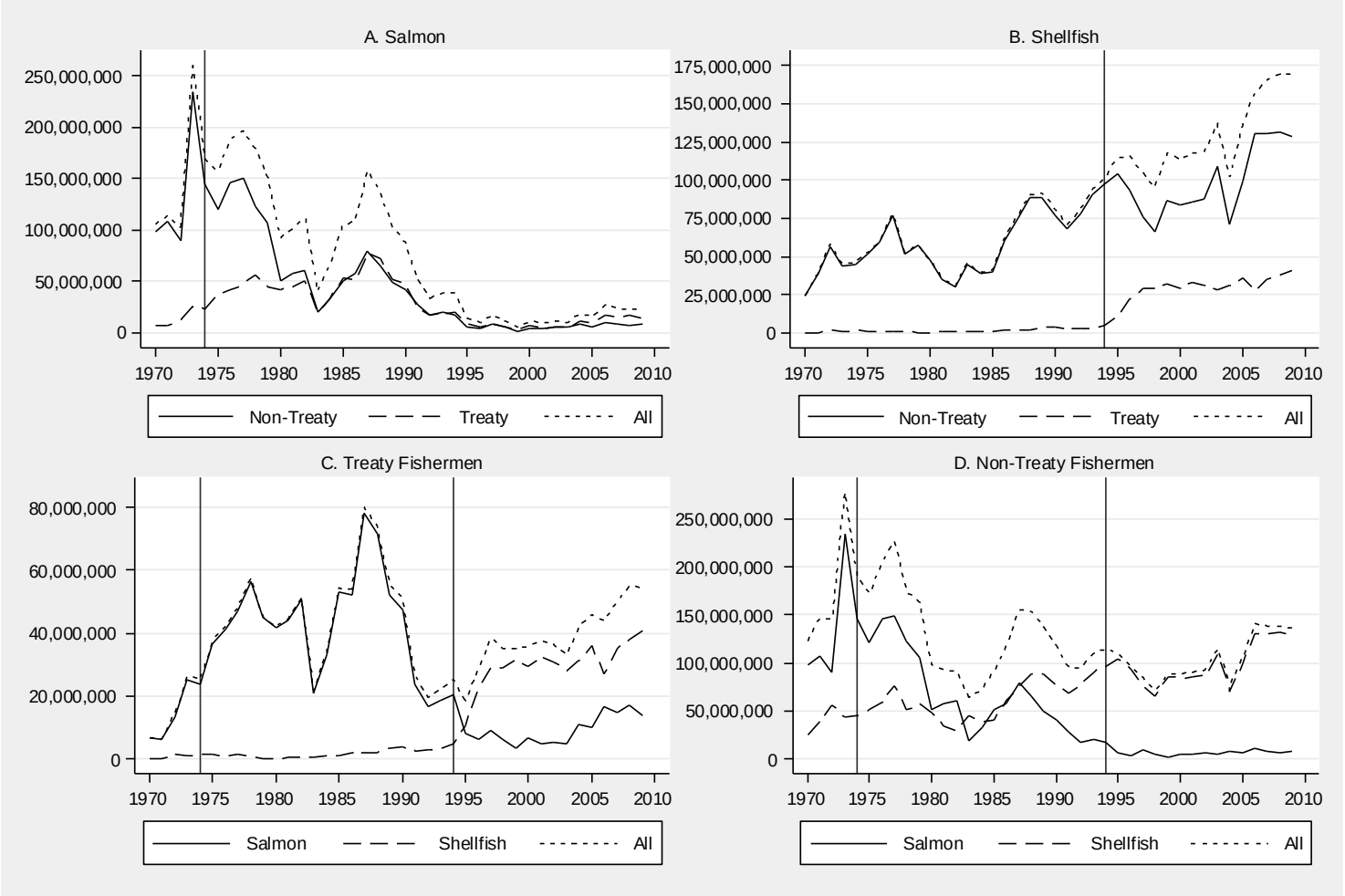
Figure 1: Commerical Salmon Harvest, Numbers of Fish Caught, 1950 - 2009



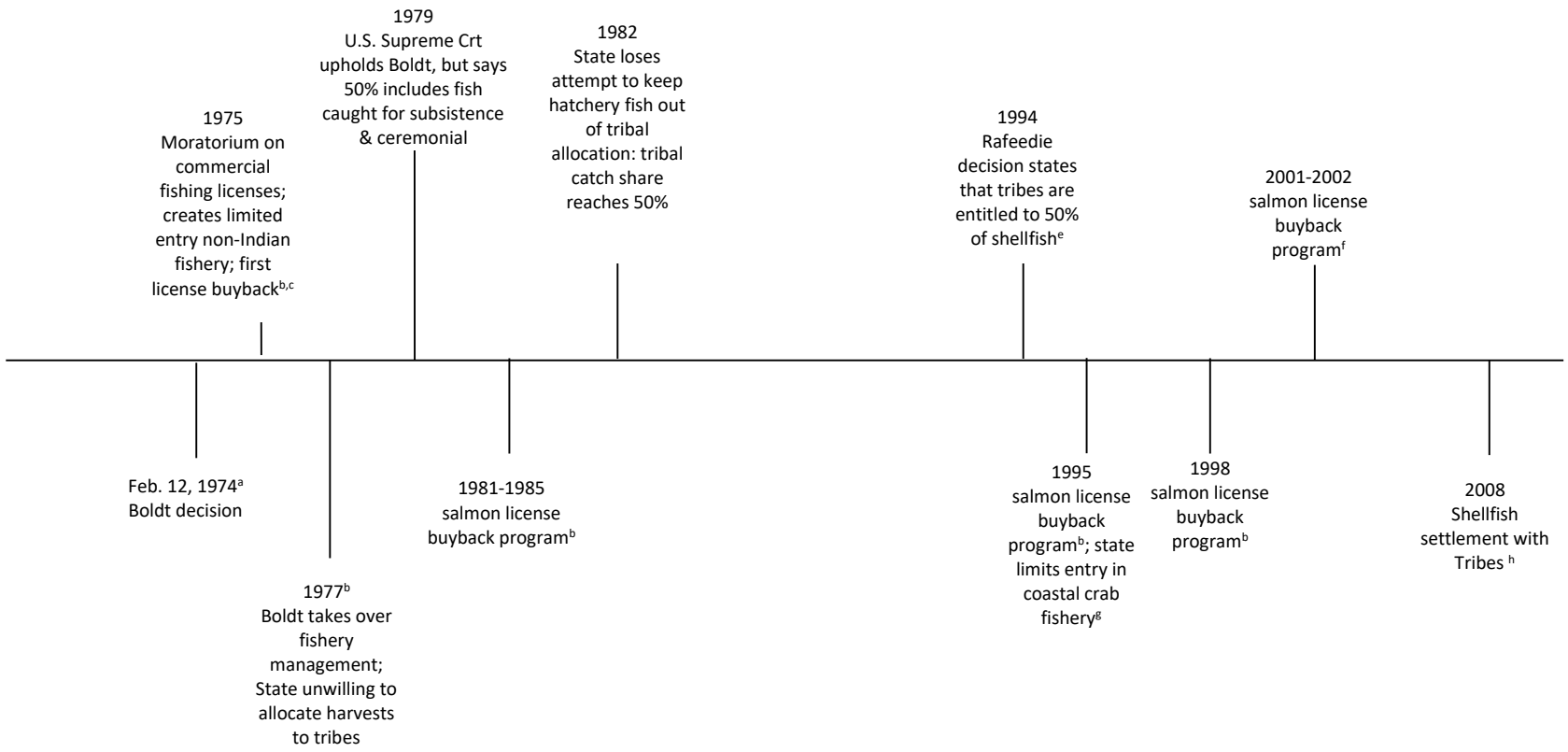
Notes: The vertical lines denote the 1974 Boldt Decision. Prior to the 1970, the data come from Washington State annual fishing reports. For 1970 to 2009, the data come from the authors' compilations of individual fish ticket data provided by WDFW. The linear trend for total salmon over 1950 to 2009 is -58,563 salmon per year (t-statistic for a two-tailed test is 3.55).

Figure 2: Commerical Revenue from Salmon and Shellfish, 1970-2009, in 2014 dollars



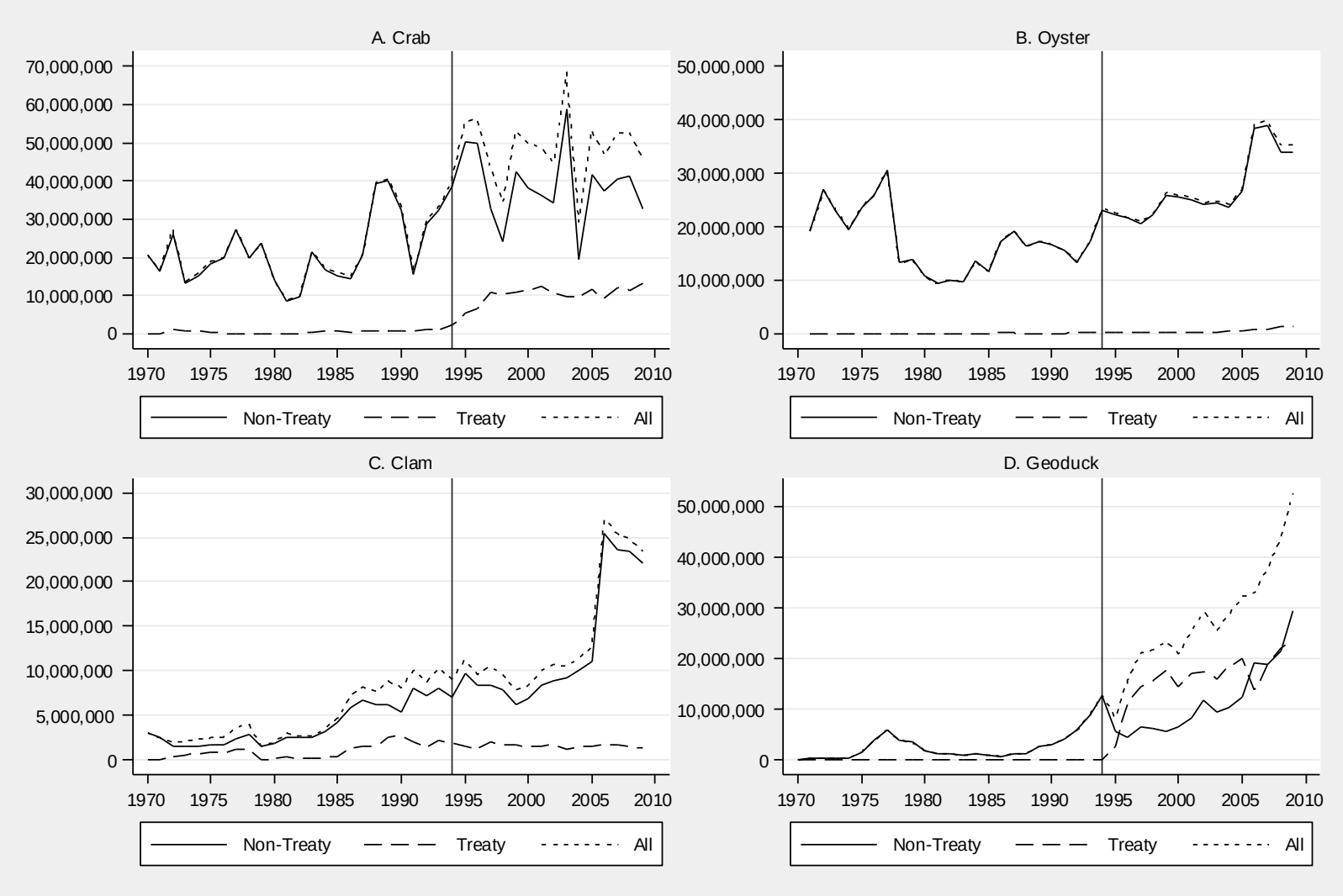
Notes: The vertical lines denote the 1974 Boldt Decision and the 1994 Rafeedie Decision. The linear trend for total salmon revenues in panel A is -4.65 million dollars per year (t-statistic for two tailed test is 8.75). The linear trend for total shellfish revenue in panel B is 3.17 million dollars per year (t-stat is 13.68). The linear trend for total treaty revenue (salmon plus shellfish) in panel C is a positive 330,709 dollars per year (t-stat is 1.52). The linear trend for total non-treaty revenue in panel D is -1.81 million dollars per year (t-stat is 3.27). Salmon revenue in 1973 is higher than in 1971 (panel A) even though catch numbers were similar. This is because salmon prices surged in 1973, and remained high during the 1973 to 1979 period. The graphs are calculated from the WDFW fish ticket data.

Figure 3: Timeline of *U.S. v. Washington* Decisions and Surrounding Events



Sources: (a) *United States v. Washington*, 384 F. Supp. 312 (W.D. Wash. 1974) (b) Kersteter (2000); (c) Schelle and Muse (1984); (d) *Washington v. Washington State Commercial Passenger Fishing Vessel Ass'n*, 443 U.S. 658, 99 S. Ct. 3055; (e) *United States v. Washington*, 873 F. Supp. 1422 (W.D. Wash. 1994); (f) SOURCE IS PAUL WATSON 5-26 PROPOSAL. (g) Washington Department of Fish and Wildlife. 2008. Report to the Washington State Legislature: "Washington Coastal Dungeness Crab Fishery License Buy-Back Program. Available at: www.psmfc.org/crab/2008-2009%20files/WA_buyback_09.pdf

Figure 4: Commerical Revenue from Shellfish by Species, 1970-2009, in 2014 dollars



Notes: The vertical lines denote the 1974 Boldt Decision and the 1994 Rafeedie Decision. The graphs are calculated from the WDFW fish ticket data.

Table 1: Economic Gains from Fisheries under Different Regulatory Regimes

	Regime 1: Open access	*Regime 2: Limited entry*	*Regime 3: Individual or group rights to fishing locations*	*Regime 4: Cooperative or unitized management of harvest*	*Regime 5: Individual quotas to share of stock*
Property Rights	None; rule of capture governs share of TAC[a, b]	Non-license holders prohibited; rule of capture governs share of TAC	Holders can exclude competitors from productive spatial zones.	Users of fishery form a cooperative. Hold rights to share of collective profit.	Holder has secure right to portion of annual TAC
Aggregate net benefits	Low	Medium[c, d]	High[f]	High[g,h]	High[e]
Distribution of net benefits	Dispersed among entrants based on skill & capital	Dispersed among license holders based on skill & capital	Concentrated among individual and group owners	Dispersed among co-op members	Concentrated among individual quota owners
Salmon examples	Washington fishery after ban of fish traps and before Boldt [i]	Non-treaty fishery after Boldt (limited number of licenses)	Native American salmon weirs prior to treaties [i, j] Corporate fish traps in [i,k,l] Alaska and Washington	Chignik salmon cooperative in Alaska[h]	
Crab examples	Crab fisheries in Washington prior to 1980s	Non-treaty Puget Sound crab fisheries beginning in 1980s; WA coastal crab fishery after 1994	Territorial User Rights Fisheries (TURFs) over the snow crab fishery in Japan[n]	Fishery Management Organizations over snow crab fishery in Japan[n]	Individual Tradable Quotas (ITQs) in Alaskan crab fishery[m]
Oyster examples	Washington fishery prior to Bush and Callow Acts of 1895.		Farm raised oysters in Washington after Bush and Callow Act		
Geoduck examples	Straits of Georgia in Canada prior to 1979 [o]	Straits of Georgia fishery in Canada, 1979 to 1989[o]	Farmed raised geoduck in Washington state Non-treaty wildstock fishery in Washington under tract-auction system[p]		Straits of Georgia fishery in Canada after 1989 under individual quota system [o]

Sources and Comments: (a) Gordon 1954; (b) Homans and Wilen 1997; (c) Deacon et al. 2011; (d) Karpoff 1984; (e) Grafton et al. 2000; (f) Wilen et al. 2012; (g) Kaffine and Costello 2011; (h) Deacon et al. 2013; (i) Higgs 1982; (j) Johnsen 2006; (k) Crutchfield and Pontecorvo 1969; (l) Colt 1999; (m) Abbott et al. 2010; (n) Cancino et al. 2007; (o) Shamshak and King 2015; (p) in a competitive auction system, most of the benefits accrue to the state.

Table 2
OLS Estimates of Decadal Changes in American Indian Per Capita Income on Reservations

	Y = Δ in Am. Indian PCI, 1970 to 1980 (2014 $s)	Y = Δ in Am. Indian PCI, 1980 to 1990 (2014 $s)	Y = Δ in Am. Indian PCI 1990 to 2000 (2014 $s)	Y = Δ in Am. Indian PCI, 2000 to 2010 (2014 $s)
	(1)	(2)	(3)	(4)
Am. Indian PCI at start of decade (2014 $s)	-0.42***	-0.48***	-0.12	-0.05
	(0.13)	(0.08)	(0.15)	(0.04)
	[0.12]	[0.09]	[0.18]	[0.05]
Boldt or Rafeedie Tribe Indicator	93.63	769.4	-986.4	551.3
	(1109)	(1013)	(1115)	(1458)
	[392.9]	[319.8]	[708.4]	[535.3]
Δ in Salmon Revenue over decade (000s of 2014 $s)	0.10*	-0.32	0.01	1.19
	(0.05)	(0.31)	(0.23)	(1.14)
	[0.03]	[0.07]	[0.05]	[0.47]
Δ in Shellfish Revenue over decade (000s of 2014 $s)			0.21	-0.66
			(0.82)	(0.71)
			[0.17]	[0.19]
Δ in Slot Machines over decade			1.50***	0.60
			(0.49)	(0.40)
			[0.29]	[0.43]
Δ in Salmon Revenue over 1980 to 1990 (000s of 2014 $s)			-0.08	-0.54**
			(0.37)	(0.26)
			[0.08]	[0.01]
Constant	5653***	4357***	4078***	1387***
	(827.9)	(788.2)	(1390)	(515.9)
	[906.5]	[1052]	[1681]	[523.3]
Observations	96	132	138	158
Adjusted R-squared	0.146	0.343	0.076	0.035
Number of state clusters groups	22	28	28	30

Notes: Robust standard errors are in parentheses, and standard errors that are clustered by state are reported in brackets. * p<0.1, ** p<0.05, *** p<0.01 based on the robust standard errors. The sample size varies across decades because the Census did not report per capita income for the same number of reservations in each time period.