Effects of New Regulations and Policy On the Economic Well-Being and Stability of Puget Sound's Commercial Crab Fishery

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I. STATEMENT OF QUALIFICATIONS

I, Bryce Ward, am a senior economist at ECONorthwest (ECONW), which provides analysis in economics, finance, planning, and policy evaluation for businesses and governments. I have also served as a Visiting Assistant Professor or a Visiting Adjunct Professor at Lewis and Clark College, the University of Oregon, and Portland State University where I taught courses in microeconomic theory, econometrics, public economics, labor economics, and environmental economics. I have testified on economic matters in administrative, legislative, and court proceedings, and I have presented papers at professional proceedings on economics. I received a Ph.D. in economics from Harvard University. I attach a copy of my curriculum vitae as Exhibit A.

II. ASSIGNMENT

As I understand the issues in this matter, the Puget Sound Crab Association (PSCA) believes that the Washington Fish and Wildlife Commission's[1] (WFWC) decision on February 4, 2011 to adopt new regulations to implement policy C-3609[2] (policy) violates statute RCW 77.04.012. This statute states in part that, "the department [Washington Department of Fish and Wildlife (WDFW)] shall seek to maintain the economic well-being and stability of the fishing industry in the state."[3] According to the WDFW estimate, the policy will increase the recreational harvest of Dungeness crab in Puget Sound at the expense of the commercial harvest. WDFW estimates that the projected 2011 commercial catch will decrease by 441,957 lbs[4], which will reduce revenues of commercial crabbers by approximately $1.2 million.[5]

The PSCA asked that I describe the extent to which the new regulations and policy adversely affect the economic well-being and stability of the commercial crabbing industry in Puget Sound. I describe my analysis, results and opinions in this report.

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[1] The nine-member citizen panel that provides guidance to the Washington Department of Fish and Wildlife (WDFW).

[2] "Puget Sound Crab Fishery, Policy Number C-3609", Fish and Wildlife Commission, October 1, 2010

[3] RCW 77.04.012

[4] "Puget Sound Dungeness Crab Fishery," Presentation by Rich Childers: Puget Sound Shellfish Manager, Washington Fish and Wildlife Commission Meeting, January 8, 2011

[5] The WDFW states that the new projected commercial catch will be 2,324,077 lbs and that the new projected commercial revenues will be $6,251,767. This is based on an assumed price of $2.69/lb. If we assume this average price, this means that revenues will decrease by $1.2 million ($2.69/lb * 441,957 lbs=$1,188,864.33)

III. Summary of Opinions

Based on the information available to me at this time, I opine the following.

- The new regulation and policy change will significantly harm the economic well-being and stability of the commercial crabbing industry in Puget Sound.

- WFWC's new regulation and policy will likely reduce commercial harvests and revenues, increase harvester's marginal costs, decrease the ex-vessel prices that harvesters receive for their catch, and reduce profitability.

- WDFW's assessment of the financial effects of the new regulations and policy change on commercial crabbers is fundamentally flawed. WDFW failed to evaluate the regional implications of the change, more likely than not underestimated the price effect, and ignored the consequences on profits, all for the 2011 season. WDFW compounded these failures by not estimating financial consequences of the change on commercial crabbers beyond the 2011 season. Because of these significant errors and omissions, WDFW's estimates of the financial effects of the change do not accurately depict the more than likely true effects.

- The new regulations and policy could contribute to the collapse of commercial crabbing in Puget Sound by increasing damage to the crab resources caused by largely unregulated and unmanaged recreational harvests and by increasing the recreational harvest to levels that leave insufficient crabs to make a commercial effort economically viable.

- WDFW's management of the Puget Sound Dungeness crab fishery violates several principles recommended by economists to maximize the economic well-being and stability of the entire fishery.

Should new information become available, or if I am asked to address additional topics, I may revise the analysis, conclusions and opinions described in this report.

IV. Background

Prior to 1994, the Puget Sound recreational-crab fishery was a year-round fishery. In 1994, a court ruling known as the "Rafeedie Decision" required that the WDFW and the Tribes co-manage Washington's Dungeness crab fishery. Tribal and non-tribal fisheries would split the harvestable surplus of shellfish

equally (50/50). Following the Rafeedie Decision, the WDFW allocated roughly 1/3 of the non-tribal catch to recreational fishers and 2/3 to commercial fishers.[6]

Dungeness crab harvests increased under co-management. Between 1995 and 2005, the combined Tribal and non-tribal commercial harvests in Puget Sound increased from 2.58 to 6.49 million pounds.[7]

During the 2009-2010 season, the Tribal catch accounted for 49.7% of the total, the commercial catch accounted for 34.0% of the total, and the recreational catch accounted for 16.3% of the total. On average, over the 2007/08-2009/10 seasons, the tribal crabbers caught 4,189,303 lbs, commercial crabbers caught 2,867,375 lbs, and recreational crabbers caught 1,316,956 lbs.[8]

Prior to policy C-3609, the state set a target harvest amount in each marine area for recreational users; however, the state did not limit the recreational harvest to this target. The state managed the recreational harvest by limiting effort instead of total catch. Specifically, the state limited an individual's daily catch to 5 male crabs of a minimum size and limited the days the fishery was open to recreational crabbers to four day per week.

As we understand it, the previous rules governing the recreational crab season were[9]:

- July – Labor Day
- Winter Season as remaining quota allows
- 4 days per week (Wednesday through Saturday)
- 5 crab daily bag

The commercial harvest follows the summer recreational season. This means that commercial crabbers harvest whatever is left of the non-Tribal portion of annual catch after the summer recreational season ends.[10] If the harvests by recreational crabbers exceed their target, WDFW reduced the commercial catch. As we

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[6] "CCA Washington Policy Statement, Puget Sound Recreational Crabbing." Coastal Conservation Association Washington; Sonntag, Brian, Washington State Auditor. 2010. *Performance Audit Report Puget Sound Dungeness Crab Fishing*. Washington Department of Fish and Wildlife Report No. 1002690. January 15.

[7] "Management Recommendations for Washington's Priority Habitats and Species." December 2008, Washington Department of Fish and Wildlife.

[8] Tribal: 4,020,432 in 2007/08, 4,104,775 in 2008/09, and 4,442,701 in 2009/10.
Commercial: 2,709,792 in 2007/08, 2,855,730 in 2008/09, and 3,036,604 in 2009/10.
Recreational: 1,141,977 in 2007/08, 1,349,487 in 2008/09, and 1,459,405 in 2009/10.

[9] "Puget Sound Dungeness Crab Policy Review Guidance," Washington Fish and Wildlife Commission, March 31, 2010. Page 3.

[10] Recreational crab fishing takes place in each of six crab-management regions of Puget Sound. Regions 1-3 are shared with commercial crab fishers and Regions 4-6 are exclusively for recreational crab fishers.

understand, the recreational harvest has never been constrained by the commercial catch.[11]

The new rules governing the recreational crab season are[12]:

- July – Labor Day
- 5 days per week (Thursday through Monday)
- October – December Winter Season (7 days/week)
- 5 crab daily bag

The new rules do away with the harvest target for recreational crabbers. They also increase the number of harvest days per week from 4 to 5, and allow recreational harvests on both Saturday and Sunday. The new WDFW Commission policy gives priority to recreational crabbing over commercial harvests. For example, the policy states,

> "Region 1 – In priority order, provide for the recreational seasons prescribed in the General Policy. Provide the commercial fishery harvest opportunities…."
>
> "Region 2 – In priority order, provide for the recreational seasons prescribed in the General Policy. Provide the commercial fishery harvest opportunities…."[13]

Recreational harvests have no quantity limit. The commercial season still follows the summer recreational season, and WDFW still regulates the state portion of the total catch by limiting commercial harvests.

WDFW estimated that the new regulation and policy will reduce commercial harvests and revenues. We describe these official estimates in the next section, Section V. Our analysis finds that the official estimates may underestimate the true impacts of the new regulation and policy on commercial crabbers. We describe our assessment in the sections following Section V.

V. Official Estimates of Impacts of New Policy on Puget Sound Commercial Crabbing Industry

WDFW estimated the impact of the new regulation and policy on commercial harvests and revenues using the following assumptions: [14]

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[11] Sonntag (2010).

[12] New Washington Administrative Code adopted February 4, 2011; "Puget Sound Crab Fishery, Policy Number C-3609", Fish and Wildlife Commission, October 1, 2010.

[13] Washington Fish and Wildlife Commission Policy Decision. Policy Number C-3609, effective October 1, 2010.

[14] Childres, R. 2011. "Puget Sound Dungeness Crab Fishery," PowerPoint Presentation, Washington Fish and Wildlife Commission Meeting. January 8.

- Saturday catch for the summer season would not change from the recent (2007-09) period
- Sunday catch for the summer season would be equivalent to the Saturday catch
- Friday catch for the summer season would equal an average Friday catch
- The catch for each summer weekday would equal an average weekday
- The winter catch during October, November, and December was projected based on historical monthly averages

To estimate the 2011 commercial catch, WDFW assumed that the total harvest would increase as expected, that the tribes would receive half, that the recreational catch would increase as described above, and that the commercial harvest would equal the remainder.[15]

We summarize WDFW's official estimate of the effect of the rule change on the commercial and recreational catch in Table 1.

Table 1. Commercial and Recreational Catch Estimates by WDFW

	Commercial	Recreational
WDFW 2011 Projected catch	2,324,077 lbs	1,832,417 lbs
WDFW 2005-2009 Average catch	2,766,034 lbs	1,276,800 lbs
WDFW Projected change in catch	-441,957 lbs	555,617 lbs

Source: "Puget Sound Dungeness Crab Fishery," presented by Rich Childers; Puget Sound Shellfish Manager, Washington Fish and Wildlife Commission Meeting, January 8, 2011

WDFW also estimated the impact of the rule change on 2011 commercial harvester revenues. For this estimate, they assumed that the price in 2011 will equal the average price from 2007-09. The WDFW's official estimate of the affect of the rule change on the commercial revenues is summarized in Table 2.

Table 2. Commercial Revenue Estimates

	Commercial
WDFW 2011 Projected Revenues	$6,251,767
WDFW 2005-2009 Average revenues	$7,440,631[a]
WDFW Projected Change in Revenues	-$1,188,864[a]

Note: a) The WDFW states that the new projected commercial catch will be 2,324,077 lbs and that the new projected commercial revenues will be $6,251,767. This is based on an assumed price of $2.69/lb. If we

[15] Childres (2011).

assume this average price, this means that revenues will decrease by $1.2 million ($2.69/lb * 441,957 lbs=$1,188,864.33)

WDFW's assessment of the financial effects of the new regulations and policy change on commercial crabbers is fundamentally flawed. WDFW failed to evaluate the regional implications of the change, more likely than not underestimated the price effect, and ignored the consequences on profits, all for the 2011 season. WDFW compounded these failures by not estimating financial consequences of the change on commercial crabbers beyond the 2011 season. Because of these significant errors and omissions, WDFW's estimates of the financial effects of the change do not accurately depict the more than likely true effects.

VI. Consequences of the New Regulation and Policy Change on the Economic Well-Being and Stability of the Commercial Crabbing Industry in Puget Sound

Based on the information available to date, I opine that more likely than not the regulation and policy change will harm the economic well-being and stability of the commercial-crabbing industry in Puget Sound. In this section I describe the information and analysis upon which I base this conclusion.

Before describing the impacts of the policy on economic well-being and stability we must first define these terms. We[16] do so in subsection A below. In subsection B, we describe the results of our analysis of the effects of the regulation and policy change on the economic well-being and stability of the commercial-crabbing industry in Puget Sound.

A. Economic Well-Being and Stability

Washington statute, RCW 77.04.012, states, in part:

> "…The department shall conserve the wildlife and food fish, game fish, and shellfish resources in a manner that does not impair the resource. In a manner consistent with this goal, the department shall seek to maintain the economic well-being and stability of the fishing industry in the state. The department shall promote orderly fisheries...."[17]

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[16] Throughout this report I use "we" and "our" to represent me and my ECONorthwest colleagues, who worked on this matter under my direction.

[17] http://apps.leg.wa.gov/rcw/default.aspx?cite=77.04.012

For information on the terms "economic wellbeing" and "economic stability" we reviewed sources including information from the National Marine Fisheries Service and other federal agencies, dictionaries, and economic textbooks.

A report published in 2000, and updated in 2007, by the National Marine Fisheries Service (NMFS) describes the guidelines by which federal agencies assess the economic effects of regulatory actions on fisheries and fish-harvesting businesses.[18] These guidelines apply specifically to analyses under the Regulatory Flexibility Act (RFA), which describe the impacts of proposed rules on small firms. Analyses conducted as part of an RFA include describing the extent to which the proposed regulation would create "significant economic impacts"[19] on small fish-harvesting or -processing firms.[20] One measure of significant economic impact is a regulation's effect on profitability,

> "Profitability. Does the regulation significantly reduce profit for a substantial number of small entities? If the answer is "Yes," the rule should not be certified."[21] [emphasis in original]

NMFS defines "a substantial number" as follows,

> "The term 'substantial number' has no specific statutory definition …"
>
> …
>
> "Generally, a rule is determined to affect a substantial number of entities if it impacts more than just a few small entities."[22]

Standard 8 of the Magnuson-Stevens Act also requires that analyses of proposed policy changes that affect fisheries take into account the impacts on "fishing communities."[23] In one case, a Standard 8 analysis used a harm threshold of a

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[18] National Marine Fisheries Services. 2007. *Guidelines for Economic Reviews of National Marine Fisheries Service Regulatory Actions*. Office of Sustainable Fisheries. Silver Spring, Maryland 20910. March.

[19] NMFS (2007), p. 25-26.

[20] The definition of a small fishing firm as described by NMFS: "Any fish-harvesting or hatchery business is a small business if it is independently owned and operated and not dominant in its field of operation and if it has annual gross receipts not in excess of $4.0 million." NMFS (2007), p. 24. [emphasis in original]

[21] NMFS (2007), p. 26-27.

[22] NMFS (2007), p. 28.

[23] Manguson-Stevens Act, Sec. 600.345 National Standard 8—Communities.

revenue loss of 5 percent for 20 percent or more of the affected fishing participants.[24]

A report published in 1985 by the National Oceanic and Atmospheric Administration describes the economic health of a commercial-fishing industry as measured by costs and revenues or net profit,[25]

> "Changes in landings, value, prices and consumption … are useful indicators of the general status of the commercial fishing industry in terms of overall relative growth. However, these changes do not necessarily give insight into the economic health of the industry which is determined by both costs and revenue. If appropriate data were available industry health could be expressed as net profit or through other measures such as rate of return on investment."[26]

The Merriam-Webster on-line dictionary defines the following relevant terms:

- "prosperity: the condition of being successful or thriving; especially: *economic well-being* …"[27] [emphasis added]
- "stability 1: the quality, state, or degree of being stable: as …
  b: the property of a body that causes it when disturbed from a condition of equilibrium or steady motion to develop forces or moments that restore the original condition …
  Examples of Stability – the country's political and economic stability …"[28]
- "volatile: … 4 b: characterized by or subject to *rapid or unexpected change* …"[29] [emphasis added]
- "industry: … 2a: systematic labor especially for some useful purpose or the creation of something of value; b: a department or branch of a craft, art, business, or manufacture; *especially*: one that employs a large

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[24] Laurence, M. 2002. "A Call to Action: Saving America's Commercial Fishermen." *William & Mary Environmental Law and Policy Review*, 26:3 pages 825-854.

[25] Norton, V., M. Miller, and E. Kenney (NOAA). 1985. *Indexing the Economic Health of the U.S. Fishing Industry's Harvesting Sector*. National Oceanic and Atmospheric Administration Technical Memorandum NMFS-F/NEC-40. May.

[26] NOAA (1985), p. 4.

[27] http://www.merriam-webster.com/dictionary/prosperity

[28] http://www.merriam-webster.com/dictionary/stability

[29] http://wast.merriam-webster.com/dictionary/volatility

personnel and capital especially in manufacturing; c: a distinct group of productive or profit-making enterprises. "[30] [emphasis in original]

Economic textbooks provide the following descriptions:

- "Stabilization of the Economy: …Although many economists believe there are forces that eventually restore the economy to full employment, the costs of waiting for the economy to correct itself—in terms of both forgone output and human misery—are enormous, and virtually all governments today take it as their responsibility to try to *avoid extreme fluctuations in economic activity*—both the downturns … and the booms …"[31] [emphasis added]

- "Stabilization policy is the name given to government programs designed to prevent or shorten recessions and to counteract inflation (that is, to *stabilize* prices)."[32] [emphasis added]

- "A *stable macroeconomic climate* means that taxes are reasonable and predictable and that inflation is low, so lenders need not worry about inflation confiscating their investments…."[33] [emphasis in original]

Agencies of the federal government use the following definitions:

- U.S. Department of Health & Human Services: " … In a paper prepared for the U.S. Department of Health, Education, and Welfare, Thomas (1977) defines *economic well-being as an economic unit's 'ability to demand goods and services, in relation to its needs*' (p. 165). …"[34] [emphasis added]

- U.S. Census: "Personal or household *income* is generally regarded as the single best measure of the degree to which people are '*well-off*.'"[35] [emphasis added]

The International Monetary Fund describes economic stability as,

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[30] http://www.merriam-webster.com/dictionary/industry

[31] Stiglitz, J. 1997. *Economics* - Second Edition. W.W. Norton & Company, Inc., page 154.

[32] Baumol, W. and A. Blinder. 1985. *Economics Principles and Policy* – Third Edition. Harcourt Brace Jovanovich. Page 83.

[33] Samuelson, P. and W. Nordhaus. 2005. *Economics* – Eighteenth Edition. McGraw-Hill. Page 633.

[34] http://www.acf.hhs.gov/programs/opre/other_resrch/eval_data/reports/common_constructs/com_ch2_dom.html ; Thomas, R. 1977. A Review of Income Concepts Used in Economic Analysis. Washington, DC: US Department of Health, Education, and Welfare. http://aspe.hhs.gov/hsp/Inc-Concepts77/inc-con-main.htm

[35] http://www.census.gov/hhes/well-being/index.html

- "Promoting economic stability is partly a matter of *avoiding economic and financial crisis*. Economic stability also means *avoiding large swings in economic activity*, high inflation, and excessive volatility in exchange rates and financial markets. Such instability can increase uncertainty and discourage investment, impede economic growth, and hurt living standards."[36] [emphasis added]

For the purposes of our analysis we considered the following meanings of "economic well-being" and "economic stability."

- Economic well-being – a: successful or thriving; b: synonymous with income.

- Economic stability – a: lack of rapid or unexpected change; b: avoiding extreme fluctuations or wide swings in economic activity; c: lack of volatility.

We also considered the harm thresholds described by NMFS and the Section 8 analysis described above for insights into the extent to which the policy will harm the economic well-being and stability of Puget Sound's commercial-crab industry.

B. Effects on the Economic Well-Being and Stability of the Puget Sound Dungeness Crab Commercial Fishery

Giving preference to recreational harvests over commercial harvests in Puget Sound will more likely than not harm the economic well-being and stability of commercial crabbers. The policy change also creates significant uncertainty for commercial crabbers regarding the costs and benefits of investments and other business decisions. We describe these effects in this subsection.

1. Effects On The Financial Performance of Commercial Crabbers

The WDFW estimates that the policy change will reduce harvest quantities and revenues to commercial crabbers by 441,957 pounds and $1,188,864. Relative to the 2007-09 averages, this represents a 16 percent reduction in harvest quantity and revenues, holding other factors that can affect harvests and revenues constant. While the precise effects on commercial crabbers are uncertain, WDFW's estimates of the impacts of the new regulation and policy change on commercial harvests and revenues may underestimates the true impacts. The new regulation and policy will also more likely than not reduce the profitability of commercial crabbing, an effect that the WDFW ignores in

[36] International Monetary Fund Factsheet. http://www.imf.org/external/np/exr/facts/globstab.htm

its estimates. Taken together, these effects will more likely than not harm the economic well-being and stability of commercial crabbers.

Reducing the quantity of crab available to commercial harvesters will increase competition to catch the available crabs. As we understand, this effect will change the timing and effort of crabbing in the two most important crab management regions, Regions 1 and 2E. Between 2005-2009, these regions accounted for over 81 percent of the commercial quota for Puget Sound.[37] According to Brian Allison, a commercial crabbers and current president of the Puget Sound Crab Association, of the approximately 170 commercial-crabbing boats that operate in Puget Sound, approximately 40 typically work out of Region 2E and approximately 120 typically work out of Region 1.[38]

Allison and other crabbers anticipate that the new regulation and policy will create a race for crab as commercial crabbers compete for fewer crabs.[39] The increased competition will more likely than not be felt in Region 2E first, which has a lower commercial quota than Region 1. The lower commercial quota in this Region, combined with increasing recreational harvests, would likely cause some and perhaps most commercial crabbers to move to and fish in Region 1 rather than Region 2E. As Allison and other crabbers describe, the quantity of commercial crabs available in Region 1 after the recreational harvest would not justify the expense of commercial harvests for some, or possibly most, commercial crabbers. Concentrating the large majority of commercial effort in Region 1 would more likely than not shorten the time it takes the commercial crabbers to reach the quota in this Region.[40]

Intense competition for fewer crabs may increase commercial harvesters' costs. First, more intense competition for scarce fish frequently increases commercial fishery costs because fishers invest in newer technology or additional labor that will help increase their share of the available catch.[41]

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[37] Washington Fish and Wildlife Commission, Management Option 2.

[38] Declaration of Brian Allison, February 28, 2011.

[39] Personal Communication. John Rantz, Brian Allison, and Karen Thompson. January 20, 2011; Personal Communication. John Rantz and Elden Hillaire, February 8, 2011; Declaration of Brian Allison, February 28, 2011.

[40] Personal Communication. John Rantz, Brian Allison, and Karen Thompson. January 20, 2011; Personal Communication. John Rantz and Elden Hillaire, February 8, 2011; Declaration of Brian Allison, February 28, 2011.

[41] National Research Council. Committee to Review Individual Fishing Quotas (1998) *Sharing the Fish: toward a national policy on individual fishing quotas.* Washington D.C.: National Academies Press.; Branch, T.A., R. Hilborn, A.C. Haynie, G. Fay, L. Flynn, J. Griffiths, K.N. Marshall, J.K. Randall, J.M. Scheuerell, E.J. Ward, and M. Young (2006) "Fleet dynamics and fisherman behavior: lessons for fisheries managers." *Canadian Journal of Fisheries and Aquatic Sciences* 63:1647-1668.; Salas, S., and D. Gaertner (2004) "The behavioural dynamics of fishers: management implications." *Fish and Fisheries*. 5:153-167.

Second, any harvester who cannot maintain or increase their catch will lose economies of scale. The fixed costs of operating a commercial boat (e.g., moorage, boat payment, insurance) will be spread across a smaller catch. A smaller expected catch may also cause commercial harvesters to pay higher prices for variable inputs because bulk purchasing is no longer profitable. For instance, one commercial harvester commented that the price he pays for squid may increase from $0.60 to $0.90 per pound due a decline in expected catch because he would purchase smaller quantities.[42] Brian Allison states that total costs may decline because a shorter season could mean lower fuel and bait costs.[43] If, however, the decline in total cost is less than the decline in harvest, average costs will increase and profitability will decline.

Intense competition for fewer crabs will likely also shorten the commercial season and reduce the average ex vessel price of Puget Sound Dungeness crab. Historically, the winter commercial-crab season begins October first and extends through the year-end holidays, Chinese New Year and Easter. Ex-vessel prices to commercial crabbers generally increase over the season, with relatively high prices during the holidays when demand for crab is greatest. The regulation and policy change will likely shorten the effective season for commercial harvests because the same number of commercial crabbers will compete for fewer crabs. Commercial crabbers will likely harvest as much as they can, as quickly as they can, to minimize the impacts of the policy change on their harvest quantities.[44]

A simple analysis illustrates how the policy change may affect the length of the commercial season. During the 2007-08, 2008-09, and 2009-10 commercial seasons, approximately half of the commercial catch was harvested in October. The share varied across regions, but was highest in region 1, the highest volume fishery. In region 1, the average share taken in October is closer to 60 percent. Assuming that commercial harvesters exert effort similar to the past and take the average volume from these three Octobers, under the new regulation and policy, 65 percent of the total commercial harvest and 71 percent of the region 1 harvest will be taken in October. If harvesters increase their efforts, the share of the total commercial harvest taken early in the season could increase above these estimates.

A shorter winter season will undo the effects of agreements among crabbers that currently extend commercial harvests through the year-end holidays. Between 2000 and 2008, the number of commercial crab pots per license declined from 100 to 50.[45] Crabbers made this change to help ensure a more

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[42] Personal Communication. John Rantz, February 8, 2011.

[43] Declaration of Brian Allison, February 28, 2011.

[44] Personal Communication. John Rantz, Brian Allison, and Karen Thompson. January 20, 2011.

[45] Thompson. K. 2010. *Puget Sound Dungeness Crab Fishing*. Puget Sound Crab Association. September 7.

even distribution of harvests over the season and so that commercial harvests extended through the high-demand and high-price holiday season.[46]

Increasing harvests earlier in the winter season will increase the supply of crabs in local markets, which could reduce ex-vessel prices below what they would have been at this time without the supply increase. Lower ex-vessel prices means less revenue. Revenues could also decline if the race for fewer crabs increases harvests so that crabbers reach their commercial quota *before* the high-demand and high-price holidays. Both of these changes—potentially lower ex-vessel prices earlier in the winter season and missing the high-priced holidays—would reduce commercial crabbers revenues.[47]

WDFW's estimated reduction in harvest revenues of 16 percent does not account for these potential responses to the policy change. As such, WDFW underestimates the true reduction in revenues to commercial crabbers. WDFW's estimate is based on an average price of $2.69[48]. WDFW's estimate averages low prices early in the season with higher prices later in the season. But, as described above, the new policy and regulation will likely cause commercial crabbers to harvest their crabs earlier in the season – potentially lowering the price early in the season and reducing (or eliminating) quantities later in the season when prices are higher. All else equal, I expect these changes to reduce the average ex vessel price commercial crabbers receive and reduce total revenues beyond the level estimated by WDFW

As described above, the regulation and policy change will likely reduce the size of the commercial catch, increase crabbers average costs, and lower the average price they receive. If these responses occur, then, more likely than not, the new regulation and policy change will reduce profits for the large majority, if not the entire fleet, of commercial crabbers in Puget Sound.

The reduction in income (or profit) to commercial crabbers will be significant. Even if we were to accept the WDFW's estimate of the reduction in commercial revenue of 16 percent as accurate—which we do not—this percent reduction in revenue is over three times the 5 percent threshold for harm applied in the Standard 8 case cited above. The expected impacts of this rule change also far surpass the NMFS threshold for harm of reducing profitability for, "more than just a few small entities." Applying the Section 8 and NMFS criteria, the new regulation and policy significantly harms commercial crabbers.

WDFW compounds all the errors described above by assuming that the lost commercial harvests and revenues apply only to the 2011 season. Such is not

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[46] Personal Communication. John Rantz, Brian Allison, and Karen Thompson. January 20, 2011

[47] Declaration of Brian Allison, February 28, 2011.

[48] Anderson, P. 2011. Puget Sound Crab Fishery Management. PowerPoint presentation by Director of Washington Department of Fish and Wildlife, January 13, Slide 18.

the case. Commercial crabbers will experience reduced harvests and revenues year after year as a result of this policy change, and it is possible that the reductions in commercial harvests and revenues in 2012, 2013, etc. will exceed the levels expected in 2011. WDFW's estimates completely ignore impacts beyond 2011.

2. Effects On Asset Values

As we describe above, the rule change will more likely than not reduce commercial-crab harvests and income. Reducing income expectations also reduces the economic value of the boat, crab pots, crab permit, and other equipment that commercial crabbers rely on for their income and profits. Just as we can observe diminished expectations regarding a company's future profitability in stock price declines, we can observe the decline in expected profitability for Puget Sound crab harvesters in declines in the price of commercial crab permits.

According to Matt Schneider, an owner and operator of a firm in Seattle that brokers commercial fishing vessels and permits for fisheries in Oregon, Washington and Alaska, the market price for permits to harvest Dungeness crabs commercially in Puget Sound increased steadily over the previous ten years. Growing from approximately $25,000 to approximately $80,000 last year. During this time, buyers would typically purchase a permit within two or three days of it coming on the market. Mr. Schneider reports that since WDFW announced the policy change in October of 2010, there has been "a complete shutdown of buyers." He refers to these permits as "sale proof," meaning no buyers express interest in the permits, and attributes this change to WDFW's policy. Mr. Schneider states that in his 28 years of experience with Puget Sound crab permits he has never seen anything like this shutdown in the market for these permits. He also notes that the policy's effect on the permit market is especially strong given that crab prices were at $3 per pound at the time, which, Mr. Schneider describes as a "very strong price."[49]

Policy changes in other fisheries have had similar impacts on permit prices. Mr. Schneider describes how a proposed change in regulations in an Alaskan halibut fishery had a chilling effect on permit sales. He notes that the National Marine Fisheries Services recently proposed increasing recreational harvests of halibut at the expense of commercial harvests in Southeast Alaska. A potential buyer of a commercial halibut permit decided not to purchase the permit because of the proposed rule change. Mr. Schneider considers commercial halibut permits unsellable because of the proposed rule change.[50]

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[49] Schneider, paragraphs 3 - 8.

[50] Sworn Statement of Matt Schneider, January 25, 2011, paragraphs 9 and 10.

The new regulation and policy change will also likely affect the value of other commercial-crabbing assets. Some commercial operations with smaller profit margins may leave the fishery or go out of business and be forced to sell their equipment. Given that, as we understand[51], crabbing equipment is specialized, the sellers would likely have few takers. The value of this equipment would be low as the market would be flooded with supply at a time when demand is low.

In sum, it is more likely than not that the new regulation and policy will reduce the value of commercial-crabbing permits and other commercial-crabbing assets. This economic harm is a by-product of the anticipated harm described above.

3. Effects On Consumers and Other Parties Related to the Commercial Fishing Industry

Reducing the commercial harvest does not simply affect commercial harvesters. The commercial harvester is one part of an economic chain that starts with consumer demand for Dungeness crab and continues through restaurants, retail outlets, transporters, and processors. Each element of this chain benefits from the commercial harvest, and reducing commercial harvests will more likely than not reduce the economic well-being for each of these groups.

For instance, a shorter commercial season (as described above) means fewer locally-harvested live crabs in Puget Sound retail markets during the holidays. As we understand, crabs harvested in Puget Sound are more robust and can survive transport to retail markets as live crabs. Consumers (and thus retailers) prefer live crabs for their freshness and high quality. Crabs harvested on the Washington coast, and in waters off Oregon and California are not has hardy as Puget Sound crabs and can suffer relatively high rates of die-off during transport to retailers in Puget Sound. The loss from die-off can offset the higher price that retailers pay for live crabs. Higher prices for live crab in Puget Sound will likely attract some supplies from outside the area, however not in quantities sufficient to offset the loss of local live crabs.[52] Both of these effects—reduced supply of locally-harvested crabs and importing higher-priced crabs—will increase prices that consumers pay for crab. This change effectively reduces consumer incomes, which also reduces their economic well-being. The policy change also makes consumers worse off because imported crabs typically cannot match the quality of local crabs.

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[51] Personal Communication. John Rantz, Brian Allison, and Karen Thompson. January 20, 2011.

[52] Personal Communication. John Rantz, Brian Allison, and Karen Thompson. January 20, 2011; Personal Communication. John Rantz, February 8, 2011.

4. Uncertainty of Future Commercial Harvests

The new regulation and policy change will more likely than not harm the economic well-being and stability of the commercial fishing industry by increasing the uncertainty of future harvests. The decline in demand for commercial permits likely stems from concerns about the impact of the rule change on the size of future commercial harvests.

Since the Rafeedie Decision, the WDFW divides the state's 50 percent of available crab between recreational and commercial crabbers. In the past, when the recreational fishery exceeded the target harvest, WDFW decreased that-year's catch to the commercial fishery.[53] Recreational crabbers faced no consequences for exceeding the recreational target.[54] In spite of, or perhaps because of, WDFW's management challenges in the recreational-crab fishery described below, recreational crabbers over-fished their target every season during the previous five seasons.[55] Commercial catches were subsequently reduced. State regulations require accurate and consistent record keeping by commercial crabbers and their buyers. This ensures that commercial harvests do not exceed the WDFW commercial target.[56]

The new policy compounds this problem for commercial crabbers because it does away with a target for recreational harvests gives priority to recreational crabbers over commercial harvests, and increases the number of days the recreational fishery is open.[57] Because the commercial harvest is simply the remainder of the state allocation after the recreational harvest, commercial harvesters bare the risks of the uncertainty in the recreational harvest. After the rule change, this uncertainty is especially acute due to the fact that, more likely than not, the commercial harvest could be substantially reduced and no rule or process prevents recreational crabbers from taking the entire harvest. Over the long-run, as Puget Sound's population grows, if crabbing becomes more popular, or both, these changes combined with the new regulation and policy will more likely than not reduce future commercial harvests. Declining future harvests threatens the economic stability—even survivability—of the commercial sector. WDFW's estimates completely ignored this effect of the new regulation and policy change.

WDFW currently manages the recreational portion of Puget Sound's crab fishery using unreliable and inaccurate data. As such, WDFW knows

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[53] Sonntag (2010), page 7.

[54] Declaration of Brian E. Allison, February 28, 2011.

[55] Personal Communication. John Rantz, Brian Allison, and Karen Thompson. January 20, 2011; Personal Communication. John Rantz and Elden Hillaire, February 8, 2011.

[56] Personal Communication. John Rantz, Brian Allison, and Karen Thompson. January 20, 2011.

[57] Fish and Wildlife Commission Policy Decision. Puget Sound Crab Fishery. Policy Number C-3609, Effective October 1, 2010.

relatively little about the actual size of the recreational harvest. Data on reported catch rates for recreational harvests are problematic. For example, approximately only one-third of summer crabbers and 10 percent of winter crabbers submit to WDFW the "catch cards " on which they record harvest information. Given the low self-reporting rates, WDFW collects information on fishery participation and catch rates using phone surveys. However, WDFW found large discrepancies in catch statistics between self-reported and phone-survey sources. WDFW concluded, "This difference in reported crab harvest success rates confirms that the Department cannot estimate the total recreational harvest simply by extrapolating the self-reported data to all crab license holders."[58]

The phone surveys produce data of questionable veracity in part because they occur weeks or months after the recreational harvests occurred, and rely primarily on respondents' memories rather than information recorded at harvest on catch-cards.[59]

Without more reliable and consistent data on the recreational catch, every year the commercial harvest faces risks associated with unexpected (and perhaps unexplained) changes in the recreational harvest data. For instance, the size of the commercial catch could decline suddenly if the state obtained better data on the recreational harvest or if an outlier group of recreational crabbers provide information to the state. While these risks existed under the old policy, the new regulation and policy increases the magnitude of the potential effects. Overfishing and unreported catches by the recreational crabbers represents lost harvest and profit opportunities not just for commercial crabbers, bur for Tribal crabbers as well.

5. Damage to the Resource

The new regulation and policy change also threatens harm to the economic well-being and stability of the commercial fishing industry by increasing the likelihood of resource damage. While Dungeness crab are generally considered a resilient species, collapses in Dungeness crab fisheries have occurred. In part, these collapses have been attributed to overfishing, expansion of fishing grounds, and high incidental mortality of non-legal crabs.[60] The lack of effective monitoring and enforcement of the recreational crab harvest coupled with an increase in recreational effort may increase

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[58] Sonntag (2010), page 10.

[59] Sonntag (2010), page 10.

[60] Orensanz, J.M.L., J. Armstrong, D. Armstrong, and R. Hilborn (1998) "Crustacean resources are vulnerable to serial depletion – the multifaceted decline of crab and shrimp fisheries in the Greater Gulf of Alaska." *Reviews in Fish Biology and Fisheries* 8:117-176.

damage to the fishery, which would decrease commercial and Tribal harvests.[61]

Regulators and other stakeholders fear that the poorly-managed recreational-crab fishery may threaten Puget Sound's crab resource over the long term. The 2010 report by the Washington State Auditor on the status of the Puget Sound Dungeness crab fishery describes the management problems in the recreational fishery that the policy change will likely make worse.[62]

In particular, the audit report describes two significant problems with the recreational crab harvest. First, due to the high level of non-compliance with catch record requirements, low self-reporting rates, and a telephone survey of limited validity, the state does not have reliable estimates for the size of the recreational harvest. The lack of reliable estimates of the recreational harvest "make it difficult for the Department to assess how well it is managing the fishery."[63] That is, the Department does not actually know the true size of the harvest or if the fishery is endanger of being overfished.

Second, recreational harvesters frequently violate the 3-S management strategy. The auditor's report includes a bolded sub-heading that states, "Violations by some recreational crabbers may jeopardize the resource."[64] One enforcement effort found 164 violations of the 3-S rules for 382 crabbers contacted with crab in their possession, or a violation rate of 43 percent. This high rate of violations causes concerns among regulators and stakeholders over the long-term viability of the crab populations. Even when crabbers follow the 3-S rules they harvest approximately 90 percent of legal-size crabs. This leaves little margin of error for environmental and biological factors that can threaten crab populations.[65] On this point the Auditor concluded, "Recreational crabbers' high rate of noncompliance with fishery management rules and environmental and biological factors can threaten the population."[66]

A letter signed by Washington State Senators and Representatives to the WFWC expressed concerns over the management deficiencies in the recreational-crab fishery described in the Auditors report. The letter states,

> "The January 15, 2010 Audit on Puget Sound crab fishery issues by the State Auditor's Office identified several issues critical to

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[61] Sonntag (2010).

[62] Sonntag (2010).

[63] Sontag (2010), page 9.

[64] Sontag (2010), page 16.

[65] Sontag (2010), page 16.

[66] Sontag (2010), page 1.

effective fishery and resource management. These include: The threat to the Puget Sound crab resource posed by the high rate of noncompliance with fishery management rules by recreational crabbers."

"These catch-record card, gear, and other rule violations illustrate only those violations directly observed through law enforcement contacts. The true extent of recreational crab violations and their impact on the accuracy of harvest estimates remains an open question. The Audit raises critical conservation and management issues for the Puget Sound crab resource, particularly with respect to the recreational fishery."[67]

Since the Rafeedie Decision, the State of Washington and Tribes co-manage the state's fisheries. The management problems in Puget Sound's recreational-crab fishery identified by the Auditor's report raised concerns among Washington Tribes not just in the recreational-crab fishery but in the State's ability to manager other fisheries as well. In a letter to Governor Gregoire, The Northwest Indian Fisheries Commission states,

"We believe that these [budget] reductions threaten to place the state in non-compliance with legal requirements to manage fisheries. If this situation continues the tribes cannot support the continuation of fisheries that are not adequately regulated or enforced such that the conservation of the resources is threatened."

"A recent example of the problem is the Puget Sound Dungeness crab fishery. The Washington State Auditor's office recently completed a performance audit of this fishery. The results were startling to many, but we have observed this decline in management capability for many years. The report found significant problems with the recreational crab fishery, both in catch reporting and regulation compliance, that are hampering our ability as co-managers to effectively manage and conserve the resources. … These kinds of catch reporting and regulation compliance problems threaten the health of the resource and that is unacceptable to the tribes."

"We fear these types of management failure will expand to other species co-managed by the state and treaty tribes."[68]

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[67] Ranker, K, K. Jacobsen, M. M. Haugen, J. Hargrove, J. Morris, K. Linville, and D. Quall. 2010. *Letter to Washington Fish & Wildlife Commissioners*. April 2.

[68] Frank Jr., Billy. Chairman Northwest Indian Fisheries Commission (2010). *Letter to The Honorable Christine Gregoire Governor*. December 10. Pages 1-2.

The new regulation and policy will more likely than not increase uncertainty and reduce economic stability in the commercial-crab industry and throughout the Puget Sound Dungeness crab fishery. Increasing recreational harvests increases the risks that recreational crabbers will overfish the resource, which would decrease commercial and Tribal harvests. Increasing recreational catches would also increase risks to commercial and Tribal crabbers by threatening the long-term sustainability of crab resources.

In effect, the recreational fishery is unregulated by quota, affected by unreported harvests and resource damage, and lacks accurate data upon which regulators can make prudent management decisions. As such, it is largely unmanaged. Resource damage can occur when managers weakly or inappropriately manage the resource. In this case, the new regulation and policy more likely than not will excaerbate the problems outlined above by increasing recreational harvests and the documented harm that these harvests have on the crab resource. Such consequences would harm the economic stability of commercial crabbers and future commercial and Tribal harvests in the near-term.

VII. Economists' Recommendations for Managing Recreational and Commercial Fisheries

Fundamentally, the field of economics studies the allocation of scarce resources, like the allocation of fish between commercial and recreational harvests. Economists have developed several recommendations to help fisheries managers allocate harvests to maximize net economic value (or economic efficiency). In my opinion, the management of the Puget Sound Dungeness crab fishery violates several of these recommendations. As such, the rules that govern this fishery—including the new rule change—likely do not maximize net economic value, which is one common definition of economic well-being.

A. Manage for Sustainability

The goal of fisheries management is sustainable exploitation.[69] That is, fisheries managers strive to prevent the collapse of the resource so that consumers can continue to enjoy it. As described above, however, the state auditor and Tribal fisheries managers have concerns that the recreational fishery will cause unsustainable exploitation of the crab resource. Specifically, Puget Sound crab managers do not know recreational harvest levels, nor have they prevented significant violations of the 3-S management strategy among recreational harvesters. These management failures may be damaging the resource. The regulation and policy change will likely increase the number of recreational trips and will likely exacerbate these problems.

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[69] Cochrane, K.L. (2002) "Fisheries Management" in *A fishery managers guidebook. Management measures and their application*. (ed. K.L.Cochrane) FAO Fisheries Technical Paper. No. 424. Rome, FAO.

Economists also argue that fixed quotas for all groups promote sustainability.[70] Economist Gordon Gislason notes, "Sustainability – biological, economic, social – can be enhanced with each sector having a formal, predetermined share of the allowable catch."[71] The WDFW does not follow this advice. Instead, it tries to manage recreational effort without an explicit quota. This practice, may endanger the biological, economic, and social sustainability of the fishery. The new regulation and policy that gives preference to the recreational catch would more likely than not make this problem worse.

Of course, some argue that only "stakeholders who support the rules of practices of sustainability should be rewarded with secure allocation rights."[72] Groups who face (and frequently pay for) strict monitoring and enforcement believe allocating harvest to groups with weak control is unfair.[73] Given the potential threat to the resource, a policy that gives preference to the recreational fishery does not promote sustainability.

B. Maximize Net Economic Value

When faced with the challenge of allocating scarce fishery resources, economists recommend maximizing the total net economic value of the harvest. NOAA economist Steven Edwards states this position very clearly, "A fishery regulation which increases net national benefits promotes the efficient use of publicly owned fish stocks and, thereby, improves … overall economic well being."[74]

When allocating harvest between commercial and recreational sectors, economists argue that managers should allocate each unit of resource to the group with the highest economic value (or willingness to pay) for that unit.[75] That is, if a manager must decide how to allocate a fish and the net economic

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[70] Hilborn, R., T.A. Branch, B. Ernst, A. Magnusson, C.V. Minte-Vera, M.D. Scheuerell, and J.L. Valero (2003) "State of the World's Fisheries." *Annual Review of Environment and Resources* 28: 359-399.

[71] Gislason, G. (2006) "Commercial vs Recreational Fisheries Allocation in Canada: Pacific Herring, Salmon, and Halibut" Paper presented to Sharing the Fish 06 Conference. *www.fakr.noaa.gov/npfmc/current.../**CommercialRecreationalCanada**.pdf*

[72] MacKenzie, C.J.A. (2010) The Dungeness Crab (Metacarcinus Magister) Fishery in Burrard Inlet, B.C.: Constraints on Abundance-Based Management and Improved Access for Recreational Harvesters. M.R.M Thesis, Simon Fraser University.

[73] Mitchell, R. and O. Baba (2006) "Multi-sector resource allocation and integrated management of abalone stocks in Western Australia: review and discussion of management strategies." *Fisheries Science* 72:278-288.

[74] Edwards, S.F. (1990) *An Economics Guide to the Allocation of Fish Stocks between Commercial and Recreational Fisheries.* NOAA Technical Report NMFS No. 94, page 21.

[75] Edwards (1990), Carter, D.W., J.J. Agar, J.R. Waters (2008) *Economic Framework for Fishery Allocation Decisions with an Application to Gulf of Mexico Red Grouper.* NOAA Technical Memorandum NMFS-SEFSC-576.

value of this fish to the recreational fishery is $10 and the net economic value to the commercial fishery is $11, then economists argue the total economic welfare is maximized by allocating the fish to the commercial fishery. Furthermore, to maximize total economic value, managers should continue to allocate any available fish to the commercial harvest until its value drops below the $10 value of the marginal fish to the recreational fishery.[76]

In order to implement this approach, managers need to know the economic value of the marginal unit to both the recreational and commercial fisheries. Obtaining these values is difficult. Both the recreational and commercial fisheries contain many groups who benefit from these harvests. For instance, consumers, retailers, brokers, commercial harvesters, and suppliers to the commercial harvester all benefit from larger commercial harvests. As such, economists expect each group would willingly pay some amount to ensure a larger commercial harvest. A number of groups also benefit from the recreational harvest and would willingly pay to increase the recreational harvest.

Public-outreach information presented by WDFW staff on the new policy include values that appear to describe economic-efficiency effects. For example, a PowerPoint presentation on January 13, 2011, by Phil Anderson, Director of the WDFW, includes information on the value of the commercial and recreational crab harvests in Puget Sound, and the revenues collected on commercial and recreational crab licenses.[77] However, these values do not provide information to determine the efficiency of the harvest allocation.

These materials cite a report prepared for WDFW by TCW Economics (TCW). The TCW report describes the author's conclusions regarding economic aspects of commercial and recreational crab harvests in Washington state. However, given deficiencies in the data upon which the author's analyses and conclusions rely, the author states that readers *should not* compare the economic performance of the two fisheries based on information in the report. For example, the report's executive summary states,

> "The study is designed to summarize the overall economic benefits of Washington's non-treaty commercial and recreational fisheries for 2006. Although the study estimates net economic values and economic impacts of both commercial and recreational fisheries, *it is not sufficiently comprehensive and the values are not estimated with adequate precision to warrant a comparative analysis of the two fisheries*."[78] [emphasis added]

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[76] Stated differently, economists argue that resource should be allocated until the marginal value of the last unit is equal across groups.

[77] Anderson, Phil. 2011. *Puget Sound Crab Fishery Management*. PowerPoint presentation on January 13. Washington Department of Fish and Wildlife.

[78] Anderson (2011), page ES-1.

While this caveat is sufficient to conclude that the values in this report should not be used to argue for the economic efficiency of any allocation, for completeness, I describe several specific weaknesses with the TCW report below.

WDFW prominently features the TCW estimate that recreational crab harvesters enjoy $43 in net economic value for each day of crabbing. I have several problems with this estimate. First, the authors of this report do not adequately explain how they calculated this value. The value was supposedly derived from a US Fish and Wildlife collection of articles on recreational fishing values[79]; however, the authors do not indicate which of the 109 articles in this database support their estimate. Given that our searches of this database revealed no studies that estimate the recreational value of Puget Sound Dungeness crab, it is difficult to assess the validity of this estimate without further analysis of the supporting materials.

This value may capture the *full* value of the trip, which includes but is greater than, the value of the harvested crab. The full value includes the value of being in a boat on Puget Sound *in addition* to the value of the harvested crab. That is, the value overstates to true value of a crab caught in the recreational fishery. When assessing the efficiency of a harvest allocation, economists want to know the value of the fish caught not the value of fishing.[80] The act of fishing provides fishers value unrelated to the actual catch.[81] The TCW value may also fail to account for the possibility that recreational crabbers could obtain much of the value of fishing by angling for a different species.[82] Without access to TCW precise supporting materials, my questions regarding these (and other) issues cannot be answered.

The estimate for the net economic value to producers also suffers from several flaws. In particular, the TCW report provides almost no description of the methods or assumptions that underlie their calculations. Furthermore, the TCW value ignores many groups who benefit from the commercial crab harvests (e.g., consumers).

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[79] Boyle, K., R. Bishop, J.C Caudill, J. Charbonneau, D. Larson, M. Markowski, R. Unsworth, and R. Paterson. (1997) *A database of sport fishing values.* Prepared fro Economics Division, U.S. Fish and Wildlife Service. Cambridge, MA: Industrial Economics, Inc.

[80] Edwards (1990) page 17.

[81] Dawson, C.P., and B.T. Wilkins (1981) "Motivations of New York and Virginia marine boat anglers and their preferences for potential fishing constraints." *North American Journal of Fisheries Management* 1:151-158.; Fedler, A.J. (1984) "Elements of motivation and satisfaction in the marine recreational fishing experience." *Marine Recreational Fisheries* 9:75-83.

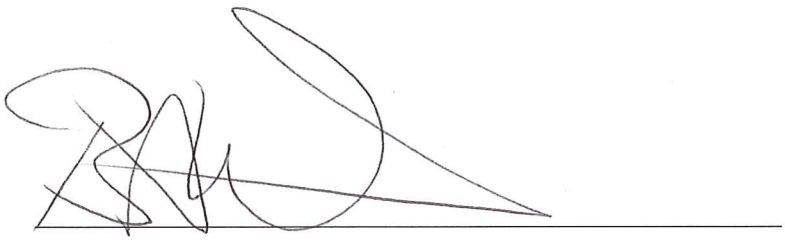
[82] Sutton, S.G., and R.B. Ditton (2005) "The substitutability of one type of fishing for another." *North American Journal of Fisheries Management* 25:536-546.; Gentner, B. and Sutton, S. (2008) "Substitution in Recreational Fishing", in *Global Challenges in Recreational Fisheries* (ed Ø. Aas), Blackwell Publishing Ltd, Oxford, UK.

More important, the TCW values reflect the average net economic value of crabbing, but the average value is not relevant for determining an efficient allocation.[83] To maximize net economic value, managers should consider marginal, not average, values.

Applying economic theory and logic to the rules and observed behaviors in these fisheries provides information about the relative marginal values of recreational and commercial crabs. Since recreational harvesters do not currently face a binding quota, nearly every individual—no matter their value for catching crab—can go.[84] Given these conditions, at least some of the recreational harvest is taken by people with a relatively low value for crab.

The policy change reinforces this outcome. The policy effectively reduces the price of crabbing by making it easier for recreational crabbers to go crabbing. Thus, the increase in recreational crabbing (and the marginal recreational harvest) will stem mostly from people who take advantage of the fact that it is easier to crab. Given that these harvesters could have harvested under the old policy but did not, one interpretation of this pattern is that these crabbers place low values on caught crab.

In contrast, the marginal crab removed from the commercial harvest as a result of the rule change has a higher value. As noted above, a shorter commercial season may result from the regulation and policy change. A shorter season will reduce or eliminate the availability of Puget Sound Dungeness crab during periods with high consumer value (and high prices). Thus, one potential effect of the rule change is the reallocation of crab from high value commercial sector to low value recreational sector. If this possibility, in fact, occurs, then the policy change will reduce the net economic value of the harvest and thus may harm economic well-being.



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[83] Edwards (1990).

[84] Only individuals with odd schedules that regularly prevent them from crabbing on the allowed days are completely foreclosed from participation. The rules may prevent a few very high value crabbers from making additional crabbing trips; however, given that most crabbers make fewer than 2 trips per year most high value crabbers can probably figure out how to fit their highest value trips into the season.