Can Catch Shares Reduce the US Federal Deficit?

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Abstract

Is catch shares management of commercial fisheries a good investment for the US federal government? We estimate the federal budget effects of switching US commercial fisheries from traditional management to catch shares, and describe the resulting impact on the federal deficit in net present value (NPV) terms.

We examine two existing catch shares fisheries and two traditional management fisheries, and estimate that converting to catch shares in these fisheries could reduce the federal deficit by approximately $165M in NPV. Catch shares reduce the federal deficit for two primary reasons. First, fishermen are more profitable, and therefore contribute increased income tax payments. Second, catch shares programs are mandated to recover some costs of management from participants, as per federal law. An additional analysis suggests that the federal deficit could be decreased by an estimated $890M to $1.24B in NPV if 36 of the 44 federal US fisheries adopted catch shares.

Keywords: Catch shares, Budget, Sustainability, Fishery management

1. Introduction

Is catch shares commercial fishery management a good investment for the US federal government? Catch shares appear to be an important tool for fishery managers to consider for a variety of economic, ecological, and social reasons (National Oceanic and Atmospheric Administration, 2010). Many recent studies suggest that catch shares may ensure sustainable fishing stocks, reduce ecological waste, increase revenues per boat, and improve safety, providing for more sustainable communities. However, there is often a transition from more part time jobs to fewer full-time jobs; and a shift in landings between ports, causing economic losses for some communities and processors and gains for others (Branch, 2008; Costello, Gaines, & Lynham, 2008; Essington, 2010; GSGislason and Associates, 2008; Knapp, 2006; McCay, Creed, Finlayson, Apostle, & Mikalson, 1995; Redstone Strategy Group, LLC (2007), "Assessing the potential for LAPPs in U.S. fisheries," unpublished). With increased attention to deficit reduction, and little attention paid to catch shares programs' government fiscal impacts, we seek to estimate the revenues and costs to the US federal government when switching commercial fisheries from traditional fishery management to catch shares.

Historically, most US fisheries transitioned from open-access to traditional management. In the last 20 years, some traditionally managed fisheries have transitioned to catch shares (including Individual Fishing Quotas [IFQs] or limited access privilege programs [LAPPs]). Traditional management fisheries are non-catch shares fisheries that use any or all of the following management tools: limited entry, effort control, and total catch limits. Catch shares management regimes allocate privileges to harvest a portion of a fishery's total allowable catch (TAC) to individual fishermen or groups. Managers set the TAC and hold participants responsible for not exceeding their allotment. These varying management regimes have important effects on fishery economics and therefore the federal deficit as this paper outlines.

Please note that this document includes findings and financial estimates, including possible future scenarios, based on public data, various assumptions, and expert opinions, and the reader should refer to the cautionary statements regarding forward-looking information in note 1.

2. Methodology

2.1 Net Present Value summarizes potential federal budget effects

To understand the government fiscal effects of catch shares, we compare the federal budget effects of catch shares and traditional management. For each estimate, we compare a fishery as if it were under catch share management to the same fishery as if it were under traditional management, regardless of its current management form. This is represented mathematically as:

(federal revenues of catch shares – federal costs of catch shares) –
(federal revenues of traditional management – federal costs of traditional management)

The result is the potential net impact on the federal deficit. Each fishery's government fiscal effect is then analyzed using net present value (NPV) – a common financial technique to calculate the present-day value of future cash flows from revenues and costs. The US government, including the Office of Management and Budget (OMB) and the National Oceanic and Atmospheric Administration (NOAA), also commonly uses NPV

to analyze the financial impact of federal policies (Office of Management and Budget [OMB], 1992). Specifically, we compare the government's NPV of catch shares to the government's NPV of traditional management. If the catch shares NPV is higher than the traditional management NPV, this suggests that switching to catch shares reduces the federal deficit.

The revenue and cost estimates are based on publicly available data and assumptions described in this Section. Revenues and costs are considered over 20 years using a conservative expected value discount rate of 13% based on standard OMB scoring practices that reflect the uncertainty of fishery industries (OMB, 1992), calculated as follows:

Nominal discount rate = (7% base real discount rate) + (3% long-term inflation assumption) = 10%

Expected value discount rate = (Nominal discount rate) + (Nominal discount rate) * [(20% policy implementation risk) + (10% internal policy design risk)] = 13%

For most factors, we use reasonable estimates of actual revenues and costs for both traditional and catch shares management. However, in some cases (mostly confined to the Alaska Halibut and Sablefish fishery), the best available data only reports the difference between traditional management and catch shares management (e.g., the Annual Reports to the Fleet). The result is that for some factors, we are only able to report the difference between traditional management and catch shares (which is the most important parameter in the estimations).

2.2 Four different fisheries are examined

We examine the difference in value between catch shares and traditional management in two commercial fisheries that have already converted to catch shares and two commercial fisheries that have considered, but not yet converted to catch shares. The two existing catch shares fisheries are Alaska Halibut and Sablefish Fixed Gear Individual Fishing Quota (IFQ) Program and the Gulf of Mexico Red Snapper IFQ Program. The two currently traditionally-managed fisheries are the Pacific Groundfish Trawl Rationalization Program and the South Atlantic Snapper Grouper fishery. Fishery revenues, participants, and management vary widely. The results of each examination are discussed in Section 4.1.

The Alaska Halibut and Sablefish Fixed Gear IFQ Program has many participants, relatively high per-participant revenues, and significant quota trading. As one of the first major US catch shares, the Program faced a number of implementation and design challenges that increased costs. Despite these challenges, the IFQ has successfully met its management goals.

The Pacific Groundfish Trawl Rationalization Program will be implemented in January, 2011. The fishery is high-value with a relatively small number of participants that are divided into two distinct sectors: an "at-sea" fleet, and a shore-based fleet. We assume an IFQ-like catch shares program with cost recovery provisions similar to what managers have proposed.

The Gulf of Mexico Red Snapper IFQ Program has a moderate number of participants with low revenues. This fishery also has a large recreational sector, which complicates management. The Gulf of Mexico Reef Fish IFQ has since subsumed the Gulf of Mexico Red Snapper IFQ and included additional species. This expansion may have created cost efficiencies that would further reduce the deficit, but we have not estimated those potential efficiency gains here.

The South Atlantic Snapper Grouper fishery potential program has a large number of participants with low earnings per vessel and low overall total revenues. This estimate assumes an IFQ-like catch shares program with monitoring and cost recovery similar to proposals currently being explored by fishery managers in the region.

2.3 Nationwide budget effects are also estimated

We also estimate the NPV of government budget effects for 36 commercial federal fisheries that are managed or might be managed by catch shares out of the 44 total federal fisheries (as indicated by fishery management plans). These 36 fisheries account for over 95% of the ex-vessel revenue produced annually in federal fisheries. The estimation used a four-step process:

First, we narrow the analysis of 44 federal fisheries to 36 fisheries. Eight fisheries merit exclusion for the following reasons: they are not currently fished for significant commercial value (e.g., Caribbean queen conch, non-pelagic remote Pacific islands, Gulf of Mexico red drum, Atlantic salmon), they manage ineligible species (e.g., Gulf of Mexico / South Atlantic coral, Caribbean coral, South Atlantic pelagic sargassum), or they have characteristics not immediately amenable to catch shares management (e.g., Pacific salmon).

Second, we group the 36 fisheries into four categories based on their economic and biological characteristics. The categories, detailed in Table 1, include: A) High vessel revenue, high participation; B) High vessel revenue, low participation; C) Low vessel revenue, fair-to-good biological performance; and D) Low vessel revenue, low biological performance.

Third, we pair each of the four fisheries estimated in detail (described in Section 2.2) to one of the fishery categories. The four representative fisheries in order of category are: A) Alaska Halibut and Sablefish Fixed Gear IFQ Program; B) Pacific Groundfish Trawl Rationalization Program; C) Gulf of Mexico Red Snapper IFQ Program; and D) South Atlantic Snapper Grouper fishery.

Fourth, we apply the outcome from each representative fishery to the specific economic and biological characteristics of the additional fisheries in each category, providing an estimated federal deficit reduction for each fishery. Where fisheries have particular management challenges, those idiosyncrasies are taken into account (e.g., Pacific pelagic stocks are an international fishery management concern). Error estimates are created based on similarities between the representative fishery and the actual fishery through estimating potential scenarios and reviewing economic and biological factors in detail for high value fisheries.

2.4 Three estimation scenarios describe potential outcomes

Three scenarios are estimated for each fishery to determine the potential range of US federal deficit reduction in NPV terms from converting to catch shares. The scenarios compare traditional management to catch shares as before, but encompass a realistic range of potential fishery characteristics for both the catch shares and traditional management fishery to best reflect what might actually happen given potential management decisions. The three scenarios model the catch share as having varying degrees of increased profitability for fishermen and cost recovery. These catch shares models are compared to three models of traditional management where stocks, monitoring, and the need for disaster relief are modified. See Table 2 for the details of the assumptions.

Each scenario is labeled based on the characterization of the traditional management fishery to which the catch share fishery is compared. These include: "effective management," "status quo," and "closure." The "closure" scenario compares the catch share to the traditional management fishery experiencing declining stocks and requiring disaster relief funding. It also includes assumptions about the catch share to estimate a very favorable scenario for catch shares, such as enhanced cost recovery, which increase the potential deficit reduction. The "effective management" scenario compares the catch share to a favorable scenario for traditional management with the fishery experiencing stock increases equal to the catch shares fishery. Finally, the "status quo" scenario uses assumptions based on current management; it compares the catch share to the status of the traditional management just prior to conversion, including flat stock levels, status quo monitoring, and flat fishermen profitability. The "status quo" is the most likely scenario. The specific assumptions are as follows:

Stocks: A fishery's stock level refers to the level of biomass caught in a given year. In each scenario, under catch shares fish stocks are considered to increase because of strong historical evidence in a large number of catch shares fisheries, including the Alaska Halibut and Sablefish Fixed Gear IFQ Program and the British Columbia groundfish trawl (Branch, 2006; Branch, 2008; Fisheries and Oceans Canada [DFO], 2010a; DFO, 2010b; Fraser, 2008; Grafton, Nelson, & Turris, 2005; Munro, 2001). For traditional management, stocks increase, stay constant, or decrease in the "effective management," "status quo," and "closure" scenarios (respectively).

Cost recovery: The government's cost recovery is the amount it is able to charge participants to offset fishery management costs. For traditional management, no additional cost recovery is assumed. For catch shares, cost recovery up to 3% of fishery revenue (as allowed by law) is included in the "effective management" and "status quo" scenarios. The "closure" scenario, which describes more favorable catch share assumptions, includes a higher level of cost recovery to reflect that governments have occasionally succeeded in recovering further costs. Generally, the closure scenario assumes that participants pay most major monitoring costs.

Profitability: A fisherman's profitability is the percent of ex-vessel revenue left after all costs of fishing are accounted for (e.g., vessel capital, fuel, labor). For traditional management, the profitability of fishermen is assumed to stay flat. For catch shares, profitability is based on observed or estimated increases in profitability, but modified ten percentage points in either direction by each scenario.

Monitoring: Monitoring includes all methods fishery managers use to keep track of a fishery's catch (further described in Section 3.2.2). For catch shares management, monitoring is set at the level required by good fishery management. For traditional management, the "effective management" scenario also uses the good management level of monitoring. For "status quo" and "closure," the traditional management scenario uses the current, often inadequate level of monitoring.

Disaster relief: The government often grants disaster relief funds to fishermen when a commercial fishery fails. These grants are typically authorized under the Interjurisdictional Fisheries Act (IFA) Section 308(b), IFA Section 308(d), or Magnuson-Stevens Fishery Conservation and Management Act (MSA) Section 312(a). Disaster relief costs are only included in the traditional management "closure" scenario, which is the only scenario expected to require relief.

In addition, we estimate the potential budget effects specifically for the National Oceanic and Atmospheric Administration (NOAA). Direct NOAA revenues are assumed to include cost recovery and quota registration fees. Direct NOAA costs are assumed to include monitoring, program administration, science, and conversion. The results of this estimation are discussed in Section 4.3.

3. Calculations

3.1 Revenues to the government increase significantly under catch shares

In the examined fisheries, the present value of government revenues is significantly higher under catch shares, totaling $260M more in NPV than under traditional management. The increase is primarily due to the increased

profitability of fishermen, which then drives additional government income and capital gains tax revenues (Figure 1). Exploring the catch share design elements described in Section 4.4 may further increase government revenues.

This Section describes these four components of revenue:

3.1.1 Income tax payments are the primary revenue source

Fishermen pay income taxes both under catch shares and traditional management. As they are more profitable under catch shares, income tax payments increase. This estimation assumes that the current federal income tax rates remain in effect for the 20-year duration of the estimation. Higher future tax rates (e.g., due to the expiration of the Economic Growth and Tax Relief Reconciliation Act of 2001) would increase government revenues.

In both of the case study fisheries that have implemented catch shares, fishing became more profitable after catch shares were implemented. For example, in the Gulf of Mexico Red Snapper IFQ Program, economic analyses predicted that the fishing vessels' average profitability would likely increase 35% with a transition to an IFQ (Weninger, 2008; Weninger & Waters, 2003). These large increases in fishermen's profits translate into higher income tax payments for the federal government. Increased profits are primarily from increased per-vessel profits (e.g., better market timing, decreased gear costs, etc.), as well as the number of vessels decreasing in each fishery. Lower vessel expenses and larger per-owner profits result in higher marginal tax brackets and increased income tax payments.

Three additional factors could affect profitability. First, the costs of leasing or purchasing quota for new entrants might decrease income tax payments from new entrants, but might increase taxes from original owners, who likely occupy a higher tax bracket. Second, some experts suggest that careful landings tracking under catch shares increases income reporting accuracy, and therefore tax collection accuracy (possibly leading to greater tax receipts). Finally, greater income for fishermen is likely to have "multiplier" effects for revenue collection in local economies. Estimating these effects is beyond the scope of this paper.

On average, income tax payments account for 60% of the average increase in government revenue in catch shares fisheries compared to traditional management.

3.1.2 Cost recovery from industry is also a major revenue source

The MSA allows the government to recover the costs of catch shares programs up to a limit of 3% of annual fishery ex-vessel revenue. Currently, the allowable cost recovery is interpreted as the marginal increase in costs from traditional management to catch shares; not the total cost of fishery management, just the amount attributable to catch shares management specifically. However, application of cost recovery has varied in US catch share programs, and each program may cover different management costs (e.g., on-board monitoring). For example, not every program charges the full amount of cost recovery possible, while others may implement more cost sharing.

The estimates in this paper make the conservative assumption that cost recovery is strictly limited to 3% of revenues, and only applies to new administration, monitoring, and science costs under catch shares. The only exception is the Pacific Groundfish Trawl Rationalization Program, where managers will phase in participant payment of the on-board observer costs separate from the 3%-of-revenues limit. The "closure" scenario assumes a higher level of cost recovery, as explained in Section 2.4.

In the two West Coast fisheries (Alaska and the Pacific Groundfish Trawl), cost recovery is generally sufficient to quickly offset the on-going costs of catch shares management because of the high revenues in these fisheries. In the Gulf of Mexico and the South Atlantic, more time is needed for cost recovery to fully offset on-going management costs. Even if not fully recovered, additional costs can be considered as funding for improved fishery management. On average, cost recovery accounts for 23% of the average increase in government revenue in catch shares fisheries compared to traditional management.

3.1.3 Capital gains taxes provide a third revenue source

Fishermen pay capital gains taxes when selling quota shares created by catch share programs. For shares granted without fee in initial allocations (as is the most common practice), the capital gains taxes when shares are sold reflect the full value of the quota. Catch shares generate significant capital gains taxes when shares are eventually sold, especially when sold by original owners.

On average, capital gains taxes account for 15% of the average increase in government revenue in catch shares fisheries compared to traditional management. Capital gains taxes are very high in the Alaska Halibut and Sablefish Fixed Gear IFQ ($65M in present value terms), but lower in the other fisheries estimated (approximately $2M in present value). The difference appears to be that the Alaska fishery sees more frequent selling of quota shares and has a higher overall value.

3.1.4 Quota registration fees do not generate substantial government revenues

The MSA also allows the federal government to collect a fee when catch shares are transferred between owners. This fee is 0.5% of the value of the shares. In practice, it appears that the fee may not be collected. However, it is included in this estimation to understand its potential effect on government revenues. This effect appears to be minor, comprising 1% of total revenues in the Alaska Halibut and Sablefish Fixed Gear IFQ Program, and less than that in the other fisheries.

3.2 Increased revenues more than offset costs

Although revenues significantly increase under catch shares, this Section describes how government costs increase as well; costs increase to a lesser extent, resulting in catch shares reducing the federal deficit. Additionally, the higher costs lead to improved fishery management, which may result in important socio-economic and environmental improvements. Across all four fisheries, the present value of the total increase in cost compared to traditional management is $95M in NPV terms. On-going costs comprise 87% of costs, while one-time conversion costs of transitioning from traditional management to catch shares are 13% (Figure 2). The first four cost categories described in this Section are on-going costs, while the final two are one-time costs:

3.2.1 On-going program administration is the primary cost category

Program administration includes the cost of staff time for the fishery management process. For catch shares, administration is likely to be higher due to personnel needed to track quota usage, monitor and register quota trades, address administrative appeals, and carry out other catch shares-related tasks. For example, in Alaska, the National Marine Fisheries Service established a new Office of Restricted Access Management with approximately 15 full-time employees to manage the Alaska Halibut and Sablefish Fixed Gear IFQ Program. This category accounts for 41% of the average increased cost of catch shares management compared to traditional management.

3.2.2 On-going monitoring also contributes to increased costs

Monitoring includes dockside monitoring (e.g., offload monitors), at-sea monitoring (e.g., observers or electronic video monitoring), and any other monitoring programs. Conversion to catch shares has often been accompanied by increases in monitoring and higher monitoring costs. However, many experts argue that these improvements represent needed management improvements that should be included in any fishery management system.

Increased monitoring costs are responsible for 31% of the cost difference between catch shares and traditional management. Monitoring regimes are designed to meet the needs and economics of each fishery. The Alaska Halibut and Sablefish Fixed Gear IFQ Program increased their at-sea monitoring (observers or electronic video monitoring), while the Gulf of Mexico Red Snapper IFQ Program only increased dockside monitoring. In general, higher-value catch shares fisheries seem better able to support the costs of robust monitoring, including full at-sea monitoring. Regardless, each of the four fisheries is estimated to be able to afford better monitoring under catch shares than under traditional management.

3.2.3 On-going enforcement costs increased in some fisheries

Enforcement includes the costs of Coast Guard time to police the fishery. Enforcement budgets have often risen following initial catch shares implementation, but have tended to return to their pre-catch shares levels over time. One example is the Alaska Halibut and Sablefish Fixed Gear IFQ Program, where enforcement budgets increased sharply (up to 100% in the years immediately following the catch share implementation), and then decreased to their pre-catch shares levels within 5-10 years (Committee to Review Individual Fishing Quotas of the National Research Council [NRC], 1999; United States Coast Guard, 2008). However, in areas where fisheries enforcement is not a major component of Coast Guard activity, enforcement costs are roughly same under catch shares and traditional management (e.g., Gulf of Mexico). On average, enforcement accounted for 14% of the increased costs of management under catch shares compared to traditional management.

3.2.4 On-going science costs did not appreciably increase

Science includes the costs of fieldwork, stock assessment modeling, and other scientific activities required to inform good management.

Science makes up less than 1% of the additional cost of catch shares management compared to traditional management in the four fisheries. This category is separate from the monitoring costs described in Section 3.2.2, although increased monitoring can also help improve science as more data and more accurate catch accounting can be used.

3.2.5 One-time conversion costs contribute, but could be decreased

Conversion includes fishery council and management costs incurred in converting the fishery from traditional to catch shares management, such as drafting and reviewing policy alternatives, handling the initial allocation and appeals, and implementing computer systems to track individual shares and landings.

In the examined fisheries, conversion costs account for 13% of the present value of the increased costs of catch shares management. Some experts have suggested that much of the staff costs to prepare and review policy options should count as the normal cost of fishery management considering alternatives. However, to be conservative, this paper includes these costs as additional costs of catch shares. In addition, as catch shares management becomes more prevalent, it may be possible to reduce conversion costs by developing central management and support systems that can apply to multiple fisheries.

3.2.6 One-time disaster relief payments are only included in the "closure" scenario

Disaster relief includes the cost of payments to fishermen if the fishery collapses. Since it could be argued that the environmental benefits of catch shares programs reduce the likelihood of a fishery collapse, some suggest that the avoided cost of disaster relief should be included as a benefit of catch shares. We estimate this factor, but only include it in the "closure" scenario.

4. Results and discussion

4.1 Four catch shares systems likely reduce the federal deficit by an NPV of $165M

In all four fisheries, government NPV under catch shares is higher than under traditional management, thus reducing the federal budget deficit. As discussed in Section 3.1, the higher government NPV is primarily driven by an increase in profitability of fishermen themselves. The difference in NPV ranges from $100M in the Alaska Halibut and Sablefish Fixed Gear IFQ Program to $10M in the South Atlantic Snapper Grouper fishery, as described below and in Figure 3:

The Alaska Halibut and Sablefish Fixed Gear IFQ Program, implemented in 1997, may have generated $100M more in NPV terms than would have been expected under traditional management (Barlow & Bakke, 1999; International Pacific Halibut Commission, 2007; National Marine Fisheries Service, Alaska Region Restricted Access Management [NMFS AK-RAM], 2007a; NMFS AK-RAM, 2007b; NMFS AK-RAM, 2008; NMFS AK-RAM, 2009a; NMFS AK-RAM, 2009b; NMFS AK-RAM, 2010a; NMFS AK-RAM, 2010b; Smith, 1998; Smith, 1999; Smith, 2000; Smith, 2003).

The Pacific Groundfish Trawl Rationalization Program, to be implemented in 2011, may generate $45M more in NPV terms for the government than traditional management (Hamel, 2007; Lian, Singh, & Weninger, 2008; NMFS, 2009; PFMC & NMFS, 2006; PFMC & NMFS, 2009).

The Gulf of Mexico Red Snapper IFQ Program may generate $15M more in NPV terms than would have been expected under traditional management (Gulf of Mexico Fishery Management Council [GMFMC], 1981; GMFMC, 2004; GMFMC, 2005; GMFMC, 2006; GMFMC, 2007; National Marine Fisheries Service Office of Science and Technology [NMFS OST], 2010; Rester, 2009; Steele, 2009). Because this program was only implemented in 2007, this estimate relies on fewer years of data than the Alaska Halibut and Sablefish Fixed Gear IFQ Program.

The South Atlantic Snapper Grouper fishery, if it converts to catch shares, may generate $10M more in NPV terms for the government than traditional management (note 2) (Cheuvront & Neal, 2004; Kinsolving, 2006; Quigley, 2006; South Atlantic Fishery Management Council [SAFMC], 2005; SAFMC, 2007; SAFMC, 2008; SAFMC; 2009a; SAFMC, 2009b).

The government typically reaches its breakeven point within two to four years (Figure 4). The 'breakeven point' occurs when the accumulated net costs of catch shares management are less than the accumulated costs would be under traditional management. Financial estimates, available by request to the authors, contain further details of each fishery's NPV estimation.

NPV with catch shares is therefore consistently greater than NPV with traditional management despite large differences between these fisheries.

4.2 National catch-share implementation may reduce the deficit by between $890M and $1.24B in NPV

The total national net deficit reduction possible by catch shares is estimated to be between $890M and $1.24B of NPV depending on the specifics of the ultimate design and implementation of each catch share (Figure 5). The difference ranges by fishery category from approximately $440M in the high vessel revenue, high participation category to $40M in the low vessel revenue, low biological performance category. Regardless of the fishery category, NPV with catch shares is consistently greater than NPV with traditional management.

As currently implemented, established catch shares are estimated to reduce the federal deficit by approximately $190M of NPV (Figure 6). Catch shares fisheries currently being implemented, or fisheries currently being considered for catch shares, may decrease the federal deficit by an additional $430M of NPV. Finally, the remaining fisheries not currently being considered for catch shares implementation may reduce the federal deficit by $375M of NPV. This implies that successful design and implementation of catch shares fisheries currently being implemented, or fisheries currently being considered for catch shares, make up 80% of the potential net deficit reductions from catch shares (Table 1 describes fishery categorization).

4.3 Catch shares reduce the federal deficit under each estimation scenario

In each estimation scenario, implementing catch shares reduces the federal deficit relative to traditional management. As an example, Figure 7 shows the results of each estimation scenario for the Alaska Halibut and Sablefish Fixed Gear IFQ Program. Results for each scenario in each fishery are available by request to the authors.

However, each of these three scenarios only addresses the fiscal picture for the entire federal government. For the NPV calculation for the NOAA budget alone, the story is slightly different because increased income and capital gains taxes go to the general US Treasury. Catch shares are estimated to represent a small net cost or, in one instance, a very slight gain for NOAA, ranging from a cost of $4M to a gain of $2.5M per fishery of NPV.

Nevertheless, catch shares fisheries have implemented (or are expected to implement) programs, such as robust monitoring and science, that should arguably be part of any effective management plan. Thus, the "effective management" scenario includes, along with more conservative assumptions, the costs that NOAA would bear in a more robust monitoring system absent catch shares. With this perspective in mind, catch shares represent a benefit to NOAA ranging from $5M to $12.5M of NPV.

4.4 Over time, careful catch share design can help further reduce the federal deficit

Given the importance of successful design and implementation, several potential ideas that government agencies may consider to maximize deficit reduction when designing catch shares systems are listed below:

Expand cost recovery: As fishermen increase their revenues from catch shares, increased cost recovery may become viable. Expanding cost recovery to include items like conversion costs might further reduce the federal deficit under catch shares. The Canadian experience with the British Columbia groundfish trawl IVQ suggests that participants can become amenable to expanded cost recovery as they appreciate the importance of good management to protect their investment in the fishery (B. Turris, personal communication, March 25, 2010).

Use tax revenues to increase NOAA funding for catch share conversions and management: Because NOAA's small net costs from catch shares management result in deficit reductions for the US Treasury, it might make sense for the government to compensate NOAA. This could encourage implementation of additional deficit-reducing catch shares programs.

Encourage efficient management: The actual number of staff needed to manage catch shares programs has sometimes proven to be smaller than initially requested by fishery managers. In Canada, the British Columbia groundfish trawl IVQ significantly reduced costs by reducing staff to seven FTEs (B. Turris, personal communication, March 25, 2010). The Alaska Halibut / Sablefish Fixed Gear IFQ Program began with approximately 15 FTEs in 1995, but have since decreased to approximately 10. When a smaller staff is sufficient to manage the fishery, reducing staff decreases management costs.

Encourage liquidity in catch shares markets: Readily tradable shares ensure that fish can be landed most efficiently, increasing income tax collection. It also results in capital gains tax collection increases as the share value better reflects the potential future fishery profits. Thus, fishery managers may not want to unduly restrict trading when designing catch shares programs. They may also wish to consider loan programs and other mechanisms to increase fluidity in share markets. Demonstrable capital gains collections might also help reduce political opposition to catch shares from those who feel that fishing privileges are "given away" cheaply.

Improve recreational fishery management: Improved recreational fishery management likely increases certainty in the business environment for commercial fishermen. This may cause permit values, and therefore tax revenues, to rise in catch shares fisheries.

5. Conclusions

Catch shares likely reduce the federal deficit over time relative to traditional management. This is primarily due to fishermen becoming more profitable, and therefore contributing increased income tax payments. In addition, catch shares programs are mandated to recover some costs of management. Therefore, catch shares reduce the federal deficit. The four catch shares programs discussed here are estimated to have reduced or might reduce the federal deficit by $165M in net present value terms. If implemented in 36 of 44 US fisheries, catch shares programs may reduce the federal deficit by an estimated NPV of between $890M and $1.24B. In each estimation scenario, implementing catch shares reduces the federal deficit relative to traditional management, albeit by differing amounts. Successful design and implementation of catch share management regimes can maximize potential deficit reduction.

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Notes

Note 1. Certain information contained in this document constitutes "forward-looking" and "assumptions-based" information. Generally, these forward-looking statements can be identified by the use of forward-looking terminology such as "plans", "expects" or "does not expect", "is expected", "budget", "scheduled", "estimates", "forecasts", "intends", "has the potential to," "anticipates" or "does not anticipate", or "believes", or variations of such words and phrases or statements that certain actions, events or results "may", "could", "would", "might" or "will be taken", "occur" or "be achieved."

Forward-looking statements are based on the assumptions noted in the document and on the opinions and estimates of the authors, data sources, and expert opinion as of the date such statements are made, and they are subject to known and unknown risks, uncertainties, and other factors that may cause the actual results, level of activity, performance, or achievements of the analyzed fisheries to be materially different from those expressed or implied by such forward-looking statements. The authors believe that the expectations reflected in this forward-looking information are reasonable but no assurance can be given that these expectations will prove to be correct and such forward-looking information included in this document should not be unduly relied upon. This information speaks only as of the date of the release of this working paper. In particular, this document may contain forward-looking information pertaining to the following: catch and landings, fish prices, fishermen revenues, fishermen profitability, catch share trading, fishery biomass, government policy, impacts on fishermen and local communities, and timing of catch share implementation.

There can be no assurance that such statements will prove to be accurate, as the fisheries' actual results could differ materially from those anticipated in this forward-looking information as a result of a variety of "Risk Factors" including, but not limited to: volatility in market prices of fish, changes in cost of capital for fishermen, changing government regulations and taxation policies, local fishery management practices and regulations, and environmental factors affecting fishery biomass including climate change and pollution.

Accordingly, readers should not place undue reliance on forward-looking statements. These factors are not, and should not be construed as being, exhaustive. Statements relating to "net present value" are deemed to be forward-looking information, as they involve the implied assessment, based on certain estimates and assumptions that the fisheries are operating in the future according to a specific design. The forward-looking information contained in this document is expressly qualified by this cautionary statement. The authors do not undertake any obligation to publicly update or revise any forward-looking information after the date of the public release of this document to conform such information to actual results or to changes in the authors' expectations.

Note 2. The potential South Atlantic Snapper Grouper catch share program is more fiscally attractive than traditional management for the federal government, but is a net cost from an NPV perspective. While the traditionally managed fishery continues to cost the federal government more each year, the catch share is estimated to provide positive revenues to the government after approximately ten years of operation. Due to the low revenues overall for the fishery and because NPV weights early years greater than further years, this is the only fishery of the four studied in detail where revenue gains in later years do not fully offset losses in the early years in NPV terms, both under catch shares and traditional management. The loss is reduced under catch shares, and deficit reduction could significantly increase with the careful catch share design elements described in Section 4.4.

Table 1. Fishery Categorization Used in this Study

Category	Fishery / Program	FMC*	Management
High vessel revenue, high participation	Alaska Halibut & Sablefish Fixed Gear IFQ	NP FMC	Catch share
	Scallop General Category IFQ	NE FMC	'09-'11 new CS
	Alaska Groundfish	NP FMC	Catch share
	GOM Shrimp	GoM FMC	Traditional
	SA Shrimp	SA FMC	Traditional
	Atlantic Mackerel, Squid, Butterfish	MA FMC	Traditional
	Atlantic Highly Migratory	NMFS	Traditional
	Western Pacific Pelagic	WP FMC	Traditional
High vessel revenue, low participation	Northeast Multispecies Sectors	NE FMC	'09-'11 new CS
	West Coast Highly Migratory	NMFS	Traditional
	Bering Sea and Aleutian Islands Crab Rationalization Program	NP FMC	Catch share
	Pacific Groundfish Trawl Rationalization	P FMC	'09-'11 new CS
	Atlantic Surf Clam and Ocean Quahog ITQ	MA FMC	Catch share
	Atlantic Herring	NE FMC	Traditional
	Deep Sea Red Crab	NE FMC	Traditional
	Alaska Scallop	NP FMC	Traditional
	Mid-Atlantic Golden Tilefish IFQ	MA FMC	'09-'11 new CS
Low vessel revenue, fair-to-good biological performance	Summer Flounder, Scup, Black Sea Bass	MA FMC	Traditional
	Gulf of Mexico Reef Fish IFQ	GoM FMC	'09-'11 new CS
	GOM Stone Crab	GoM FMC	Traditional
	Monkfish	NE, MA FMC	Traditional
	GOM/SA Mackerel	SA, GoM FMC	Traditional
	NE Multispecies Small Mesh / Whiting	NE FMC	Traditional
	Hawaii - all	WP FMC	Traditional
	Mariana - all	WP FMC	Traditional
	Atlantic Dolphin and Wahoo	SA FMC	Traditional
	American Samoa - all	WP FMC	Traditional
Low vessel revenue, low biological performance	South Atlantic Snapper-Grouper**	SA FMC	'09-'11 new CS
	GOM/SA Spiny Lobster	SA, GoM FMC	Traditional
	PR-USVI Reef Fish	C FMC	Traditional
	Coastal Pelagic	P FMC	Traditional
	NE Skate Complex	NE FMC	Traditional
	PR-USVI Spiny Lobster	C FMC	Traditional
	Golden Crab	SA FMC	Traditional
	Spiny Dogfish	NE, MA FMC	Traditional
	Bluefish	MA FMC	Traditional

*Fishery Management Council. C = Caribbean, GoM = Gulf of Mexico, MA = Mid-Atlantic, NE = New England, NMFS = National Marine Fisheries Service, NP = North Pacific, P = Pacific, SA = South Atlantic, WP = Western Pacific

**This fishery *may* implement a catch share in the near future, and has been analyzed as such

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Table 2. Scenario Assumptions

Scenario	Catch shares	Traditional management
Effective management	Stocks: increasing	Stocks: increasing
	Cost recovery: capped at 3% of revenues	Cost recovery: none
	Profitability: improved, less 10%	Profitability: flat
	Monitoring: sufficient	Monitoring: sufficient
	Disaster relief: none	Disaster relief: none
Status quo	Stocks: increasing	Stocks: flat
	Cost recovery: capped at 3% of revenues	Cost recovery: none
	Profitability: improved	Profitability: flat
	Monitoring: sufficient	Monitoring: current
	Disaster relief: none	Disaster relief: none
Closure	Stocks: increasing	Stocks: decreasing
	Cost recovery: expanded	Cost recovery: none
	Profitability: improved, plus 10%	Profitability: flat
	Monitoring: sufficient	Monitoring: current
	Disaster relief: none	Disaster relief: necessary

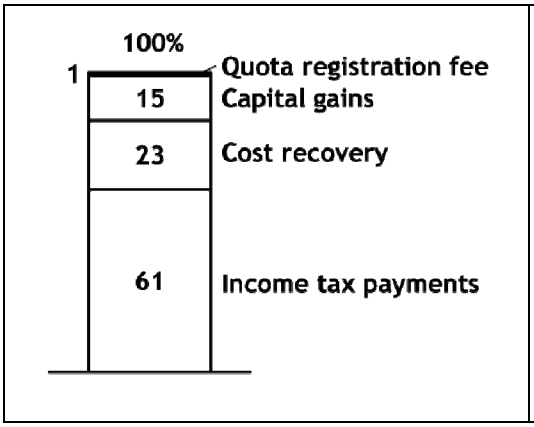

Figure 1. Average Composition of Increased Government Revenues (%)

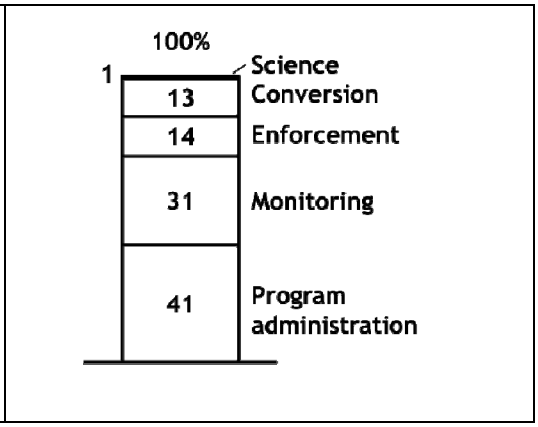

Figure 2. Average Composition of Increased Government Costs (%)

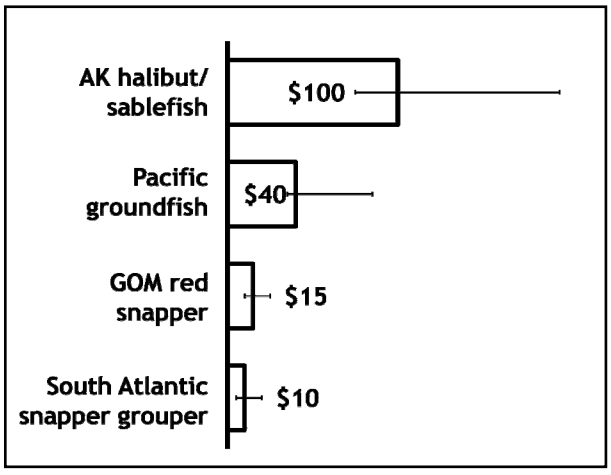

Figure 3. Federal Deficit Reduction due to Catch Shares for Four Fisheries ($M NPV)

The range bars match estimation scenarios explored in Section 2.4.

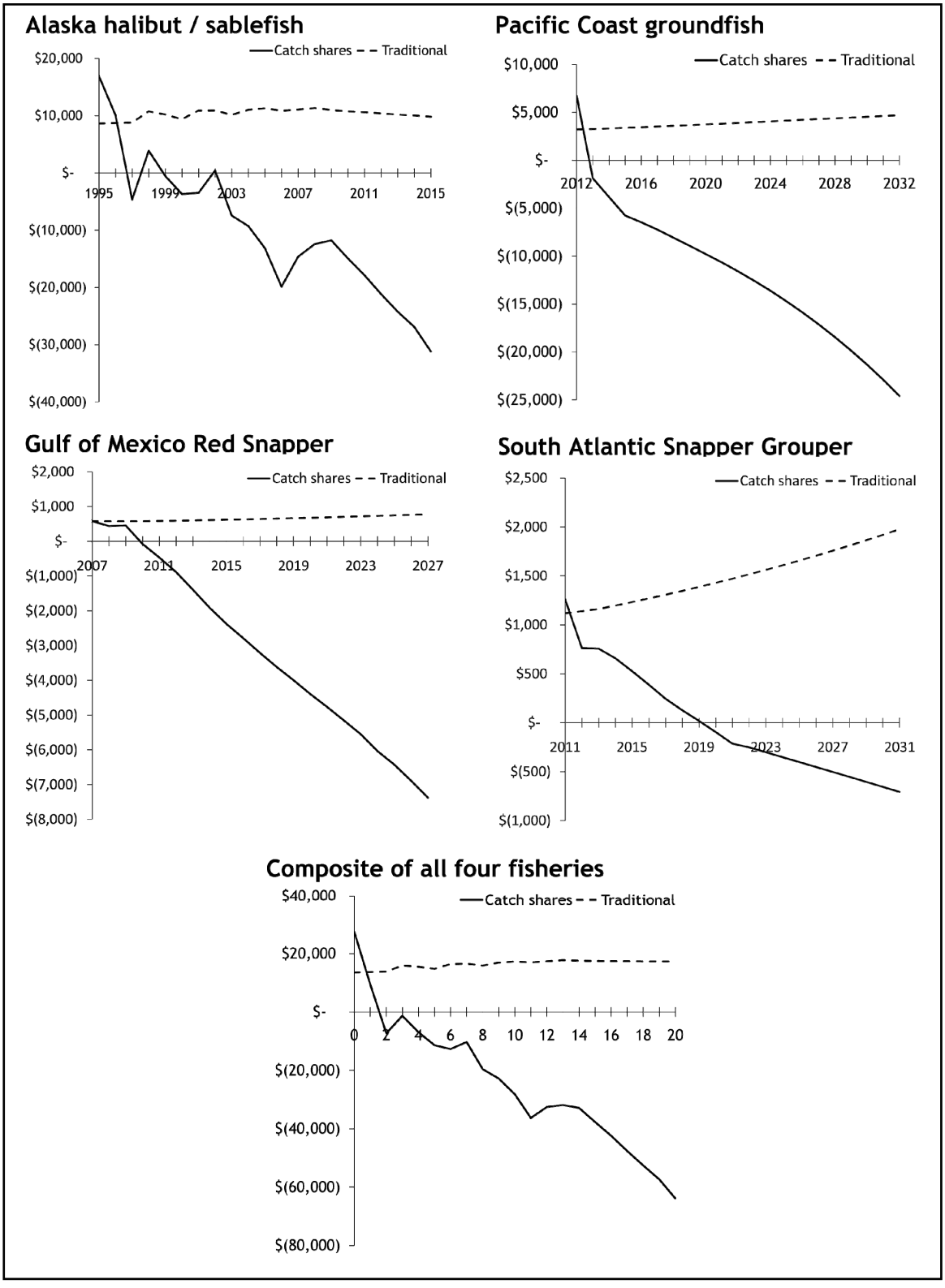

Figure 4. Annual Net Cost to the Federal Government of Catch Shares and Traditional Management ($k)
The horizontal axis of the final chart describes years since catch share adoption.

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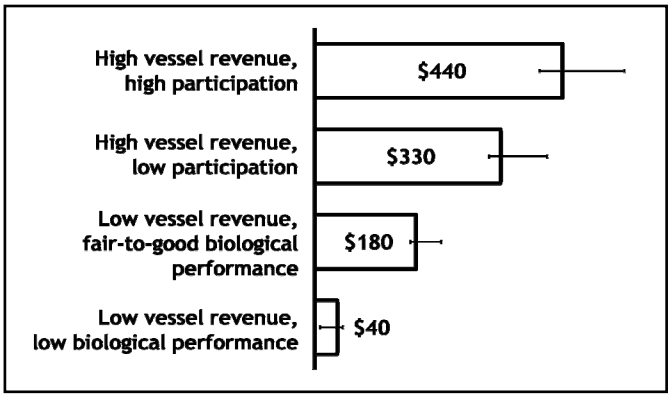

Figure 5. Federal Deficit Reduction due to Catch Shares for 36 of 44 Federal Fisheries, by Type ($M NPV)

Error estimates were created based on similarities between the representative fishery and the actual fishery through estimating potential scenarios and reviewing economic and biological factors in detail for high value fisheries (see Section 2.3)

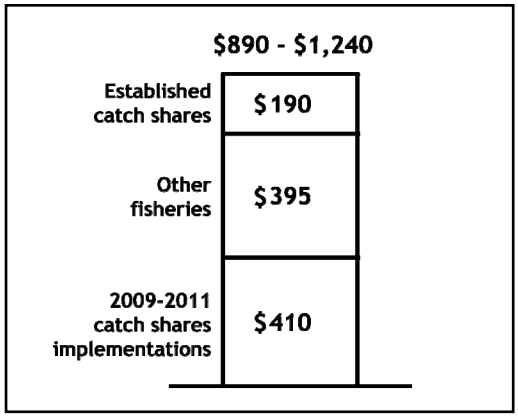

Figure 6. Federal Deficit Reduction due to National Catch Share Implementation, by Category ($M NPV)

As per the categorization described in Table 1: four fisheries have already established catch share programs; five were under consideration, development, or implemented between 2009-2011; the remaining 27 fisheries are still under a traditional management regime, but could implement catch shares management in the future

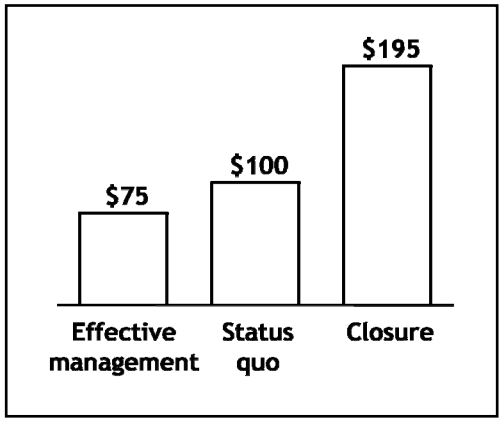

Figure 7. Estimated Deficit Reduction due to Catch Share Implementation Compared to Three Traditional Management Scenarios in the Alaska Halibut / Sablefish Fishery ($M NPV) Catch shares NPV minus traditional management NPV for the three estimation scenarios described in Section 2.4. These three scenarios represent the breadth of potential deficit reduction from transitioning to catch shares.